UNIVERSITY OF TURKU

ABSTRACT

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Abstract

In the even faster changing and increasingly uncertain environment in which corporates, start-ups, public sector players and governmental institutions operate, the importance of ecosystems as a form of organization is growing and will further grow in the future. Ecosystems are an emerging research topic. Due to the very complex composition, structure and dynamics of ecosystems, the challenges of foresight in ecosystems multiply in comparison to foresight in more simple types of organization.

This research explores how foresight can contribute to the design, orchestration and development of business ecosystems and innovation ecosystems and how it could be utilized in a more effective and impactful way. The main objective is to add to the body of empirical research of foresight in business ecosystems and innovation ecosystems and to contribute with insights to further development of foresight in this novel, complex and challenging collaboration environment.

The study is qualitative. Secondary data has been collected through a literature analysis of academic research articles, books and existing case studies. Based on that analysis semi-structured theme interviews were designed and conducted with highly qualified researchers and practitioners in order to gather primary empiric data. The data has been analyzed and interpreted with aid of relevant ecosystem theory and foresight theory.

The results of this research emphasize the benefits of foresight along the lifecycle of business ecosystems and innovation ecosystems, from their design to their development and transformation. Moreover challenges and best practices of foresight related to foresight design for ecosystems, limited foresight capabilities, ecosystem complexity, ecosystem-specific business aspects and ecosystem dynamics are discussed.

It can be concluded that ecosystems demand from foresight a high degree of customization and understanding of the context, structure, players, dynamics and lifecycle phases of the particular ecosystem. To improve the credibility of foresight and foresight capabilities, more empiric research and case studies of successful foresight in ecosystems are required.

Key words	Business ecosystem, innovation ecosystem, foresight, foresight in ecosystems, foresight capabilities

TURUN YLIOPISTO

TIIVISTELMÄ

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Tiivistelmä

Nykypäivänä yritykset, startup-yritykset, julkisen sektorin toimijat, sekä hallituksen alaiset instituutiot toimivat yhä nopeammin muuttuvassa ja epävarmemmassa ympäristössä. Sen seurauksena ekosysteemien merkitys organisaatiomuotona kasvaa, ja tulee yhä kasvamaan tulevaisuudessa. Ekosysteemit ovat nouseva tutkimusaihe. Ekosysteemien koostumus, rakenne ja dynamiikka ovat hyvin monimutkaisia ja tämä johtaa siihen, että ennakoinnin haasteet ekosysteemeissä moninkertaistuvat.

Tämä Pro gradu-tutkielma käsittelee ennakoinnin mahdollisia hyötyjä liiketoiminta- ja innovaatioekosysteemien suunnittelussa, johtamisessa ja kehittämisessä. Sen lisäksi se tutkii, miten ennakointia voidaan käyttää tehokkaammin ja sen vaikuttavuus voidaan maksimoida. Päätavoitteena on myötävaikuttaa empiiriseen tutkimukseen alueella ennakointi liiketoiminta- ja innovaatioekosysteemeissä, sekä tuoda esille oivalluksia, joista on hyötyä kehittäessä ennakointia tässä uudessa, kompleksisessa ja haastavassa yhteistyöympäristössä.

Tutkielma on luonteeltaan kvalitatiivinen. Sekundaaridata on kerätty akateemisten artikkeleiden, kirjojen ja olemassa olevien esimerkkitapausten kirjallisuuskatsauksen avulla. Sekundaaridatan analyysin perustella on suunniteltu ja toteutettu teemahaastatteluja hyvin pätevien tutkijoiden ja ammattilaisten kanssa primaaridatan keräämiseen. Data on analysoitu ja tulkittu relevanttien ekosysteemiteorioiden ja ennakointiteorian avulla.

Tutkimustulokset korostavat ennakoinnin hyödyt liiketoiminta- ja innovaatioekosysteemien elinkaaren aikana, niiden suunnittelusta niiden kehittämiseen ja muuntamiseen. Tutkielma tuo esille myös ennakoinnin erityyppisiä haasteita ja parhaita käytäntöjä liiketoiminta- ja innovaatioekosysteemeissä liittyen ennakoinnin suunnitteluun, ennakointiosaamisen puutteisiin, monimutkaisuuteen, liiketoimintaan ja dynamiikkaan.

Tutkielman loppupäätelmä on, että ekosysteemi edellyttää ennakoinnin räätälöintiä ja sitä varten ekosysteemin kontekstin, rakenteen, toimijoiden, dynamiikan ja elinkaaren ymmärtämistä. Ennakointiosaamisen ja ennakoinnin uskottavuuden parantamiseen tarvitaan lisää empiiristä tutkimusta ja esimerkkitapauksia onnistuneesta ennakoinnista ekosysteemeissä.

Avainsanat	Liiketoimintaekosysteemi, innovaatioekosysteemi, ennakointi ekosysteemeissä, ennakointiosaaminen

UNIVERSITY OF TURKU
Turku School of Economics

USING FORESIGHT IN BUSINESS ECOSYSTEMS AND INNOVATION ECOSYSTEMS

Master's Thesis
in Futures Studies

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The originality of this thesis has been checked in accordance with the University of Turku quality assurance system using the Turnitin OriginalityCheck service.

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1 INTRODUCTION

This Master Thesis explores how foresight is conducted in two types of ecosystems: Business ecosystems and innovation ecosystems.

1.1 The Topic and Reason for its Choice

In the even faster changing and increasingly uncertain environment in which corporates, star-ups, public sector players and governmental institutions operate, the importance of ecosystems as a form of organization is growing and will further grow in the future. Ecosystems are perceived as the systemic, complex and flexible form of organization suitable to generate innovation and renewal as well as to resolve humanity´s grand challenges. Uncertainty does not only come from the external environment (landscape) but also from inside ecosystems. Their flexible and dynamic nature increases uncertainty and generates challenges for ecosystem players and ecosystem orchestrators. These factors on their side call for effective foresight and a better leverage of foresight results. Foresight is required for actionable strategies as well as concrete action plans and their implementation. There is growing interest and an increasing body of literature about collaboration networks and ecosystems. Ecosystems constitute an emerging research topic. The focus of this research is on two types of ecosystems: Business ecosystems and innovation ecosystems.

This research explores how foresight can contribute to the design, orchestration and development of business ecosystems and innovation ecosystems and how it could be utilized in a more effective and impactful way. Interviewees confirmed the importance of this research.

The motivation of the author of this Master Thesis is both in contributing to research and practice in the area and the desire to work as an ecosystem futurist, ecosystem orchestrator and as a trainer of foresight for ecosystems.

1.2 Research Objectives and Research Questions

1.2.1 Research questions

This Master Thesis postulates these pre-assumption:

A1: Foresight can contribute to the design, orchestration and development of business ecosystems and innovation ecosystems.

A2: Due to the complexity and the more fluid and temporary nature of ecosystems, foresight may be underutilized. Its benefits may not be leveraged at its maximum potential in ecosystems.

The research questions are:

Q1: How do participants in business ecosystems and innovation ecosystems currently apply foresight in design, orchestration and development of business ecosystems and innovation ecosystems?

Q2: How can foresight contribute in general to business ecosystems and innovation ecosystems?

Q3: How can foresight contribute in concrete during different development phases of business ecosystems and innovation ecosystems along their lifecycle?

Q4: How can foresight be performed and leveraged more effectively in business ecosystems and innovation ecosystems?

The main objective of this research is to add to the body of empirical research of foresight in business ecosystems and innovation ecosystems and to contribute with insights to further development of more effective and impactful foresight in this novel, complex and challenging collaboration environment.

1.3 Research design

The research philosophy on which this Master Thesis is founded is pragmatism. Pragmatism is a research philosophy that focuses on the research objectives and questions as the main criteria for selecting the research design and philosophy (Saunders and Lewis 2012, 107). The reason for this philosophy choice are practitioners as the main interviewee group in the empirical part.

The approach was predominantly inductive. Induction is the process of building theory or/and conclusions from collected data (Saunders and Lewis 2012, 109). Since ecosystems is an emerging research field and foresight practices in them a very specific topic, most answers to the research questions were inducted from the data collected. For the same reason the main type of study utilized was exploratory and descriptive: Literature analysis, case study analysis and interviews.

Due to time constraints this study was cross-sectional.

1.4 Perspective, Focus, Scope and Guiding Argument

Early ecosystem research had adopted the perspective of the business of the keystones and other companies that often initiate and lead ecosystems. An example is the work by Moore (1993; 1996) and Iansiti and Levien (2004a; 2004b). As a consequence, studies of foresight in ecosystems mainly take the perspective of foresight practices that key companies conduct separately. More recent research studies ecosystems from the point of view of the ecosystem as a whole, like in the work by Adner (2006; 2017) and Kola et al. (2020). There start to be available case studies of foresight in ecosystems where foresight has been conducted jointly from the point of view of the ecosystem as a whole. A good example are the case studies about foresight in ecosystems analyzed for this Master thesis: Battistella et al. (2013), Karjalainen and Heinonen (2018), Pombo-Juarez et al. (2017), Ketonen-Oksi (2018); Birtchnell et al. 2020)

This Master Thesis focuses on foresight in business ecosystems and innovation ecosystems. Although the context impacts foresight design and limits the generalization of research results across different contexts, analyzing foresight in two types of ecosystems and in different contexts increases the opportunity of cross-pollination and novel ideas for developing foresight practices across ecosystem types. Moreover the interview questions addressed both generic information about how foresight is used in both types of

ecosystem as well as concrete information e.g. about sources, processes and methods used in foresight along the lifecycle phases of ecosystems. The generic approach ensures capture of a larger body of data that can be generalized and is complemented by concrete data relevant for practice. The aim is to reach a good balance between generic and concrete data as well as between academic secondary data and primary empirical data provided by practitioners. Furthermore, there is a need for more empirical data and case studies on the ecosystem field. Frequently the point of view in which business ecosystems are regarded is the one of the keystone (Iansiti and Levien 2004b), also called driving or focal firm (Adner 2017). In contrast, this research will adopt the more actual ecosystem level perspective and the ecosystem joint value proposition or ecosystem purpose viewpoint. Therefore, interviewees from different kinds of ecosystem player and role were selected.

The underlying argument for this study is that foresight and strategy development at the level of the business ecosystem keystone company and of any individual ecosystem member do not suffice for business ecosystems and innovation ecosystems. Foresight and strategy development at the ecosystem level as a whole are required. Business ecosystems and innovation ecosystems are large, populated by a very diverse range of players with interests that are difficult to align, and very complex in their interdependencies, dynamics, feedback loops and cross-impacts. For that reason an antecedent for successful foresight is an understanding of the structure, constituents, players and roles, dynamics of interaction, cooperation, innovation, co-creation and orchestration as well as the lifecycle phases of ecosystems. Foresight in ecosystems requires, in addition to the mentioned good understanding of ecosystems, advanced and ecosystem-specific foresight capabilities that many of the ecosystem players and individuals may not have. In special, ecosystem orchestrators play a key role in facilitation or integration of foresight in ecosystems and their foresight capabilities for ecosystem foresight need to be built.

2 THEORETICAL BACKGROUND

2.1 Theories and Literature Review

The main theories selected as foundation for this study support building the understanding of ecosystems required for foresight in ecosystems, answering the research questions and inspiring novel insights for foresight practice in ecosystems.

Ecosystem theory contributes with definitions and taxonomies of ecosystems and related concepts. For this purpose has been chosen literature by Moore (1996), Iansiti and Levien (2004a), Adner (2006; 2017), Porter (2000) as well as Scaringella and Radziwon (2018). In relation to structure, constituents, players, roles, dynamics and orchestration in ecosystems, this study utilized the work by Moore (1993; 1996), Iansiti and Levien (2004b), Scaringella and Radziwon (2018), Kola et al. (2020) and Prange et al. (2016). The phases in an ecosystem´s lifecycle were described on the base of publications by Moore (1993) and Kola et al. (2020).

Foresight theory has contributed with definitions based on the work by Amanatidou (2014), Dufva and Ahlqvist (2015), Bell and Mau (1971), Minkkinen (2020), Voros (2003) and Ahlqvist and Rhisiart (2015). Additionally novel foresight frameworks that are promising for ecosystem level foresight have been analysed. Some examples are multi-layer/multi-level perspective analysis frameworks combined with foresight (Geels and Shot 2007, Dufva et al. 2015, Vähäkari et al. 2020 and Pombo-Juárez et al. (2017) and social network analysis frameworks such as MOBENA (Battistella et al. 2013).

Finally, foresight capabilities have been addressed based on the contributions by Rhisiart et al. (2015) and Miller (2007).

2.2 Business Ecosystems and Innovation Ecosystems

The research results in this chapter are derived from secondary data analyzed during the literature review.

2.2.1 Ecosystems: A Blurry Concept

The term ecosystem is problematic since there is a lack of clarity between the different neighboring concepts of networked organizations such as clusters, value networks, value chains and sociotechnical systems and their boundaries and as a consequence, part of these terms are used as synonyms for the term ecosystem. Moreover the literature about

ecosystems is often inconsistent and blurry. In order to identify and limit the object of study of this research, this chapter distinguishes business ecosystems and innovation ecosystems from the other related concepts. Furthermore it explains the main types of ecosystems and describes ecosystem constituents and players, the logic by which ecosystems operate, including collective impact, the challenges associated with ecosystem orchestration and the evolution and life cycle of ecosystems. That information is essential to understand business ecosystems and innovation ecosystems also from the point of view of foresight.

To overcome the previously mentioned terminological Scaringella and Radziwon (2018) have conducted an extensive and rigorous literature review and built a holistic conceptual framework of ecosystems and neighboring concepts that merges the two dominant research streams: The ecosystem approach and the territorial approach. On one side, their framework is based on ecosystem theory and the business point of view in a broad perspective. On the other side, it is founded on the territorial (local) perspective.

Based on their literature analysis, Scaringella and Radziwon (2018) consider business ecosystem as an umbrella term for ecosystems while the other three types of ecosystems (knowledge ecosystems, innovation ecosystems and entrepreneurial ecosystems) seem to be different directions of development of business ecosystems (Scaringella and Radziwon 2018, 65). Similarly, Kola et al. (2020, 82-87) suggest that business ecosystems may expand and evolve into innovation ecosystems and present as an example of such evolution a case study of the Luxturrim5G ecosystem. However the empirical results of this Master Thesis reveal that the evolution between business ecosystems and innovation ecosystems may flow in both directions. Two interviewees involved in an innovation and business ecosystem perceive that the ecosystem started as an innovation ecosystem and turned into a business ecosystem during the commercialization phase. The ecosystem has plans for expansion and new innovations and seems to be on the way back into an innovation ecosystem.

Scaringella and Radziwon (2018, 62) present a taxonomy of ecosystem terms with their definitions. For the term business ecosystem they provide the definitions by Moore and Iansity and Levien:

> "An economic community supported by a foundation of interacting organizations and individuals–the organism of the business world. This economic community produces goods and services of value to customers, who are themselves members of the ecosystem. The member organisms also include suppliers, lead producers,

> competitors, and other stakeholders. Over time, they coevolve their capabilities and roles, and tend to align themselves with the directions set by one or more central companies." (Moore, 1996, 26).

> "Loose networks – of suppliers, distributors, outsourcing firms, makers of related products or services, technology providers, and a host of other organizations – affect, and are affected by, the creation and delivery of a company's own offerings. Like an individual species in a biological ecosystem, each member of a business ecosystem ultimately shares the fate of the network as a whole, regardless of that member's apparent strength." (Iansiti and Levien, 2004a, 69).

Regarding the concept innovation ecosystem Scaringella and Radziwon turn to Adner´s definition:

> "The collaborative arrangements through which firms combine their individual offerings into a coherent, customer-facing solution. Enabled by information technologies that have drastically reduced the costs of coordination, innovation ecosystems have become a core element in the growth strategies of firms in a wide range of industries." (Adner, 2006, 98-99).

Later Adner (2017, 42-43) fine-tunes his innovation ecosystem concept. He emphasizes the joint value proposition of the ecosystem as the starting point to build the ecosystem. Furthermore he points out that the relationships and alignment between the ecosystem partners are of multilateral interdependence in order to implement the joint value proposition.

This Master Thesis refers to the term joint offering as the solution or set of solutions co-created by ecosystem players. Correspondingly joint value proposition means the value of the joint offering sold to customers and the positive impacts and benefits it also has on society and on the planet.

Valkokari (2015) differentiates between business, innovation and knowledge ecosystems based on their focus, relationships and players and their roles: The focus in business ecosystems is on creating customer value by leveraging resources. In innovation ecosystems it is about co-creation of innovation. Knowledge ecosystems are dedicated to exploring and sharing knowledge. The relationships in business ecosystems are global and characterized by coopetition. In innovation ecosystems the level of openness and cooperation differs and actors are usually geographically clustered. Knowledge ecosystems

reach synergies through knowledge exchange and are decentralized. Typical actors and roles in business ecosystems are focal companies, their supplier and customer networks and a set of actors who cooperate more loosely. The players in innovation ecosystems are innovation brokers, innovation policy makers, funders, local intermediators, SMEs, start-ups and research institutions. Knowledge ecosystems include research institutions, innovators and technology enterprises.

The main differences between an ecosystem and a network are the degree of openness and stability as well as the type of relation between members: Networks are more closed and their constitution is more stable: Network members do not enter and leave as frequently as in ecosystems. This study adopts here the characterizations by Adner (2017) to distinguish value networks and supply chains from ecosystems. The relations between members in networks are bilateral while in ecosystems relations are multilateral. In value networks and business networks the focus is on the set of partners, the ties between them and the centrality of their position in the network rather than on the joint value proposition. Their relationships are viewed as bilateral and in an upstream-downstream position, e.g. in supply chains the supplier-buyer relationship. Moreover, the dynamics are more about bargaining and capture of value. Value networks not only include suppliers and buyers but also companies, their competitors, suppliers, customers and complementors. (Adner 2017, 50, 52).

A sociotechnical (eco)system is a system integrated by people using a technology and the technology (Alter, 2019, 2). It is a social system that runs on top of technology such as social media (Facebook, email, eBay, etc.)

Porter (2000, 16) defines clusters as groups of complementary interconnected companies and institutions that share geographical proximity, a field and some commonalities, and cooperate as well as compete with each other.

This Master Thesis limits its focus to foresight in only business ecosystems and innovation ecosystems.

2.3 Structure and Dynamics in Business Ecosystems and Innovation Ecosystems

Since foresight is a step in strategy development, this chapter describes the structure and the dynamics of ecosystems from ecosystem strategy point of view. This perspective best supports the analysis of the empirical data.

The composition and dynamics of ecosystems can be described from an affiliation perspective and from a structure point of view. Adner (2017, 40-43) contrasts both approaches and suggests combining them. On one hand, the affiliation perspective is limited to the amount and increase of ecosystem members, the focal firm that leads the ecosystem and centrality, growing power and value capture by the most influential members. On the other hand, the ecosystem structure approach directs the focus toward the joint value proposition and it therefore supports development of a strategy at the ecosystem level. Strategy at the ecosystem level refers to a strategy for the ecosystem as a whole from the point of view of the ecosystem´s purpose or joint value proposition.

I present here shortly the potential players (human participants) and non-human constituents in business ecosystems and innovation ecosystems.

The players of a full-fledged business ecosystem or innovation ecosystem and their roles can be following:

The participants from the public sector are political institutions, policy makers, standardization bodies, business accelerators, funders, research institutes and laboratories, regions and cities.

The private sector players are usually at the core of the ecosystem and represent large global or national enterprises and the focal company or keystone that usually launches and orchestrates the ecosystem. Alternatively there might be a designated external ecosystem orchestrator that coordinates and facilitates the activities, ensures alignment between ecosystem members and roles, balances value creation and value distribution and mediates in conflicts. Additionally there are small- and medium-sized enterprises (SMEs) and start-up companies as well as the networks, clusters and value chains of the enterprises in the ecosystem. At the ecosystem core take place innovation, research and development of products and services in these enterprises. Often also platform suppliers who provide the ICT technology for collaboration are part of the ecosystem. At the periphery of the ecosystems are the stakeholders and end-users. They usually do not participate in the activities but rather only follow-up.

The Non-human constituents of ecosystems are the contextual constituent such as the wider external context (environment or landscape layer) and the internal context inside the ecosystem (meso or regime layer), the ecosystem´s purpose **(**Kola et al. 2020) or joint value proposition **(**Adner 2017), the goals and the roadmaps. Moreover an ecosystem includes an infrastructure **(**premises, equipment, testbeds, technologies, digital collaboration platforms, service platforms, marketing platforms, etc.), knowledge and information, funds, rules**,** contracts**,** agreements (e.g. cooperation and interaction rules, IPRs, licensing, knowledge ownership and sharing, value distribution, agreements for joining and leaving the ecosystem), flexible processes and procedures as well as KPIs and scorecards to assess and measure value created and impacts.

Regarding the roles ecosystem players may take, there are two perspectives: The ecosystem dynamics perspective suggested by Iansiti and Levien (2004b) and the project-related, motivational and emotional roles discussed by Kola et al. (2020).

According to Iansiti and Levien (2004b, 68) following four key roles can be taken by players or stakeholders in a business ecosystem: Keystone, landlord, dominator and niche player.

Keystones are highly central business ecosystem members and act as a network hub that manages and facilitates the connection between the other ecosystem members, take care of diversity and productivity as well as build many niches. They provide stability and predictability and often also a collaboration platform. Moreover they take care of the business ecosystem´s health as a whole ensuring at the same time the constant profitability of the own firm. If the keystone is removed from the ecosystem, it would lead to ecosystem collapse. Iansiti and Levien (2004b, 68-72). Keystones create and leverage resources and capabilities in the business ecosystem, shape its structure, manage external resources as well as share information, assets, funds, tools, intellectual property and contacts to producers and customers. Iansiti and Levien (2004b, 82-83). Keystones perform these tasks in value creation: Create sharable assets of high value, leverage customer connections, create and manage hubs of physical and intellectual assets, set uniform information standards, jointly agree the rules of the game and supervise that these are kept. Moreover keystones create and share novel tools and building blocks for innovation, set and maintain performance standards, gather and provide financial assets for business ecosystem operations, take care of centralized coordination and communication and reduce uncertainty and complexity e.g. via powerful platforms. Iansiti and Levien (2004b, 93-95). Regarding distribution of the value created in a fair and easily scalable way,

keystones are responsible for keeping the balance between value creation and value capture, contracts and agreements e.g. about IPRs, licensing and knowledge ownership. Keystones maintain in balance the power between members in order to keep the dynamics and interactions healthy. Iansiti and Levien (2004b, 91-97).

Some member may compromise the health and balance of a business ecosystem by taking an overly dominating and value absorbing role. Such roles are the landlord and the dominator. Landlords do not integrate into the system to coordinate it but focus on extracting value from the system and capturing too much value for themselves. Their behavior may turn the business models of niche companies unsustainable and therefore destabilize the ecosystem in an unhealthy manner. Iansiti and Levien (2004b, 107-115). Dominators integrate into the ecosystem vertically or horizontally in an ecosystem domain or the ecosystem to produce end-to-end a product or platform that tends to have closed standards, so that other ecosystem members cannot leverage and further develop the dominator´s product. They attempt to eliminate other companies on their market. Dominators control both value creation and value capture. Often they conquer other markets and ecosystems. Since niche players may create disruptive innovations, they are frequently competitors or threats for dominators. The damages dominators may cause on the long term are preventing niches to emerge, and reduction in diversity and resilience of the ecosystem. Iansiti and Levien (2004b, 115-122).

Business ecosystems contain numerous niche players**.** Niches are highly specialized and focused on their area of expertise and solutions, occupy the edges of the ecosystems and take risks, explore new markets and create disruptive innovations. Niche players leverage the capabilities, technologies and assets offered by keystones and bring diversity into the ecosystem. However they are dependent on other members, may get into strong coopetition with complements, need to understand the way keystones, landlords and dominators play in order to survive on the ecosystem playground, and focus on the ecosystem´s value creation and offering as a whole. Niche players may develop too much power over keystones and become dominators. Iansiti and Levien (2004b, 123-126, 128-130, 133-141).

Next paragraphs describe ecosystem dynamics, such as complexity, geographical aspects, coopetition, ecosystem orchestration and psycho-social aspects.

Business ecosystems and innovation ecosystems are complex systems due to their hybrid nature, size, diverse actors and interdependence relationship between them, ambitious goals, self-organizing dynamics, complex interrelations, their strong adaptive socio-technical dimension and coevolution. Dattée et al. (2018) highlight that, in uncertain times and environments, creation of ecosystems is a systemic process in which organizations have to identify and dynamically manage coupled feedback loops in the ecosystem. Moreover, Dattée et al. (2018) conducted an exploratory analysis of how managers took action, built and managed systemically ecosystems based on their anticipation of uncertain futures. The model presented Dattée et al. (2018) can be utilized by keystone companies and ecosystem orchestrators when managing the complex dynamics of ecosystems.

The dynamics in business ecosystems and innovation ecosystems are detailed here based on the framework by Scaringella and Radziwon (2018, 73) and the combination of the affiliation and structure approaches by Adner (2017).

One of the dynamics at the territorial level is spatial agglomeration of firms and research institutions in a specific region and/or industry. This agglomeration fosters knowledge exchange and collective learning, lowers the cost of knowledge acquisition and transactions, reduces risks and improves innovation, spillovers, economic growth, competitiveness and entrepreneurial initiative. Having in common history, culture, rules, routines and values generates a territorial atmosphere that easies building of trust and of a sense of belonging. Territorial clusters are quite closed and path-dependent systems. At the territorial ecosystem level the system is more open and additionally allows synergies and economies of scale as well as reduction of uncertainty. Cooperation coexists with competition (coopetition relationships). Stakeholders are involved in the value chain. Furthermore, at the ecosystem level additional dynamics of reinforcement of entrepreneurial activities and emergence of start-up enterprises, ecosystem orchestration, complementary capabilities, interdependence, co-creation and co-evolution are present. Scaringella and Radziwon (2018, 65-75).

Adner (2017) criticizes that former approaches viewed ecosystems predominantly from the focal firm or keystone point of view, the keystone firm´s value capture and power interests as well as the ecosystem as part of the keystone´s strategy. He suggests studying ecosystem dynamics from the point of view of the joint value proposition.

Similarly Kola et al. (2020, 21-27) consider the ecosystem´s purpose as the reason to exist and the starting point of ecosystems. They point out that ecosystems emerge around a common purpose and collectively agreed goals derived from the purpose. The purpose

is usually a complex problem and solution ideas, innovations and knowledge to be created together. Consciousness that the purpose cannot be reached alone generates the motivation to build an ecosystem and to collaborate.

Moreover ecosystems create collective impact. Prange et al. (2016) differentiate collective impact from other forms of collaboration: Collective impact puts emphasis on shared agendas and assessment systems. It needs the support of backbone organizations and its approach and value system are rather collaborative than competitive.

Regarding the orchestration of ecosystems, Kola et al. (2020, 43-49, 57-63) stress the importance of psycho-social dynamics and shared leadership: Building and maintaining trust, motivating as well as alternating and sharing leadership roles. Trust is based on the ecosystem partners understanding and appreciating one another, collectively agreed rules, transparent practices, open communication and feedback as well as keeping promises and agreed rules. Motivation relies on the joint purpose, win-win-win goals, and awareness of the interests, benefits, contributions and cultures of the partners. Additionally are needed regular measurements and communication of impacts and achievements at each life cycle phase and of the overall impact at the final phase of the ecosystem, at three levels: The profit, the people and the planet (wider socio-economic impact) levels using e.g. an Ecosystem Balanced Scorecard. (Kola et al. 2020, 89-95 and 111).

Also Adner (2017, 42-44) emphasizes the importance of the alignment between the ecosystem members´ roles, goals and expectations in regard to the value to be created and the value they wish to capture.

Often at the initial phases leadership or orchestration is taken care of by the driving organization(s) of the ecosystem, the ones with the biggest interest in the ecosystem outcomes. Leadership is shared and circulated from activity to activity and from phase to phase along the life cycle of the ecosystem. Ecosystem leadership requires that leaders or orchestrators control their egos and are able of letting go of control. In ecosystem leadership key activities are related to people and collaboration: Facilitating dialogue, building trust, generating commitment and motivation and engaging partners, stakeholders, customers and end-users. Kola et al. (2020, 57-63). The Ecosystem Handbook by Kola et al. (2020) also contributes to the understanding of ecosystem players and to resolving alignment issues by providing a table that presents the roles, rational motivations (e.g. goals, interests, expected benefits) and the emotions (e.g. attitudes**,** assumptions and prejudices about other partners) of each type of ecosystem player. They also deduce the potential impact of motivations and emotions on collaboration. That table is presented next in an

edited version. I have added to tables 1 and 2 the column *Role and value-added* in order to detail the activities of the roles and the potential value they can add to the ecosystem. Also as small details have been added to the other columns.

Table 1: **Motivations, emotions, contributions and benefits of ecosystem partners - ecosystem companies (Kola et al. 2020, 15) modified by Carmen Tomas Martinez**

ECO-SYSTEM PARTNER	RATIONAL MOTIVATION	EMOTIONAL CONSIDE-RATIONS	IMPACT ON COLLABORATION	ROLE AND VALUE ADDED
Global platforms	New business development; more users, dominance and data	"For them, it is their highway"	May limit collaboration	Provides centralized and compatible collaboration tools
Global corporations	New business development and new partners Access to innovations, technologies and knowledge Speed and agility Sustainability	"It takes forever for them to make decisions" "They are document heavy…"	Smaller players may not want to dance with the elephants. They may be also "dominators" (Iansiti and Levien 2004b) and try to exert too much control and capture most of the value	They are often the focal / keystone organization or orchestrator, provide access to global markets and networks and add scale. They search partners with needed capabilities Invite new niche partners
National corporations	New business development Access to global markets and networks Speed and agility Sustainability	"They are slow" "They speak their own language and are in their own silos"	Missed opportunities as result of their limited view of opportunities; they may be also "dominators" (Iansiti and Levien 2004b) and try to exert too much control and capture most of the value	Provide access to regional markets and networks and add scale
SMEs	New markets and customers Faster growth Speed and scale	"All they talk about is their product / solution" Limited ability to think big and long term	Limited ability to think big may limit their opportunities to grow together with others	Specialization in their niches; agile in creating new solutions
Start-ups	New markets and customers Faster growth Speed and scale	"This guys see only their own point of view with fast exit in mind" "A lot of hype without capabilities to make real impact"	Limited ability to think big may limit their opportunities to grow together with others	New ideas, innovations and business models; they bring new customers Often in a niche role; Agility, risk taking and experimenting

Table 2: **Motivations, emotions, contributions and benefits of ecosystem partners - supporting ecosystem players (Kola et al. 2020, 15) modified by Carmen Tomas Martinez**

ECO-SYSTEM PART-NER	RATIONAL MOTI-VATION	EMOTIONAL CONSIDE-RATIONS	IMPACT ON COLLABO-RATION	ROLE AND VALUE ADDED
Research insti-tutions	World class research New knowledge, real-life cases, labs	"They do not know enough about the real-life business"	More practical approach and collaborative mindset could help benefit more from research	Research skills Global research networks New knowledge and data Technologies and testbeds
Public players (governments, regions, cities, business acceler-ators, funders)	Regional support: Fa-cilities and funding Funding instruments Piloting facilities and infra	"Big talk, less action" "What is their decision making logic?" "Election is coming – so there is vote fishing"	Public funding, partnering or piloting opportunities are essential for solving grand challenges and wicked problems	Understanding of needs of customers and citizens They offer living test labs, end-users and funds
Orchestrators	New business develop-ment and new part-ners; access to innova-tions, technologies and knowledge Speed and agility Leadership	"They are just facilitat-ing and waving hands"	Orchestrators can add a lot of value – and manage both rational and emo-tional aspects – as they are not competing with other partners	Search partners with needed capabilities; Coordination, risk man-agement; thy ensure that all participants contribute Balancing goals, interests, power and alignment Mediating in conflicts, neutrality, soft skills

2.4 Lifecycle Phases in Ecosystems

There are several models about ecosystem lifecycle phases. Moore (1993; 1996), Rong and Shi (2015) and Kola et al. (2020). In comparison, the model by Moore takes a business, keystone company and commercialization perspective. The model by Rong Rong and Shi (2015) adopt a product innovation point of view. The model by Kola et al. (2020) looks additionally at psycho-social dynamics.

This Master Thesis utilizes the ecosystem lifecycle model by Moore (1993) and complements it as necessary with information from the model by Kola et al. (2020). Kola et al. (2020) call their ecosystem lifecycle model The Ecosystem Journey. It takes into account iterations as well as assessment and communication of impacts at the end of each phase and of the overall impact at the end of the ecosystem journey, comparing the impacts against the ecosystem´s purpose on the levels of profit, people and the planet (Kola et al. 2020, 89-95). Additionally Kola et al. (2020, 101-117) provide a collection of canvases to guide the design, formation, goal setting and leadership/orchestration of ecosystems.

I have added a pre-birth phase, inspired by the emphasis Kola et al. (2020) put on the ecosystem´s purpose as the reason for its existence and as its starting point:

Phase 0 Pre-Birth: Becoming aware (of an issue / need) and defining the purpose: The strategic purpose and the targeted state envisioned are derived from the desire to resolve issues or attend needs. The purpose answers to the existential question why the ecosystem exists and is the base for setting the ecosystem´s goals. Clear objectives will generate rational and emotional commitment. The goals are set on the profit, people and planet level. The goals on the profit level are about financial describe the ecosystem´s business models and the financial targets, on the people level the goals relate to engagement of partners, employees, customers and stakeholders and the value to be created for them and on the planet level goals relate to the broader impact and benefit for society and the environment. The goals are linked to the purpose with help of an ecosystem specific Balanced Scorecard that serves to measure the value created and the impact at each phase of the ecosystem life cycle and the overall impact in the final phase (Kola et al. 2020, 17 and 21-27).

Phase 1 Birth

This phase is about investigating the needs for the solution to be created and/or assessing customers´ needs and expectations as well as the value proposition for the joint offering. The best form to implement, deliver and scale up the solution is planned. The right players are invited into the ecosystem and relevant stakeholders are attracted to follow ecosystem activities and outputs. An ecosystem leader is needed to draw the ecosystem players together and guide the ecosystem toward the grand desired future (Moore 1993, 76-79).

Kola et al. (2020) adopt the point of view of ecosystem orchestration and provide a more detailed complementary description of this phase: According to the purpose and goals, the required building blocks of the ecosystem are identified, the partners necessary ecosystem players are invited to collaborate, roles are agreed, the problem´s to be solved scope is defined and the ecosystem´s first project is planned to create potential solutions for the problem. The building blocks are the passionate and committed people (players), aligned objectives, the project(s), actions and necessary resources. The key organizations drive the ecosystem formation. The first project is a vehicle to commit resources, start working together as an ecosystem team, build trust between partners, to test the

cooperation capabilities and create some tangible results that maintain the motivation high (Kola et al. 2020, 17, 29-35).

Phase 2 Expansion

Once the design and plans created in phase 1 are in place, the ecosystem engages in expansion of the solution content and market growth and creation of market demand, while competing with possible rival ecosystems and trying to dominate the market segment (Moore 1993, 77, 79-80).

Kola et al. (2020) call this phase evolving and provide information about the human aspects. Now that the building blocks of the ecosystem are in place, the focus point resides specially on the human aspects of collaboration: Building a common language as well as trust and commitment towards the common purpose and goals via dialogue, open communication and transparency among the ecosystem players is paramount. Key partners communicate the purpose and problem in a compelling way, recruit and onboard new partners. Governance and management structures as well as the rules of the game, transparent practices and the contracts (e.g. about IPRs, licenses, openness of knowledge, entering and exiting the ecosystem) as well as the values and culture of the ecosystem are agreed upon. Often a neutral external orchestrator is designated to facilitate cooperation and co-creation and to mediate in potential conflicts. Co-creation starts and results gradually become visible (Kola et al. 2020, 17, 43-49). Part of the activities mentioned here by Kola et al. (2020) belong also to the next phase Leadership.

Phase 3 Leadership

Leadership is needed to create a vision of the future for the continuation of the ecosystems. The vision maintains the motivation of the ecosystem players to continue the development and improvement of the joint offering and to maintain innovation. Keystone companies or central contributors may utilize and even try to increase their bargaining power and become dominators in the ecosystem (Moore 1993, 77, 80-81).

Phase 4 Self-renewal

At this point the ecosystem and its join offering have matured and start to be threatened by other emerging ecosystems and innovations. Also changes in the ecosystem environment and in customer behaviour may generate the need for the ecosystem to transform. In order to renew the ecosystem and induce successive generations of innovations

new members and innovators are invited into the ecosystem, the ecosystem re-organizes and it renews its culture and activities (Moore 1993, 77, 81-86).

Kola et al. (2020, 17) divide this phase into two: Adapting and Expanding.

The key organizations that had a driving role start giving up control and let others lead as trust is strong. The ecosystem´s dynamics change, roles evolve and sub-groups form. New problems are identified and interfaces are redefined. The purpose and goals need to be revisited to make quality decisions and reinforce commitment. It is advisable to also rethink the win-win-win. Giving and receiving feedback are very important during this phase. The progress and impact for all parties as far is assessed and lessons are learnt from success stories and failures. The purpose and goals are now re-shaped and the partners re-aligned with them. The ecosystem scales up and the purpose of the ecosystem may now shift or change. Some old members may exit the ecosystem and a broader set of new members enter. The ecosystem may split into new initiatives and teams. It is important to let go in order to enable renewal. The orchestrator may change also. The shared story, purpose and culture enable the ecosystem´s transmutation and risk taking. (Kola et al. 2020, 17, 57-63, 71-79).

I would suggest introducing a post-phase called *Assessing the overall impact* in order to remember performing the final overall impact measurement and making it publicly visible:

Post-phase: Assessing the overall impact:

The results and impact will become more concrete and visible as the ecosystem develops along its lifecycle. Impact should be measured and communicated at each phase. At the end of the life cycle the overall value created by the ecosystem is systemically and holistically assessed against the ecosystem´s purpose on the levels of profit, people and the planet. Moreover Kola et al. (2020) provide a set of balanced scorecards to support measurement of impact and value at each phase and overall at the final phase. Depending on the impact the ecosystem may cease, transform into another type of ecosystem or split into several ecosystems. Part of the learning, ideas and goals may move with ecosystem partners and individuals into other organizations and ecosystems. (Kola et al. 2020, 17, 89-95, 111).

2.5 Challenges in Business Ecosystems and Innovation Ecosystems

Working in an ecosystem invites to change the mindset: From business, goals, interests and value capture of the own firm toward collective value creation for common stakeholders and fair distribution of the value captured. If the mindset does not sufficiently change, large firms may become “dominators” and try to gain more influence over the ecosystem and capture an unfair share of value. Such behavior is detrimental for trust, motivation, ecosystem culture and cooperation dynamics. It may cause SMEs and start-ups to leave the ecosystem.

Coopetition constellations can reduce the willingness to share knowledge and information about the players´ business intelligence because that may result in losing competitive advantage in front of ecosystem players that are competitors.

The focal firm or keystone may not want to give up control and handover orchestration to other players when a certain ecosystem lifecycle or changes in the external and internal environment require it. Moreover orchestration of ecosystems differs from traditional management. In an ecosystem with its large number of differing players it is challenging to reach alignment between the ecosystem roles and activities, between the individual business goals of players and between the ecosystem goals. Moreover it is hard to balance the multiple expectations and the individual members´ value capture objectives, the amount of power and influence as well as the value creation for the ecosystem as a whole, for each player, for individual persons and for society and the planet as well.

Lastly ecosystems face serious business challenges related to commercialization of the joint offering, value capture from the market and the distribution of the value among players.

To prevent and resolve these challenges Kola et al. (2020, 47, 48) advice to use the ecosystem purpose or value proposition as the starting point and perspective and to designate a neutral external ecosystem orchestrator that is specialized in ecosystem leadership.

Companies that provide ecosystem orchestration and consultancy services begin to emerge. An example is Spinverse (spinverse.com 2021).

2.6 Foresight

The research results in this chapter are derived from secondary data analyzed during the literature review.

2.6.1 Foresight Concepts

The most suitable definition and description of foresight in relation to collaborative ecosystems is the one compiled by Amanatidou (2014, 274-275), where foresight is divided into three building blocks according to its objectives and benefits: Building knowledge, building networks and facilitating participation and action. First, foresight generates futures knowledge in form of strategic vision and anticipation of alternative futures. To do so it employs multidisciplinary and evidence-based approaches, interactions and participatory methods. These methods also improve collective learning. Second, foresight brings together partners and stakeholders and builds networks of cooperation, co-creation, dialogue and negotiation. Third, foresight encourages participation in decision making processes and policy making and increases the points of view and interrelations taken into account as well as increases commitment. It helps align and coordinate decisions, policies and actions taken by agents toward a commonly agreed vision of the future.

The time span of foresight is of shorter term (3-10 years) than the one of futures studies (10-50 years).

Next some key concepts of foresight are defined as necessary for the empirical analysis of primary data gathered through the interviews: Futures knowledge, images of the future, scenarios and visions.

Dufva and Ahlqvist (2015, 252) define futures knowledge as

> "justified contingent plausibilities": It deals with alternative images of the futures, and the rationalities behind these images under certain plausibility assumptions, and scopes how present actions could affect these images."

Bell and Mau (1971) consider that images of the future describe states of things that are expected to materialize at some future time. Images of the future have a motivational function and may exert influence on which of the alternative futures turns into reality (Bell and Mau 1971, 18).

Scenarios, in contrast, contain both images of the future and the evolution path, narrative and logic that lead to a certain image of the future.

Visions are images of the future built with the intention to mobilize people to act and materialize the future described in the visions (Minkkinen 2020b, 9).

2.7 Functions and Benefits of Foresight

The motivation to engage in foresight activities depends on the awareness and perception an organization has of its value. This sub-chapter aims at making more visible the functions and benefits of foresight, especially from business ecosystem and innovation ecosystem point of view. The economic point of view of Rohrbeck and Schwarz (2013) applies to business ecosystems and to the commercialization phase of the innovations created in innovation ecosystems. The policy making perspective of Amanatidou (2014) is also especially relevant for innovation ecosystems, since creation, dissemination and commercialization of innovations often require new policies or modifications to existing policies. Policy makers are frequently one of the players in ecosystems or they receive policy suggestions based on foresight activities for ecosystems.

Rohrbeck and Schwarz (2013, 1594-1598) adopt the economic perspective of value contribution of strategic foresight to performance in businesses. They divide the value contributions of foresight into four categories: Perception, interpretation and usage in strategic management, interpretation and usage in innovation management and overall. On the perception side, foresight aids to gather insight into the changes that occur in the environment and thus to reduce uncertainty. Foresight data contributes in strategic management by generating discussion about strategies, adjusting to uncertain situations, better coordinating business objectives and adopting alternative views. In innovation management it identifies opportunities and threats for solution portfolios, reduces the uncertainty of research and development projects, improves the understanding of the market, supports identification of new customers and improves understanding of customers´ needs. In overall, foresight supports learning and generates opportunities for pro-actively shaping the future.

The point of view adopted by Amanatidou (2014) is more focused on the benefits of foresight for policy making. Amanatidou (2014, 277-278) classifies the intended impacts of foresight based on the functions of foresight:

The first function of foresight is to provide a knowledge base about the future. It contributes to informing policy planning and to fostering strategic thinking. Under this category belong following impacts: A better understanding of the dynamics of change and capability to perform a SWOT analysis, proper assessment of policies and strategies, enhanced risk management, detecting and analyzing weak signals, framing knowledge in a way that supports policy making, e.g. by uncovering obstacles and hidden agendas,

setting agendas, prioritizing funding and informing policy development. Moreover foresight develops capabilities in using foresight tools.

The second function of foresight is facilitation of decision making and policy implementation through interaction, shared visions, alignment and joint learning of multiple actors. Following impacts are related to it: Joint learning, knowledge co-creation and flow, shared visions, crossing geographic, disciplinary and institutional boundaries, building a culture of foresight and increasing foresight activities, challenging limitations and mindsets, thinking out of the box, enhancing decision making and policy development, gathering buy-in to decision making, increased alignment and commitment to shared visions, increased self-awareness and improved conflict management. Other potential impacts are improved interactions, trust, collaboration and relations between actors, building new networks and links, fostering empowerment and leveling up image and reputation.

The third function of foresight is related to including more stakeholders´ perspectives in policy-making and engaging them in decision making. The impacts under this category are: Reinforced role of society and democratic renewal through broaden participation, more public debate and dialogue with society, directing innovation toward societal needs, basing policies on social debate as well as open, transparent, participatory and legitimate governance.

The functions and benefits of foresight suggested by Rohrbeck and Schwarz (2013, 1594-1598) and by Amanatidou (2014, 277-278) can serve as a base to create balanced scorecards for foresight in business ecosystems and innovation ecosystems.

2.8 Simple Foresight Process and Methods Commonly Used in Foresight

A simple and popular foresight process that can easily be adopted and tailored in business ecosystems and innovation ecosystems is the one suggested by Voros (2003).
Figure 1 visualizes that process and presents its guiding questions and the tools frequently utilized in each phase of the foresight process.

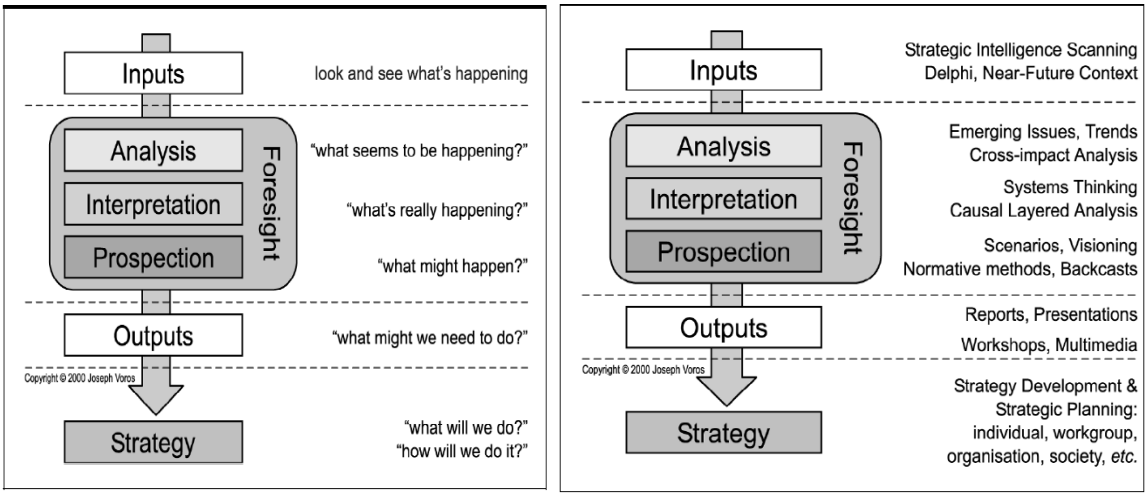

Figure 1: Foresight process framework and Methods (Voros 2003, 14-15)

As the figure above shows, the foresight process is linked to certain foresight methods across its steps. The results obtained in a previous step flow as input into the next steps.

Step 1 *Inputs* is about collecting information about what is happening in the present and about emerging phenomena in the environment that appear to be relevant for the activities and futures of an organization. Voros (2003, 14). The methods commonly used to collect information are shortly described below.

Environmental scanning captures changes, megatrends, trends and week signals in the external environment of the organization (landscape or macro level). Its purpose is to detect future threats or opportunities on 5 areas: Politic, Economy, Society, Technology, Ecology and Culture (PESTEC); A megatrend is a

> "long-term direction of change with broad societal influence" (Minkkinen 2020a, 10).

Trends are characteristics and changes of the present that are believed to continue in the future (Minkkinen 2020a, 10). A weak signal is

> "an indication of a possibly emerging issue or trend" (Minkkinen 2020a, 11).

Additionally disruptive changes are taken into account imagining unlikely future events that cannot be extrapolated from the past. Their possible impacts are deduced. Such unlikely events are wild cards and black swans. A wild card is an event that has low probability but its occurrence has a high impact (Voros 2003, 17). Black swans are events outside regular expectations that have an extreme impact and that become explainable and predictable only in hindsight (Minkkinen 2020a, 11).

Delphi surveys and expert panels are organized with experts of relevant disciplines. The experts provide rating about priority, probability and desirability of the events and justify their answers as well.

Step *Analysis* 2 is a preliminary analysis of the data gathered to organize it into clusters, map it and present it adequately for effective interpretation in order to answer the question "what seems to be happening?". Voros (2003, 14-15).

Next I will shortly describe a series of methods that can be leveraged for analysis.

The futures wheel is a graph in form of wheel that supports systems thinking. A circle is drawn in the centre of a paper and a trend or event is written into it. It grows like a mind map. Around the circle in the middle are drawn circles each with a relevant primary consequence. Around primary consequences are placed circles with secondary impacts and the outer layer of circles is formed by tertiary consequences. Interrelated consequences are connected with lines. The futures wheel helps build a system model and identify interrelationships and feedback loops.

A Field Anomaly Relaxation, also called Futures Table, assesses the internal coherence of futures paths toward different scenarios and uncovers scenario logics.

Futures paths are sequences of events that develop into a future state of the world or situation.

Trend Impact Analysis and cross-impact analysis are quantitative methods utilized to extrapolate the effects of past or present events on relevant trends and also the impact of future events on trends and variables.

Axes of Uncertainty are drawn on a four-quadrant-axis to distribute logical elements among scenarios and identify the variables with highest impact and most uncertainty.

In Decision Modelling a model of the decision process applied by decision-makers and consumers is built to analyze past decisions or to support complex decisions which may affect people widely for long periods of time.

Step 3 *Interpretation* asks “what is really happening?”. Voros (2003, 15). It deepens beneath the surface to uncover reality, underlying worldviews and metaphors using e.g. Causal Layered Analysis (CLA) or Soft Systems Methodology (SSM) as well as systems thinking.

I shortly describe here some methods for interpretation:

Causal Layered Analysis (CLA) analyses data at four layers. The first layer is the "litany" and focuses on objective reality, problems and interprets quantitative trend data. The second layer focuses on social causes and on economic, cultural, political and historical factors. The third layer goes deeper and uncovers the structure and the discourse/worldview that provides legitimation. Finally, the fourth layer of analysis is at the level of the metaphor or myth. It makes explicit collective archetypes, unconscious feelings and thoughts and even paradoxes of the culture of an organization or society. Scenarios can be developed at each of these levels. Soft Systems Methodology (SSM) helps identifying, structuring and resolving messy problems as well as uncover differing perceptions of various actors. Systems thinking and modelling help in building models and simulations of a system to predict its behavior when certain conditions, thresholds and tipping points are reached.

Step 4 *Prospection* looks for an answer to the question “what might happen?”. Voros (2003, 15). Alternative scenarios and images of the future are built, narrated and visualized. Desirable futures are selected and envisioned in detail, so that they can be pursued. Back-casting from desired future scenarios to the present is conducted and paths and strategies for action are built.

Step 5 *Outputs* summarizes and presents the outputs of previous steps in a format that is suitable for strategy development. The outputs can be foresight reports, presentations in different media formats and workshops. Voros (2003, 15).

Step 6 *Strategy* answers to the questions “what will we do?” and “how will we do it?”. Voros (2003, 16). Finally a strategy, strategic goals, roadmaps (including technology roadmaps) and action plans are developed.

According to Voros (2003, 16-18) it is important to distinguish between the different kinds of futures. In that way foresight participants become aware of what kind of future they are considering. Futures can be divided into following categories:

First, possible futures are based on known futures that may happen. Second, projected futures are business as usual futures extrapolated from the past and present. Third, plausible futures are based on current knowledge and it is considered that they may happen. This is the type of future in mind when creating scenarios. Fourth, probable futures are likely to happen. Fifth, preposterous futures are considered impossible. To this type belong wild cards and black swans. Sixth, preferable futures are based on value judgements with focus on human agency. When visioning a desired future, back-casting and strategic planning this is the kind of future utilized.

More recently, two more types of futures have been depicted: Critical futures and integral futures.

Critical futures question the other six and aim at "decolonizing" futures, opening totally new alternatives and revealing domination to overcome it (Ahlqvist and Rhisiart 2015).

Integral futures take a holistic view of futures including the axes individual-collective and interior-exterior, whereas: individual-interior = intentional, individual-exterior = behavioural, collective-interior = cultural and collective-exterior = social (Voros 2008, 197-200).

2.9 Potential Elements of Foresight Frameworks for Ecosystems

Multi-Layer Perspective analysis frameworks may be combined fruitfully with foresight. Which framework or combination of frameworks is most suitable to be applied in foresight depends on an ecosystem´s context, purpose, field, joint offering and activities.

There are three good examples of Multi-Layer Perspective analysis frameworks that have been utilized in foresight.

First, the geographical framework suggested by (Pombo-Juárez et al. (2017). The layers in their framework are international layer, the national layer, the regional layer and the international layer. Pombo-Juárez et al. (2017) utilized this geographical framework combined with the framework by Dufva et al. (2015) in the case study Foresight for the European Personal Health Systems (PHS) innovation ecosystem.

Second, the multi-layered foresight framework utilized by Dufva et al. (2015, 102-106) adopts the innovation and organizational points of view and includes following layers: Landscape layer (external context), innovation system layer (how to analyze the system and creating structures that foster innovation), organizational layer and individual layer (individual persons that participate).

Third, the Multilevel Perspective framework by Geels and Schot (2007) adopts a socio-technical perspective on innovation and includes these layers: Socio-technical landscape (external context), sociotechnical regime and niche innovations. The sociotechnical regime is a set of patterns of technical development and contains the cognitive routines, standards, regulations, infrastructures, investments, lifestyles and competencies. The term niche innovations refers to novel radical solutions created e.g. by SMEs and start-ups at the micro level. Figure 2 presents the multilevel perspective of sociotechnical transition with its dynamics and interrelations.

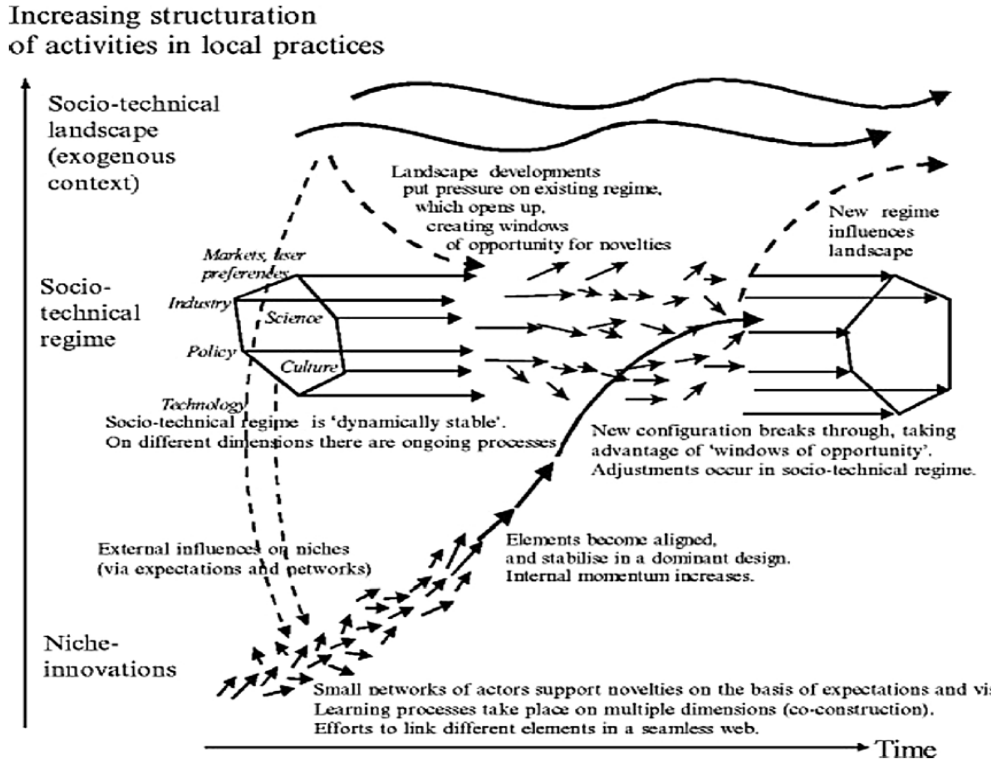

Figure 2: Multilevel perspective on sociotechnical transitions (Geels and Schot, 2007, 401)

Technology plays an important role in ecosystems: Technologies (e.g. digital collaboration platforms) facilitate cooperation in ecosystems, generate change and support the goals of ecosystems. Often one of the outputs of innovation ecosystems are technology innovations or innovations enabled by novel technologies. Sociotechnical ecosystems are systems integrated by people and technology (Alter, 2019, 2). Business ecosystems and innovation ecosystems and sociotechnical systems have some constituents in common such as technology (collaboration platforms and other technologies) and part of the sociotechnical groups like companies, funders, research institutions, public authorities and institutions and end-users. However in sociotechnical systems the focus is on the technology, the processes and the people who use the technology while in ecosystems technology is rather an enabler of collaboration and innovation and/or one of the results of co-creation in the ecosystem.

The multi-layer perspective, also called multilevel perspective (MLP) is used to analyse how sociotechnical transformations evolve from the past to the present and aims at supporting transformation towards a desired state in the present. In contrast, futures studies explore how alternative futures may materialize from the present towards the future. By integrating both, a better understanding of timelines, development paths and path-

dependencies can be gathered, alternative visions of preferred futures can be built and paths and milestones towards these preferred images of the future can be planned and turned into concrete action Vähäkari et al. (2020).

Vähäkari et al. (2020) describe how MLP can be linked with scenarios.

Furthermore the relational, cultural and ethical aspects in ecosystem collaboration, ecosystem purpose and ecosystem impacts can benefit also from the Causal Layered Analysis (CLA) method. There are case studies where MLP has been combined with CLA and futures workshops, such as the case studies presented by Ketonen-Oksi (2018) and Birtchnell et al. (2020).

Next paragraphs will present an overview of the Multi-Level Perspective framework and the examples of how it can be combined with scenarios and CLA.

MLP explores transformation at three levels (Vähäkari et al. 2020): First, the sociotechnical landscape level (external context or macro level) over which actors have little influence and which shows slow evolution processes with long-term impacts on the levels below. Megatrends function at the landscape level. Unexpected but highly impacting events like wild cards and black swans at the landscape level can have profound impacts on society and regimes. Second, the sociotechnical regime level (meso level) comprehends the sociotechnical structure and the physical infrastructures such as the dominant technologies, markets, modes of production, functions, norms, rules and networks of actors like enterprises, policy makers, communities of practice, manufacturers, service and technology providers, end-users and citizens. The regime level maintains stability and changes are frequent but minor and consensual. Trends belong to the regime level. Third the niche level (micro level), where innovations occur in an environment rather free from regime regulation and market pressures. In the niche visioning, research, development, experimentation, radical innovations and learning take place in a network type of collaboration. An innovation created on the niche level may prosper through persistent development, a good price-performance relation and broad enough market coverage. Niche innovations can be inhibited by a regime that is not ready for them or by resistance from interest groups and incumbents. Weak signals and emerging trends often originate on the niche level and may later become trends and megatrends.

The three levels interact with each other in form of a complex system. Changes on the landscape level put pressure to change on the regime level and inspire innovations on

the niche level. Niche innovations can penetrate and cause changes on the regime level and further on the landscape level.

Vähäkari et al. (2020) provide a framework that merges scenarios and MLP to create alternative regime scenarios. An example of the combination of their MLP framework with scenarios is illustrated in figure 3.

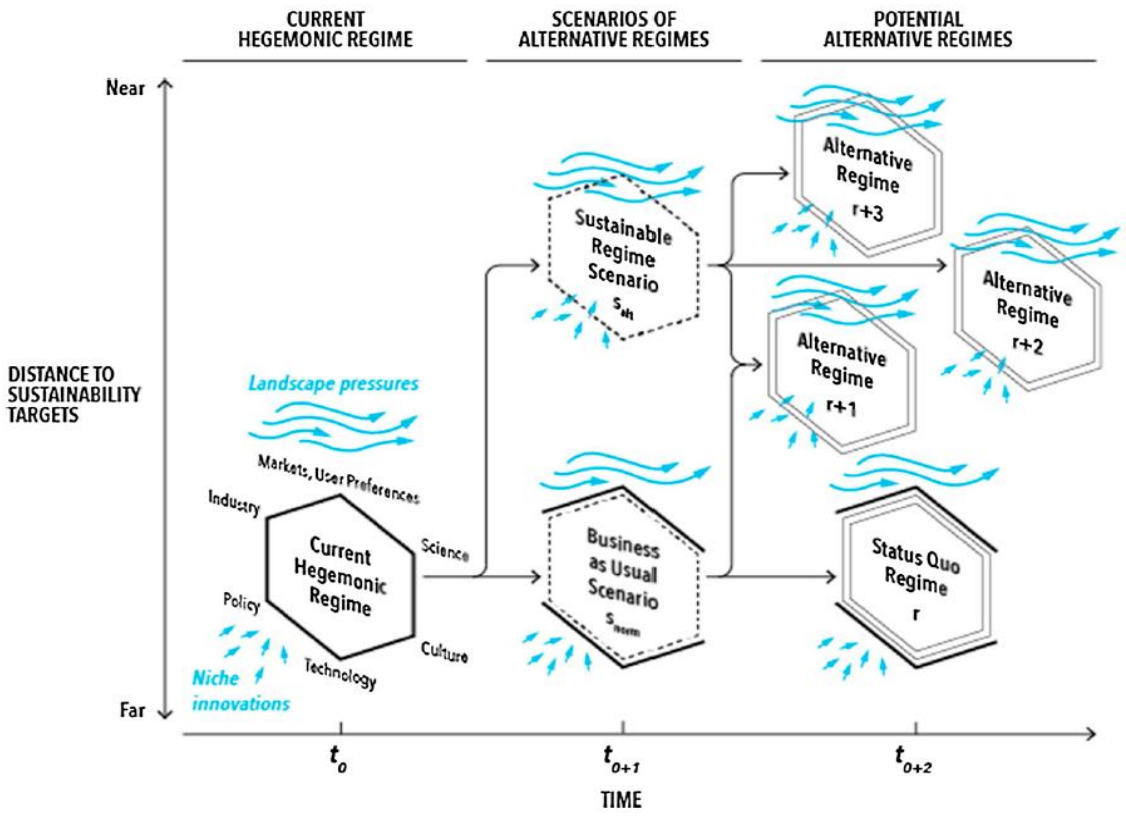

Figure 3: A foresight framework that combines scenarios and MLP to draw sustainable futures (Vähäkari et al. 2020, 8)

2.10 Challenges for Foresight and Strategy Development in Ecosystems

The time span of corporate foresight for its strategy and business goals is usually 3-5 years. In business ecosystems the goals are more long term than the ones of corporates and furthermore, in innovation ecosystems, the goals are longer term than in business ecosystems. Also the time spans of ecosystem players may differ. Moreover, decisions tend to be made on short term basis even if the undelaying foresight has been made for the long term. Balancing between long term and short term is problematic. A longer time span correlates with a higher degree of uncertainty and with less predictability. Therefore

this makes foresight in and for ecosystems more demanding and at the same time very essential.

Regarding the scope of foresight and strategy, Adner (2017, 53-55) emphasizes that corporate foresight from the focal firm or keystone point of view is not suitable for ecosystems and recommends developing an ecosystem level strategy.

Since foresight is one of the steps preceding strategy development, I deduce that also foresight should be conducted at the ecosystem level. Ecosystem players openly sharing their individual foresight results and strategies can be a first step. However an ecosystem level strategy is much more than the sum of the strategies of its players. It departs from the ecosystem´s purpose or value proposition, it observes a wider macro or landscape level context, the ecosystem´s internal context and the contexts of its individual players and finally, it has a broader content and a more complex and systemic web of multilateral interrelationships and cross-impacts to take into account. Therefore foresight and strategy development at the ecosystems level demand as a minimum a basic understanding of ecosystem structures, constituents, players, stakeholders and functional roles and the phases of an ecosystem´s lifecycle. The chapter about ecosystems aimed at overcoming this challenge by providing such a basic understanding of these ecosystem aspects.

Moreover, varied business environments (dynamic vs. established) and types of change, (disruptive vs. cumulative change) and different lifecycle phases may require distinct foresight activities.

Another challenge of foresight is translating foresight results into compelling communication and relevant actions.

Some authors suggest more recent streams of foresight as especially suited for business ecosystems and innovation ecosystems, that may alleviate these challenges: Networked foresight (Van der Duin et al. 2014; Heger and Boman 2015) and Foresight 2.0 (Schatzmann et al. 2013).

Van der Duin et al. (2014, 63-65) emphasize the link between collaborative innovation in networks and ecosystems and futures research conducted as networked foresight. In networked foresight, the players of the innovation network or ecosystem involve also external experts, stakeholders, customers and end-users in foresight activities in order to collect a broad base of knowledge of the future contributed by all. The resulting images of the future are leveraged to create a joint vision for the network or ecosystem and for its development path. Van der Duin et al. (2014, 63) assume that futures research is developing toward networked foresight.

Moreover, Schatzmann et al. (2013) explore the opportunities and applications that ICT technology and web technologies offer to foresight, especially for networked and virtual massive open foresight. One of the challenges in foresight is the difficulty to find trustworthy information for environmental scanning and trend analysis. Companies that offer foresight platforms with reliable trend information, and intelligence databases have started to emerge such as the Futures Platform (www.futuresplatform.com) and Fibres (fibresonline.com). Other applications are software for collaborative scenarios and foresight games.

Finally, lack of or insufficient foresight capabilities of ecosystem orchestrators and ecosystem players constitute an obstacle to leveraging foresight in ecosystems.

Next sub-chapter addresses the topic of foresight capabilities.

2.11 Futures Literacy and Foresight Capabilities

Foresight capabilities for ecosystem orchestrators or ecosystem futurists can be classified and described as follows:

Cognition- and attitude-related foresight capabilities are, for example, a foresight (anticipative) attitude, awareness of own cognitive biases and of the cognitive biases of others, the ability to detect, challenge and renew prevailing assumptions and mental models and to overcome the resistance toward information that is dissonant with them. Lacking or deficient cognitive and attitudinal foresight capabilities stand on the way of detecting weak signals of change and reacting to them. Additionally dynamic capabilities are needed. Dynamic capabilities refer in this case to the ability of integrating futures knowledge and making sense of it in order to re-configure the plans and competences of an organization, so that the organization is able to adapt to changes in its environment. Futures literacy can be seen as the skill to understand the impacts of the future on the present and the ability to exert impact on the future through decisions and actions.

Rhisiart et al. (2015) describe the different levels of futures literacy and the techniques to develop it. They summarize as well the Futures Literacy – Hybrid Strategic Scenario method designed by Miller (2007). (Rhisiart et al. 2015, 125-129).

Table 4 briefly illustrates the levels of futures literacy and the techniques.

Table 3: Levels of futures literacy – tasks and techniques (Rhisiart et al. 2015, 127)

Futures literacy	Task	Technique
Level 1 awareness	Temporal awareness, shifting both values and expectations from tacit to explicit – all of which build the capacity of people, teams and leaders to respond and innovate	A wide range of catalysts and processes generate the discussions and sharing of stories that elicit people's views on what they want and expect in the future
Level 2 discovery	Rigorous Imagining (RI) involves two distinct challenges – imagination and rigour, the former in order to push the boundaries and the latter so that what is imagined is "scientific" and intelligible	Escaping from the probable and preferable to imagine the possible demands systematic creativity and creating systematically; non discursive reflection and social science are essential ingredients
Level 3 choice	Strategic scenarios are aimed questioning the assumptions used to make decisions in the present, not as targets to plan-by but to provide new insights into the potential of the current world as a way to embrace complexity, heterogeneity and the pertinence of spontaneous actions that put values into practice	Strategic scenarios are constructing using the capacities and stories acquired in developing Levels 1 and 2 FL, by combining values, expectations and possibilities into scenarios that follow the narrative rules and the methods of "history of the future"

Rhisiart et al. (2015, 127) present three levels of futures literacy that build on each other. First, on level 1 it is about increasing awareness about the own perception of time, attitudes, mental models, biases, values and expectations is required. It is built through questions, discussions and stories. On level 2 creative and analytical skills are developed in order to break patterns of thought and limits to creativity, imagine wide ranges of possible futures, make sense of them and present them in a logical and intelligible way to others. Level 3 refers to the capacity of building shared meaning, making values-based choices using futures knowledge and novel insights, navigating complexity and engaging in action. Thereafter Rhisiart et al. (2015, 127-130) suggest employing the Futures Literacy – Hybrid Strategic Scenario method designed by Miller (2007) as a mean to acquire futures literacy and foresight capabilities. The method is based on learning-by-doing, self-awareness and reflection. It combines practical scenario work with periodic surveys. The survey questions help track own competence levels and the learning progress along the scenario creation process.

3 METHODS FOR DATA COLLECTON AND ANALYSIS

The methods utilized in this research were qualitative. This research employed several research methods and data triangulation (theoretical data, case studies and interviews).

3.1 Sources and Data Collection

The first step was a literature analysis in order to collect secondary data. Its main sources were academic research articles, books and existing case studies.

The second step was the conduction of semi-structured theme interviews**.** A questionnaire was created in advance and it was flexibly followed during the interviews. While conducting the interviews, new questions emerged as necessary, existing questions were re-formulated and questions irrelevant for a particular interviewee were skipped. The interviews were conducted and recorded with Zoom. A voice recorder was used as a back-up device. Posteriorly the interviews were transcribed for analysis. The targeted interview response sample size was 10 interviews.

The interview questionnaire was divided in three parts: Background information about the interviewee, his / her organization and the roles the organization and the interviewee had played ecosystems and in the foresight activities of the ecosystems. This background information part helped put the answers into context and identify the interviewee´s perspective. The second part was about foresight in business ecosystems and innovation ecosystems in general, based on the experience and insight of the interviewee. The third part was about ecosystems where the responded had participated, in which foresight activities had been particularly successful or interesting. The interview questions can be found in Appendix 1.

Since ecosystems are complex systems, this research intended to gather a systemic and holistic view on how foresight is utilized in business ecosystems and innovation ecosystems, the roles the different ecosystem players play in foresight activities and how the foresight outcomes flow into the activities of the ecosystems they build, orchestrate and / or support. Moreover this holistic approach helps to systemically identify research gaps and ways to improve how foresight is conducted and leveraged in ecosystem. Therefore the interviewees were carefully selected and represent as many different kinds of ecosystem players as possible, in special ecosystem players from public organizations that had received less attention in prior research. This approach proved fruitful, since the

interviews indicated that such ecosystem players as business accelerators and funders, governmental organizations, research institutes and non-profit organizations (NPOs) often build and orchestrate ecosystems. Furthermore public ecosystem players have high foresight capabilities, systematic and rigorous foresight processes, sophisticated foresight instruments and access to extensive international foresight networks and resources. They perform rich foresight activities and share the outcomes of their foresight in the ecosystems they support. For more contextual consistency, most of the interviewees represent players of the ecosystem landscape in Finland. To add the international foresight cooperation perspective, one responded was included from a governmental foresight organization from Japan that cooperates with Finnish business accelerators, funders, research institutes and think tanks.

The interviews have been anonymized and the interviewees will be referred to using I which stands for interviewee and the distinctive number assigned to each interviewee (I-1 - I-10). Table 3 provides an overview of the interviewees, the type of ecosystem player they work at and their role.

Table 4: Interviewees

PUBLIC SECTOR ECOSYSTEM PLAYERS			PRIVATE SECTOR ECOSYSTEM PLAYERS				
Governmental Foresight Organization (Japan)	Business Accelerator and Funder (Finland)	Research Institute (Finland)	Multinational Keystone company	Consulting Start-up 1 (Finland)	Consulting Start-up 2 (Finland)	NPO 1 (Finland)	NPO 2 (Finland)
Interviewee 10	**Interviewee 1**	**Interviewee 4**	**Interviewee 2**	**Interviewee 2**	**Interviewee 3**	**Interviewee 8**	**Interviewee 9**
Director in Science and Technology Foresight Centre	Ecosystem Lead	Researcher in area Strategy and Foresight	Head of Strategy	Senior Consultant	Founder and CCO	CEO	CEO
	Interviewee 7	**Interviewee 5**	**Interviewee 3**	**Interviewee 6**			
	Head of strategy and foresight	Researcher in area Foresight and Ecosystems	Head of Operator Business and Markets	Ecosystem Leader and Consultant			
			Interviewee 6				
			Research Manager				

The interview interviewees represented following types of ecosystem players:

Two interviewees come from a business accelerator and funder (I-1 and I-7). The role of this ecosystem player includes foresight on the landscape and international layer, international market opportunity identification, funding, consultancy and support for business growth and internationalization of Finnish companies and ecosystems. It as well builds, orchestrates and consults ecosystems in the strategic focus areas that the business accelerator and funder identifies through its foresight and strategy process. The perspective of this ecosystem player is on the creation of commercial value for companies and customers, wealth and well-being generation for Finland, international business, market and financial efficiency and foresight that is both broad and long-term and action-relevant.

Two interviewees represent a research institute (I-4 and I-5). It conducts research and foresight on a great variety of topics and initiates and facilitates many ecosystems. Its perspective is development, learning, co-creation and the common good.

Three interviewees nowadays work in a consulting company as consultants and consult, build and orchestrate ecosystems for the customers of the consulting company. Two of them (I-2 and I-3) had previously worked in ecosystems of a large multinational keystone company in positions in global business intelligence, foresight and strategy. The third interviewee worked in R&D leadership in a large multinational (I-6). These interviewees adopt the perspective of large international keystones and of start-ups, strategic thinking, practical efficiency, value creation and capture as well as human-centric leadership and socio-economic fairness.

Two interviewees are CEOs in non-profit companies that are ecosystems themselves and that link and orchestrate other larger ecosystems at global scale (I-8 and I-9). Their point of view is strongly on project goals, efficiency and making impact through concrete action.

One interviewee works at a Japanese governmental organization that performs foresight for science, technology, innovation, societal development and policy (I-10). This governmental organization cooperates globally in foresight projects. Its perspective is on scientific and technological development, innovation, policy making, stakeholder engagement, consensus and societal development.

In addition to provide their experiences and views about foresight in business ecosystems and innovation ecosystems in general, part of the interviewees described foresight practices in some of the ecosystems they had been involved in.

3.2 Data Analysis and Presentation of Results

The theoretical literature was analyzed and relevant insights were selected and summarized from the point of view of this study´s topic. Then they were employed during the analysis and interpretation of the empirical data.

The literature case studies and the responses of the semi-structured interviews intended to produce targeted and detailed qualitative data. This qualitative data was codified in pre-conceived and emergent thematic and sub-thematic categories guided by selected theoretical frameworks. The data was summarized into a highly granular Excel matrix for the analysis. The Excel had three sheets: One for the literature case studies, one for the generic responses of the interviews and one for the specific foresight case studies the interviewees described.

A systematic analysis of the results was conducted. Thereafter the results were grouped into clusters as appropriated to answer the research questions and to be presented in the research report.

Finally the empirical results of research were reported, analyzed and interpreted in this Master Thesis´ chapter 4 *Empirical Results*. In chapter 5 *Discussion* the researcher presents her own thoughts upon research results and draws overall conclusions.

4 EMPIRICAL RESULTS

The chapters below link interview responses with research questions and interpret them. The results are illustrated with quotes or fragments from the interviews.

4.1 Q1: How do participants in business ecosystems and innovation ecosystems currently apply foresight in design, orchestration and development of business ecosystems and innovation ecosystems?

This study uses the Multi-Layer Perspectives suggested by Pombo-Juárez et al. (2017) from the wider landscape level (global/international) to analyze the data provided by public player interviewees. The layers in their framework take a geographical perspective: International, national, regional and local. Also the foresight framework that combines scenarios and MLP by Vähäkari et al. (2020, 8) is employed to explain some of the difficulties related to dissemination and commercialization of the co-created joint offering.

This analysis starts with the broadest view of foresight in governmental organizations and shows how it cascades down to cooperation with foreign and national institutions that build, orchestrate, accelerate and fund business ecosystems and innovation ecosystems together with research institutes and think tanks. Thereafter business accelerators, funders, research institutes and think tanks process and combine global foresight information and share it in the ecosystems they support as appropriate for the specific ecosystems. It is then the responsibility of the ecosystems to leverage and compliment foresight information with own focused foresight and to derive actions.

In Japan foresight and innovation responsibilities are distributed among several governmental institutions. A Japanese governmental foresight institution inside NISTEP (National Institute of Science and Technology Policy) conducts regular foresight programs:

> "In Japan governmental foresight and innovation responsibilities are distributed among several institutions. NISTEP, JST and NEDO are collaborating in foresight surveys. NEDO is under the Ministry of Industry and it funds and fosters business development. […] NISTEP conducts a foresight project every 5 years to make a Science and Technology basic plans, including policy recommendations. The purpose of NISTEP is technology development and foresight information is a tool and a source of ideas. A Ministry of Digitalization will be established soon and it will support business ecosystems and innovation ecosystems in the digitalization field. NISTEP conducts a foresight project every 5 years to make Science and Technology basic plans. The purpose of the basic plans is to promote R&D in prioritized areas. The current plan (2016-2020) targets at realizing desirable social change towards *the*

> *Super-Smart Society*, also called *Society 5.0*, as well as defining performance indicators and numerical targets. […] NISTEP cooperates with Finland´s business accelerator and funder, research institutes and think tanks. The joint foresight results flow into Finnish ecosystems like in the Circular Economy area´s innovation and business ecosystems. In Japan NISTEP shares foresight results with ecosystems and ecosystems are responsible to think by themselves how to apply results of foresight in their activities." (I-10, a director of a Japanese governmental organization that performs foresight for science, technology, innovation, societal development and policy)

NISTEP, Business Finland, VTT and Sitra cooperated in a foresight project on the area of the Circular Economy and created a joint foresight report (Urashima et al. 2020).

> "Last year we participated with VTT and our foresight and strategy units and run a Delphi together with the Japanese organization that is the long-term foresight leading actor, for up to 2030 – 2040. In 5 years intervals they do foresight for the circular economy broader context for ecosystems. […] NISTEP from Japan makes technology foresight, research foresight and some very ambitious scenario projects that include the societal and technological aspects e.g. about digitalization issues and well-being issues." (I-1, Ecosystem Lead at a Finnish business accelerator and funder)

Foresight in global networks contributes to capturing information and weak signals that would go unnoticed in an individual country. Global foresight networks help the Finnish business accelerator and funder to see the weak signals that are not visible in Finland. The global foresight information is then related to the Finnish environment and ecosystems in cooperation with advisors and stakeholders.

> "We are collaborating with international think tanks globally because our focus is global. We try to boost innovation and export activities. So we need to have global information. We do have partnerships with institutes for futures studies and the Copenhagen Institute for Futures. And also in Asia we have partnerships in the local think tanks and then we also operate with some of the governmental organizations and do have collaboration partnerships with some of the governmental organizations like for instance in Japan. So we are trying to build also the innovation partnerships so that we are really close on the same agenda. […] So because we have global networks so we collect signals from different topics very focused and then we have the signals sessions in our global network. What are the signals we do not see here in Finland? So they are having this kind of sessions and I am leading the signal sessions here in Finland and connecting the signals in Finland with our

> advisors and stakeholders as well." (I-7, Head of Strategy and Foresight at a Finnish business accelerator and funder)

Further international cooperation partners for foresight with which the Finnish business accelerator and funder collaborates are:

> "For US the Silicon Valley Institute for the Future, for Europe the Austrian Institute of Technology and the Urban Europe project as a European foresight and innovation benchmark. The projects´ strategies and innovation agendas point of view is in urban and societal aspects on the intersection between technological and societal aspects but it lacks the industrial approach we would like to see." (I-1, Ecosystem Lead at a Finnish business accelerator and funder)

The interviewees were asked questions about the purposes for which they conduct foresight, the sources they use, the contents of foresight as well as the utilized foresight processes and methods. They were also invited to describe how foresight results were structured and communicated and to evaluate the impacts of foresight.

Foresight Purposes and Content

Business accelerators and research institutes utilize foresight for their own strategic planning in order to decide the areas they will focus on and in which they will build ecosystems and provide support.

The Finnish business accelerator and funder conducts foresight mainly for their own strategic planning and for defining the strategic areas for which they will provide support and funding and in which they will build and support business ecosystems and innovation ecosystems. Its responsibilities are described as follows:

> "We are a public business accelerator and funder with focus on industry, internationalization, business and industry growth, competitiveness, sustainability and well-being and prosperity for Finland. We do feasibility studies. We realized that sustainability, digitalization, clean tech and the circular economy are the areas where Finland has good potential to address the challenges in our partner countries. We organize round table meetings to prepare projects and build ecosystems. […] Enable new strategic research-based or company-driven ecosystems, strengthen existing ecosystems on the R&D stage and help gathering EU funding for the ecosystems. Funding of Academy of Finland and the

> Ministry of economy and employment and of ministry of education and culture ecosystem projects, vocational university profiling, looking at the potential of the EU funding for recovery and the Green Deal. I am ecosystem lead, give hand-on sparring to innovation ecosystems, lead programs in circular and bio-economy areas and policy making; look at how to make the ecosystem partner structure functional; There is a clear need [of support for ecosystems] for a transition from the innovation stage towards international piloting and international business ecosystems." (I-1, Ecosystem Lead at a Finnish business accelerator and funder)

> "Our institution organizes round table meetings to prepare projects and build ecosystems and organizes the *poker table* and wants to see the hidden cards of the companies in order to understand the win-win-win and advise them when to show the hidden card and when to keep it hidden. One purpose of foresight is to create novel solutions and the demand for them. When a novel joint offer is created, it is not clear who will be the customers, who will be the investor, etc. There is a need for new business models and roles for creating also demand. Market and demand foresight is needed in ecosystems. Science and technology foresight is another aspect. Foresight about the competences that will be needed. Digitalization, AI and automation will renew traditional industries. Technopolis and Forefront are doing an impact assessment to look at the evolution of Academy of Finland and main steps 10 years back and 10 years into the future. Foresight about the role of public organizations may have in the future and how they should develop. About impact and evolution of public funding organizations. What has changed? What will change and what are the issues? What remained the same and should remain the same? How to balance between the change and the continuity? Combining market opportunities currently and market opportunities in the future and what is the right innovation ecosystem." (I-1, Ecosystem Lead at a Finnish business accelerator and funder)

Other ecosystem players´ interviewees added further purposes and content of foresight: Understanding the landscape and the regulations related to the ecosystems´ field of activity (I-6, an ecosystem orchestrator and consultant), setting the direction and creating a shared vision and the roadmaps for the ecosystem (I-2, an ecosystem orchestrator and consultant; I-3, an ecosystem orchestrator and consultant; I-4, a researcher and ecosystem orchestrator at a research institute and I-5, a researcher and ecosystem orchestrator at a research institute), detecting emerging sciences, technologies and their enablers (I-5, a researcher and ecosystem orchestrator at a research institute and I-10, a director of a Japanese governmental organization that performs foresight for science,

technology, innovation, societal development and policy), technology road mapping and creating scenarios for the ecosystems´ projects (I-6, an ecosystem orchestrator and consultant), setting goals and R&D project planning (I-3 and I-6, ecosystem orchestrators and consultants), agreeing on ecosystem projects´ roles (I-4, , a researcher and ecosystem orchestrator at a research institute), for companies to decide in which ecosystems to participate (I-2, an ecosystem orchestrator and consultant), identifying the right players and inviting them into the ecosystem (I-5, a researcher and ecosystem orchestrator at a research institute and I-6, an ecosystem orchestrator and consultant), assessing and mitigating the risks of the approach taken (I-2 and I-6, ecosystem orchestrators and consultants), exerting influence on policy making (I-10, a director of a Japanese governmental organization that performs foresight for science, technology, innovation, societal development and policy) and standardization (I-3, an ecosystem orchestrator and consultant), for desirable societal development (I-5, a researcher and ecosystem orchestrator at a research institute and I-10, a director of a Japanese governmental organization that performs foresight for science, technology, innovation, societal development and policy), for answering specific questions related to the ecosystems´ activities (I-6, an ecosystem orchestrator and consultant) and for setting up new areas of activity (I-8, CEO of a NPO that orchestrates ecosystems at global scale).

No references were made to preparedness for unexpected high impact events such as wild cards and black swans, except for two references to COVID-19. I-5, a researcher and ecosystem orchestrator at a research institute, mentioned that it has increased the interest toward foresight and I-10, a director of a Japanese governmental organization that performs foresight for science, technology, innovation, societal development and policy, pointed out that, as a consequence, digitalization has become a focus area in Japan´s foresight and development support.

Foresight Sources

Altogether the sources of foresight mentioned were: Reports about novel developments and global market opportunities by Gartner, Frost & Sullivan and McKinsey, reports about horizon scanning results, megatrends, trends e.g. by Aalto University, Helsinki University, VTT and Sitra, international governmental foresight reports, World Economic Forum reports and Futures Platform.

Foresight Processes, Methods and Tools

Public organizations conduct the most structured and sophisticated foresight processes and adopt a long-term timeframe of 10 – 30 years.

I-10, a director of a Japanese governmental organization that performs foresight for science, technology, innovation, societal development and policy, supported her responses with a comprehensive slide set about foresight practices in NISTEP. The slide set presents in detail the foresight process and methods employed; the participants of foresight and the way foresight results are communicated (Science and Technology Foresight Center of National Institute of Science and Technology Policy, Ministry of Education, Culture, Sports, Science and Technology 2015). The slide set was provided by email. Based on her interview and the written information provided, the foresight process conducted by NISTEP can be summarized as follows:

In Japan governmental foresight has a long tradition starting in 1971. The stake holders of foresight projects performed by NISTEP are governmental policy makers, industry, finance, academia, NPOs and citizens. The foresight project takes place on regular basis every five years. Its outcomes are basic plans for science, technology, innovation and policy development. The focus of foresight has shifted along time and basic plans: From 1971 to 1997 the perspective was technology development-centered, from 2001 to 2005 it was needs-driven, from 2005 to 2010 the focus moved toward problem solving and finally since 2010 it has been on building visions for desirable societal development. Part 1 of the foresight process uses the KIDSASHI system for daily horizon scanning on the international layer with the goal to gain insights about weak signals, megatrends, trends, drivers of change and new movements in science, technology and society. Scanning is supported with sophisticated ICT tools and data collection and analysis methods: Big data analysis, AI, machine learning, database tracking, cohort study tracking, case studies, literature reviews, focus group interviews, public opinion polls and SWOT analysis. Part 2

consists of visioning. Nowadays the visions strongly focus on desirable societal development. Visioning happens during regional workshops through discussions with citizens, NPOs, specialists, industries, education, finance and local governments. In part 3 a Delphi survey is conducted. Part 4 utilizes the inputs of parts 1, 2 and 3 for scenario planning, strategic planning and prioritization of funding, support, policies and actions as well as with definition of metrics for tracking. This is done in participatory workshops and expert panels.

The foresight process of the Finnish business accelerator is described as follows:

> "Our institution has a strategic process to support strategic choices of the themes and attract players into them to build or to support ecosystems and create transformation. The topics are such that have huge market opportunities in 10 years. […] Our institution initiates once a year foresight analysis to support its strategy and conducts 20 weak signals session per year across its international partners. The results are then discussed in Finland. Our institution builds ecosystems on many levels related to its key programs and shares foresight information as relevant and specific with the ecosystems it builds, leads and supports and with its customers, e.g. about trends that affect market and customer demands. Many ecosystem players and customers have no foresight competences nor in-house foresight activities and our institution acts as a foresight platform for their businesses." (I-7, Head of Strategy and Foresight at a Finnish business accelerator and funder)

Further methods mentioned by the interviewees were the futures wheel, the futures table and cross-impact analysis.

While the timeframe of foresight utilized by public sector players is 10-30 years, the timeframe of foresight adopted by private sector players is 3 – 5 years.

Some of the private sector players´ interviewees answered in a vague way the questions about foresight processes and methods and seemed uncomfortable with the questions. Their answers shifted from foresight activities to project activities of the ecosystem. This phenomenon became the more accentuated, the closer the role of the person was to the core activities of an ecosystem. The interviewer did not direct back their attention toward foresight but instead listened in order to gather a better understanding of their perspective and the ecosystem context. The perspectives and expectations of CEOs in NPOs, SMEs and start-ups and of ecosystem orchestrators and project managers are on the practical implications of foresight results that lead to action plans and

concrete actions. They seem to expect from foresight such more certain, concrete and quantitative results as forecasting provides, instead of the broad views and alternative futures that foresight offers.

A novel methodological finding was the combination of foresight with theories of change as done in an innovation ecosystem (I-8, a CEO in a NPO that orchestrates global ecosystems). This is consistent with the case studies in the literature that had indicated that foresight can be more effective in ecosystems when combined with relevant theories such as Social Network Analysis theory (Battistella et al. 2013), multi-layer perspective analysis frameworks (Geels and Schot 2007; Vähäkari et al. 2020; Pombo-Juarez et al. 2017), Service-Dominant Logic theory (Ketonen-Oksi 2018) and open innovation and innovation ecosystem theory (Karjalainen and Heinonen 2018).

One innovation ecosystem has started to conduct foresight after an employee with foresight capabilities joint the organization:

> "Now we have started some foresight activities, since one of our employees has a Master in Futures Studies. […] We conduct foresight in a practical way in our own domain and follow foresight groups. We run workshops in very small groups of 4-6 persons and use the collective intelligence and insights of our members. We also conduct online surveys and discussions to clarify meaning of questions and answers among members and communities; we use Miro to re-arrange and prioritize. In May we will have community workshop or *town hall meetings* with everybody who wants to participate and is interested in foresight, and discussion with 10-25 participants. We use online tools such as Google Drive, Google Docs, Slack for discussion, Miro for sense making and digital whiteboards. The foresight methods are combined with change theory. […] It is not yet part of our orchestration and we have not yet made a decision to include it." (I-8, a CEO in a NPO that orchestrates global ecosystems)

Responsibility for Leading Foresight, Participants in Foresight and Networked Foresight

Most of the interviewees emphasized that foresight for and in ecosystems is not systematic and structured enough and that it is mostly conducted by a single player from its point of view, mainly by a public sector player or the keystone company. Public sector players and large companies have dedicated foresight organizations with foresight

capabilities. Small and medium-sized enterprises (SMEs) often lack foresight capabilities and financial resources to purchase foresight services. Foresight is seldom done jointly by all ecosystem players at the ecosystem level as a whole, although that would be the most effective option. The reason behind foresight not been conducted in a systematic, structured and joint way seems to be the lack of foresight capabilities in ecosystem players from the private sector.

> "Mostly foresight is led by research directors of companies, by research directors and professor at universities and research centers or by external consultants like Spinverse, Gaia consulting, or think tanks like Sitra in projects with long-term visionary approach about the circular economy, World Circular Economy Forum with foresight and scenarios for their innovation and technology portfolio, recognizing living lab actors. Some of the companies Sitra has identified are partners in ecosystems. Visionary lead people may be start-up founders." (I-1, Ecosystem Lead at a Finnish business accelerator and funder)

> "I think If I were to organize foresight in an ecosystem in an optimal way it would be a joint activity because then you can collect the different viewpoints, add them together and come up with probably much more and better quality of insights than if every player would be doing it on their own. And then obviously comes up with the role of the orchestrator. Actually I do not like the word orchestrator that much so I recently what I use is "producer" and the producer is in a position to pull-in the needed resources at every step of the way. Foresight should happen at the ecosystem level. I think the only individual that is well known for his visionary thinking is Risto Linturi. But he also works with a team. I think that in term of capabilities there are two actions that need to happen: The orchestrator / producer needs to understand the need for the foresight and most likely the orchestrator can facilitate a futures workshop or so forth. But there are different capabilities that have to be brought-in in terms of understanding what foresight is and that is a different discipline of its own. The foresight methodology expertise is a capability that most likely the orchestrator does not have so that needs to be brought-in. And then there is the subject matter expertise that, if I think for example that the University of Turku that we both study at there is the lab of business disruption led by Thomas Westerholm. I think what they are trying to do is to specialize on the process that would combine foresight and strategy. And I think that that type of approach would be very good, because from that perspective they are in the position to pull-in also the subject matter expert." (I-2, an ecosystem orchestrator and consultant)

"I think if we take the public organizations, then you may have specific people who are in charge of foresight. In organizations, in companies or corporations, foresight may be part of the strategy work but typically not. It is the strategist who should be part of the strategy work process. And then when we think in the interesting role of business management who is anyways in charge of the, let´s say, of the decisions made today and the results that are made today, I think they should understand the role of foresight but then the risk of and understand the risks as well. So that if they stick to the traditional strategic management there is a risk that foresight is forced to be too narrow. If foresight is done with a too narrow view of the future options, then the challenge is that it kind of states the obvious and does not expand the view of the future as it should. The public organizations that take part in foresight are ministries and then governments, let´s say, their development organizations like VTT in Finland which is a research organization. VTT has a specific foresight department. And then thinking like the ties of Business Finland who is, let´s say, directing the government or public funding to ecosystems. Foresight plays an important role in that type of organizations." (I-2, an ecosystem orchestrator and consultant)

"I cannot say that there are special [foresight] roles. Usually there are special teams. If you think of smaller companies, they do not. They cannot afford these different roles. They use consultants if any. They do ad hoc like what weather is tomorrow. I have not seen that there are specific foresight teams or foresight people in any of these ecosystems. It is a kind of like we have people who analyze and research the market in the way of where the market is moving but I do not see that this is exactly the foresight what you are referring when you use the term. Consultancy companies are used: If you look at the big ones McKinsey and alike who are bringing their views on the future. Most of the companies are using their reports or some of their consultants to build their future or scenarios they want to do. There are many companies who are around there. And of course large companies are also teaming up with the academic world in order to get the help for the research they are doing." (I-3, an ecosystem orchestrator and consultant)

I-4, a researcher and ecosystem orchestrator at a research institute, points out the need to assess the motivation a SME or start-up company has to join an ecosystem and recommends to avoid inviting companies that are looking rather for their own benefit instead of the joint positive impact to be created by the ecosystem. He may be referring to the role of the landlord described by Iansiti and Levien (2004b, 107-115, 118-122) as a player that does not integrate into the system to coordinate it but focuses on extracting value from the system and capturing too much value for themselves. Furthermore he sees a correlation between the motive of a company to join an ecosystem and its

motivation to engage in foresight. Companies that mainly seek to co-create innovations rather than just getting benefit for themselves seem to be more willing to participate in foresight:

> "Companies with the right motivation to join the ecosystem, who want to create together the ecosystem solution, are more interested in foresight." (I-4, a researcher and ecosystem orchestrator at a research institute)

I-5, a researcher and ecosystem orchestrator at a research institute, had identified that the lead for foresight is taken both by the ecosystem orchestrator and the key players that lead vision building. In her opinion foresight is however seldom officially included. She informed that public organizations usually conduct foresight at the ecosystem level in order to create roadmaps and projects. She also mentioned that in some cases foresight is conducted by both single players and at the ecosystem level as per example in one business ecosystem. She added that foresight capabilities and futures knowledge of public and private ecosystem players are sometimes complimented with the ones of professional futurists, associations and clusters of the relevant industry sectors.

In an innovation and business ecosystem foresight had been utilized separately by the key player companies and jointly at the ecosystem level:

> "All companies that are involved have their own business intelligence that is behind their plans. […] They have their own insights why they are doing this and what are they aiming at. […] With the key companies we built the plans. […] Before we started the work, we did some kind of foresight together with the key partners in the early phase to ensure that we are doing the right things that cities need when they want to turn smart and sustainable. […] In the two first years of the joint project we utilized our university partners for the foresight work and co-created the basic understanding of different scenarios and possibilities. Also in the second phase we are conducting the strategic foresight studies with our university partners. […] We are studying the regulatory environment, the business environment and the operation environment, related to all the new things we are working on. And for all these aspects we need to look at the future as well, at different scenarios and so on. That is why we have taken it [foresight] as part of the ecosystem´s joint R&D plan." (I-6, an ecosystem orchestrator and consultant)

The importance of joint foresight at the ecosystem level as a continuous activity and of expanding the foresight time frame is pointed out by several interviewees.

> "We should do foresight on a continuous basis and in a collective networked way and share the work and results. Leading ecosystems should be scientific and systemic. May be we should expand the time frame from 2-3 years to 10 years." (I-8, a CEO in a NPO that orchestrates global ecosystems)

In one business ecosystem some persons with strategy competences of the five big companies facilitated foresight together with public players:

> "Persons from the strong companies´ strategy departments, from research institutes and futurists from the Futures Research Center of the University of Turku facilitated the process. Nearly all companies provided input." (I-9, a CEO in a NPO that orchestrates the ecosystem)

Many of the interviewees agreed that the most suitable role to facilitate joint foresight at the ecosystem level would be the ecosystem orchestrator. Foresight should be part of his/her leadership role. But before that becomes possible, ecosystem orchestrators would need to build their foresight capabilities.

4.2 Q2: How can foresight contribute in general to business ecosystems and innovation ecosystems? Q3: How can foresight contribute in concrete during different development phases of business ecosystems and innovation ecosystems along their lifecycle?

These questions are interrelated. Q2 looks for benefits of foresight in ecosystems and Q3 links them to certain lifecycle phases. The results of both questions are combined here in order to avoid repetitions.

To answer these research questions the questionnaire contained questions about both the potential and realized benefits, impacts and value-add of foresight and whether certain benefits can be linked to specific lifecycle phases of an ecosystem.

According to the data analysis foresight can contribute to the design, orchestration and development of business ecosystems and innovation ecosystems in many ways. However the interviewees could say more about potential benefits of foresight than report about its materialized impacts. The reason behind is that ecosystems are an emerging type of organization and foresight in ecosystems is still incipient. The ecosystems the interviewees had participated in have been built only 1.5 – 5 years ago and foresight impacts are not yet visible nor have they been measured. Only the orchestrator of a

wireless telecommunications business ecosystem built in 2004 by a telecommunications equipment manufacturer together with its customer in Brazil could report some success of foresight:

> "The ecosystem aim was to expand the new wireless telecom technology WCDMI to Brazil. As a part of the project plausible scenarios were created about how the technology, market and customers would evolve. In 2009 the scenarios materialized, including figures very close to the ones estimated with the business and technology simulator we built. However we did not win the deal." (I-2, an ecosystem orchestrator and consultant)

Only I-2, I-3 and I-6 (ecosystem orchestrators and consultants) and I-4 and I-5 (researchers and ecosystem orchestrators at a research institute) are familiar with the ecosystem lifecycle phases although with different models and phase naming. Half of the interviewees were not able to link foresight activities and benefits to lifecycle phases. Foresight activities tend to accumulate in the initial and final phases of the lifecycle. Most interviewees agreed that foresight activities should be conducted on a continuous, iterative basis.

To overcome the different and inconsistent ecosystem lifecycle models, here is utilized the model that is closest to the descriptions of benefits provided by the interviewees: The model of the evolutionary stages of a business ecosystem by Moore (1993). The interviews pointed out following benefits that can be linked to lifecycle phases.

Phase 0: Pre-birth of an ecosystem

This phase is not part of Moore´s model however it pictures an important preparatory period before the ecosystem is designed and built.

As stated earlier, governmental organizations conduct foresight to promote emerging science, technology and innovation as well as societal change towards preferred future visions and to support policy development and standardization. Public players like research institutes and business accelerators and funders utilize foresight in order to decide on the strategic areas they will focus their activities on and support. Additionally they apply foresight to decide which ecosystems they will initiate, support and fund as well as to select the funding instruments to be applied.

During the pre-emerging phase of an ecosystem, a horizon scanning of the landscape in which the ecosystem operates is performed to detect megatrends, trends, drivers and weak signals and assess their potential impacts on the purpose for which the ecosystem is being created, on the problem the ecosystem tries to solve or on the innovation idea and the needs the idea aims to satisfy. Foresight helps ecosystems to understand their landscape and the relevant regulations. These findings are consistent with the ones in the literature case study by Pombo-Juarez et al. (2017, 280-283) where they report that foresight improves systems understanding and awareness of drivers and barriers as well as enhances networking and strengthens innovation activities.

Phase 1: Birth:

During this phase the ecosystem is designed and built. The goals are set, roadmaps are created and stakeholders are mapped. The boundaries of the ecosystem are drawn, the necessary players are identified and invited to join the ecosystem, a shared vision is created and the key project and roles are defined.

> "If I think about the beginning of the ecosystem obviously there then, if we talk specifically about the, let´s say, the key project, then the type of ecosystems that are deliberately, let´s say, ignited, then foresight plays an important role in defining or framing the ecosystem. Because that is as said, if even though we may think about ecosystems very broadly, typically they are somehow like ecological ecosystem. They are constraint and geographically in different locations and have different flora and fauna. In a similar way in business ecosystems and innovation ecosystems there are some boundaries. Boundary setting is very important in the beginning." (I-2, an ecosystem orchestrator and consultant).

Companies use foresight to create their strategy for collaboration with external players and networks and to decide which ecosystems they will join.

Phase 2: Expansion

Business accelerators and businesses use foresight to create a solid business case for the ecosystem´s joint offering, that means to assess potential business opportunities of the planned joint offering an ecosystem aims to create, the fit between the offering and the target markets, the right timing to launch the offering to the markets and how to create demand for the joint offering on the markets. They also dynamically re-define plans upon changes detected in the environment:

> "It [foresight] is leveraged at very different levels, depending on how and how much it is used. I think so far it has not being used systematically and it is a small part of the strategic vision but this is not a fact, just my impression. There are a lot of case-specific and industry specific differences and the similarities are in organizations and people that interact together. Other ways there are a lot of ecosystem specific, topic specific and industry specific aspects. You need to understand the differences in order to utilize potential and utilize the competitive edge. Ecosystems try to do competitive business in new ways and clarify who need to get together in the innovation stage to develop and pilot and to gradually build the credibility of the new way. If the ecosystem business case is solid, then it is expanding in a competitive way. […] Foresight can prevent ecosystems from allocating resources to the wrong things and doing the wrong things at the wrong timing. It is an important tool in strategic planning. If used in the strategic planning, it will make more likely to do the right things. When foresight shows some changes, ecosystems should re-define their targets and goals, be agile enough not to stick to the original plan. Foresight is a compass you use and you look at the targets and your surroundings and at what you are doing and then at the compass again. You need to realize that foresight is dynamic. If you base your work on static foresight you may do something that is not valid anymore when it is completed." (I-1, Ecosystem Lead at a Finnish business accelerator and funder)

> "I think the benefits of foresight are better solutions to the problems that the ecosystem is solving. Larger and richer set of partners, and the ability to apply learnings in the broadest possible sense. […] And then in the expanding phase, when business models start forming and there start to be much more players, then obviously the potential that foresight has as we use to see, when the solution would be fit for other purposes, then the

already final one. Then when I think about the role of foresight, by definition it is about not setting too narrow boundaries too early on." (I-2, an ecosystem orchestrator and consultant)

Phase 3: Leadership

Foresight has motivational effects:

"It helps the whole ecosystem team to look to the future in a similar manner. Because it might be so that, depending on the background and depending on their organization, they have different views of what is happening in the future. So it could be used as uniting the shared view or vision of what are the scenarios for the future and then they as a team can decide which one they pick as the most desired one to follow and which ones are those they want to be prepared for, which changes are happening around. This is I would say one of the value-adds. You have the foresight depicting that these are the reasons why is worth doing what you are doing." (I-3, an ecosystem orchestrator and consultant)

"Understanding how the ecosystem can create impacts and the value of the ecosystem activities." (I-5, a researcher and ecosystem orchestrator at a research institute)

SMEs and start-up players are especially interested in the road to revenue and the timing of revenues as an output of foresight:

"Start-ups do not talk about foresight but about the road to revenue." (I-3, an ecosystem orchestrator and consultant)

Phase 4: Self-renewal

Only one interviewee mentions foresight benefits in the self-renewal phase:

> "Then when ecosystems start evolving then the foresight has a possible role in ensuring that there is enough breath so that the potential solutions for the problem the ecosystem is solving remain large enough." (I-2, an ecosystem orchestrator and consultant)

Scaringella and Radziwon (2018, 65) see innovation ecosystems as a type of business ecosystem and Kola et al. (2020, 81-87) argue that business ecosystems evolve into innovation ecosystems during the self-renewal phase. However, two interviewees add a new point of view to the discussion and consider that innovation ecosystems evolve into business ecosystems when they commercialize the joint offering in phase 2 Expansion:

> "There is a clear need for a transition from the innovation stage towards international piloting and international business ecosystems." (I-1, Ecosystem Lead at a Finnish business accelerator and funder)

> "We have been working in our innovation and business ecosystem in the last 4-5 years, starting with the first innovation project [keystone project] which was prepared with the keystone and 14 other partners. The ecosystem has been evolved from that time already and now we have the second phase on-going with 26 partners working intensively together in two different project streams. We are now heavily discussing and working on this issue: How would we take this [the ecosystem´s joint offering] to the market. […] The challenge is that we are making so new things and so holistic things that the commercialization is not straightforward. It is not just building a few products; it is changing the infrastructures in cities. It needs big investments and efforts which are tight to other activities in urban planning. It might be so that for some time it will be joint business by several partners which can mean also transition to a business ecosystem. That is the challenge that we are trying to solve still this year, how to bring it to practice. It depends on the ecosystem very much but in many of the ecosystems where new things are done together so that it does not fit to anybody´s current business, there is the issue who is the one that will take it to the market. Sometimes it is the problem in such ecosystems where the role should be clear but they are not effective enough or do not know how to do it. We have built different scenarios and capabilities to be prepared

> for the next stage, but that is naturally a lot dependent on the market" (I-6, an ecosystem orchestrator and consultant)

Apparently the transition between business ecosystems and innovation ecosystems can happen in both directions, even in a same ecosystem. It is plausible that an ecosystem starts as an innovation ecosystem in phase 1 Birth, develops into a business ecosystem in phase 2 Expansion and, once the joint solution is on the market, it may want to continue its activities and move to new areas to create new solutions during phase 4 Self-renewal, that way transforming back into an innovation ecosystem. This seems to be the evolution path of the previously mentioned innovation and business ecosystem.

4.3 Q4: How can foresight be performed and leveraged more effectively in business ecosystems and innovation ecosystems?

To answer this question case study data was distributed into relevant themes and interview interviewees were asked questions about the challenges of foresight in ecosystems, the reasons for the challenges, potential solutions for the challenges, best practices and lessons learnt.

For more clarity the data analysis has been grouped into clusters based on types of challenge and its suggested solutions.

Table 5 provides an overview of the key challenges and best practices identified. The table is followed by a detailed analysis.

Table 5: Challenges and best practices for foresight

Area	Challenges	Solutions
Foresight design	Ecosystem complexity and multiplied complexity of foresight in ecosystems	Develop dedicated foresight processes and methodologies for ecosystems. Combine with foresight relevant theories for the ecosystem goals and characteristics, e.g. MLP frameworks, MOBENA for social network analysis, theories of change and of open innovation, Service-Dominant logic, etc.
	High variety of landscapes, industries, business environments, goals, activities and players of ecosystems	Tailor foresight for the specific ecosystem and select different foresight methods for different contexts, purpose and lifecycle phases. Make foresight modular and scalable for input, administration and geographically. Make foresight easy to maintain and update.
Different perspectives and limited foresight capabilities	Players´ different perspectives, values, needs, expectations, resources, timeframes and socio-cultural and political contexts.	Conduct foresight jointly at the ecosystem level and on a continuous basis. Make foresight part of ecosystem leadership activities and include foresight into ecosystem plans and resourcing. Keep an uninterrupted chain of foresight from the landscape level and gradually narrow it down till the micro level of concrete action.
	Some players have limited foresight capabilities. The benefits of foresight are not recognized and foresight lacks credibility.	Build foresight capabilities of orchestrators and players. Create awareness about the role of foresight. Create a Balanced Scorecard and metrics for foresight. Make foresight concrete for actions. Measure foresight quality and impacts and demonstrate its benefits. Create and share case studies of foresight success stories.
Business	Deciding where to invest resources Ensuring the market fit of the joint offering Estimating the right timing for the pre-market prototype, for the launch of the joint offering to the markets and for the time-to-revenue for the players	Foresight researches the future market needs and the joint offering´s market fit These timings become part of foresight
	Responsibilities and business models for the joint offering´s marketing, the single point of contact for customers, distribution channels and maintenance	Foresight for business model design and for models of commercialization, distribution and maintenance
Ecosystem dynamics	Coopetition, conflicting interests and alignment issues among players Players unwilling to share results of their individual business intelligence and foresight	Nominate an external neutral orchestrator to lead the ecosystem and facilitate foresight. Conduct foresight jointly at the ecosystem level . Create shared visions and plans based on foresight. Foster a culture of trust, mutual understanding and open communication.
	Multilateral interdependencies Undesired behaviors (e.g. landlords and dominators)	Focus on the common goal and value co-creation and generate motivation and engagement. Keep players and goals aligned.

Challenges, solutions and best practices related to foresight design

The landscape, ecosystem goals and activities, ecosystem players and their contexts, the industries involved in an ecosystem and its regional, national and local contexts vary greatly. For that reason the complexity of foresight in ecosystems multiplies in comparison to corporate foresight. Therefore foresight should be carefully designed and tailored for a specific ecosystem.

Pombo-Juárez et al. (2017, 279-283) make following recommendations for the design of foresight for ecosystems that may help address heterogeneity and safe resources: To tailor foresight for the specific ecosystem and to make foresight modular. Different subprocesses and modules should be able to be created independently from each other and

combined in different ways for different purposes and foresight projects. For example the same analogous foresight processes can be carried out simultaneously in different countries and then compared and combined. Modularity increases scalability for addition of input, for administration and geographically. Foresight should be easy to maintain and update. The case study Foresight for the European Personal Health Systems (PHS) innovation ecosystem by Pombo-Juárez et al. (2017) is an excellent example of carefully and systemically designed and tailored foresight that aims at ensuring broad and long-lasting impacts and benefits.

In the foresight project for circular economy ecosystems (Urashima et al. 2020) a Delphi survey about science, technology and societal change was conducted in parallel in Japan and Finland. The Delphi results were compared and combined into a report that was utilized for circular economy ecosystems. Similarly in the foresight for the Personal Health Systems innovation ecosystem foresight processes were conducted simultaneously at international, national, regional and local levels.

In some of the foresight case studies in the literature, foresight design was supported with other relevant theories and frameworks. For example the case study Foresight for the digital image business ecosystem by the operator´s Telecom Italia Future Centre (Battistella et al. 2013) combined with foresight Social Network Analysis theory and designed the MOBENA network analysis framework that integrates the future perspective. They then conducted foresight combining MOBENA with foresight methods. The case study about the value co-creation service ecosystem Kampusareena of Tampere University of technology (Ketonen-Oksi 2018) integrated the Service-Dominant logic with foresight. Moreover Karjalainen and Heinonen (2018) integrate open innovation and innovation ecosystem theory with foresight in the case study Foresight for Kenya innovation national ecosystems for neo-carbon energy (Karjalainen and Heinonen 2018). Pombo-Juárez et al. (2017) combine various models of Multi-Layered Perspective analysis with foresight in the case study Foresight for the European Personal Health Systems (PHS) innovation ecosystem. Finally, in an innovation ecosystem, theories of change are combined with foresight methods (I-8, a CEO in a NPO that orchestrates global ecosystems).

There is a need to develop a process and methodologies especially suited for foresight in the context of ecosystems. I-2, an ecosystem orchestrator and consultant, and I-4, a researcher and ecosystem orchestrator at a research institute, are developing such a foresight process.

A researcher and ecosystem orchestrator suggests to emphasize the value of foresight, tailor foresight for the ecosystem and adopt a multi-perspective in foresight:

> "Understand why foresight is done; customize foresight for the ecosystem and select the right foresight process and tools. […] The main aspects is to understand the multi-perspective approach so that the focus is not limited too much based on today´s business environment or the players involved at the moment in the ecosystem." (I-5, researcher and ecosystem orchestrator at a research institute)

Challenges, solutions and best practices related to different perspectives and limited foresight capabilities

Different ecosystems players and ecosystem project roles have different perspectives, values and expectations towards foresight. Governmental institutions, research institutes, business accelerators and funders are specially focused on the landscape perspective, on strategy creation and on strategic choices. Their foresight time span is 5-30 years and their foresight activities happen on a regular basis. Governmental institutions and research institutes are more concerned with collective benefits and educational, socio-economic and innovation aspects. Business accelerators and funders think and act upon internationalization, markets, seizing of business opportunities and prosperity.

Large companies and multinationals have foresight capabilities and dedicated organizations for business intelligence, foresight and strategy. They do long-term planning for the next three, five and 10 years. Their focus is mainly commercial.

However ecosystem orchestrators and the smaller ecosystem players that actively participate in the co-creation of the ecosystem´s joint offering have a short-term planning perspective of up to three years. Small and mid-sized enterprises often lack foresight capabilities and the necessary time, personal and monetary resources to engage in foresight. Their approach to foresight is very practical. They view foresight as too uncertain and speculative and therefore hesitate to make decisions based on foresight. They expect from the foresight results shared with them more relevance for the goals and activities of the ecosystem and a stronger connection to concrete actions. The smaller the player, the higher the priority they place on quick wins and revenues.

Challenges are caused, on one hand, by the speculative nature of foresight and, on the other hand, by the heterogeneity of ecosystem players:

> "There is an underlying difficulty about foresight knowledge or foresight information that is always speculative in its nature. It is always difficult to make decisions based on information that is speculative and uncertain. Even when that is done in a single company. There is always the difficulty of interpreting the information about the future and making sense of the findings. All this is then amplified in an ecosystem setting where you have a number of different actors there and the motivation why the want to be in an ecosystem can be quite varying between them. Making sense of the findings when you have a large number of perhaps conflicting interests and also a large number of different kind of players. That amplifies the very basic difficulties that are related to foresight projects." (I-4, a researcher and ecosystem orchestrator at a research institute)

> "We have much foresight information but a challenge is utilization of foresight information in a smart way in practice since the priority of company players is on action." (I-7, Head of Strategy and Foresight at a Finnish business accelerator and funder)

> "Not all understand the benefits of foresight." (I-5, a researcher and ecosystem orchestrator at a research institute)

Below are some of the solutions and best practices suggested by interviewees to address the apparent lack of credibility that foresight has in the eyes of part of the ecosystem players and the differences in perspectives, expectations and capabilities related to foresight:

A more systematic approach in foresight and having foresight activities in the ecosystems as part of the ecosystem leadership activities on a continuous basis, e.g. a yearly check-up can help create a routine for foresight. Foresight can be part of the target setting and the follow-up metrics. However ecosystems have only recently started to use foresight and success stories of foresight in ecosystem have still to be written. Most of the ecosystems reviewed or discussed are still too young and foresight results too recent to assess the impacts and benefits of the foresight activities conducted.

Foresight resources should be included in the ecosystem planning phase and in the follow-up of the ecosystem evolution and of the impacts of foresight on it. Foresight in ecosystems should be a joint activity and part of the role of the orchestrator that puts together needed resources at each moment. The orchestrator needs to understand the need

for foresight, have foresight capabilities and subject matter expertise. The orchestrator can organize futures workshops.

> "Foresight as part of the leadership activities and on a continuous basis, e.g. a yearly check-up, having foresight in the target setting and the follow-up metrics. As part of the target setting. Foresight resources should be included in the ecosystem plans and planning phase and in the follow-up. […] To boost foresight we should include it as part of the agenda during the discussions and open it up and increase the likelihood that the focus is the right one." (I-1, Ecosystem Lead at a Finnish business accelerator and funder)

> "The orchestrator/producer needs to understand the need for the foresight and most likely the orchestrator can facilitate a futures workshop or so forth. But there are different capabilities that have to be brought-in in terms of understanding what foresight is and that is a different discipline of its own. The foresight methodology expertise is a capability that most likely the orchestrator does not have so that needs to be brought-in." (I-2, an ecosystem orchestrator and consultant)

Foresight needs to demonstrate its credibility in order to be taken seriously in sufficient manner. It is important to define the role of foresight for ecosystems and to make foresight tangible as well as to build awareness about the role of foresight. Foresight has to be concretized for practice. A value proposition for foresight has to be made and foresight benefits demonstrated. It would be helpful to share success stories of foresight in ecosystems by finding cases where foresight has been part of successful ecosystems and presenting the cases.

Also the way foresight results are communicated is important in order to address attitudes towards foresight: Speaking about foresight and its results in the language of the business leaders. Scenarios should be both qualitative and quantitative and include figures about business and revenue prospects, trend developments and trend impacts, so that choices can be better made.

> "I would say it is about awareness building, so that the people understand what is the value of foresight. That is one thing and the second is to look at how we can use it for that specific purpose that ecosystem is addressing for the impact as discussed earlier. And make it concrete, make it concrete enough in a way that the value proposition of the foresight is still communicated, that people see what the foresight building requires. I would say that that is my personal view that it is still in its early phase. […] I would say may be that case studies to show the value of foresight could help those ecosystems to understand the value." (I-3, an ecosystem orchestrator and consultant)

> "The main aspect is to understand the multi-perspective approach so that the focus is not limited too much based on today´s business environment or the players involved at the moment in the ecosystem. It is I think the main challenge in their foresight work. The roadmap and vision building in the ecosystem is that players are too tight on the current and trying also to maintain the status quo rather than to change it. Or if they have identified the need for the change then they have limited focus on what they are willing to change." (I-5, a researcher and ecosystem orchestrator at a research institute)

> "Combining the cross-disciplinary knowledge was both a challenge and a success factor. There should be foresight in ecosystems but it does not need to be a very formal process but rather discussions about the future and shared visions and direction. For foresight is better to have a neutral facilitator that does not come from one of the companies and that does not dominate the discussions but instead makes people talk. Plan concrete measurable activities to create impact with small steps. Make foresight resourced and allocate dedicated persons that take accountability. The term "ecosystem" should be clearly defined and separated from previous types of networks. There should be a person responsible for foresight and foresight impacts should be measured." (I-9, CEO of a NPO that orchestrates ecosystems).

Ecosystems should better not be just project-based. The persons of the ecosystem player work in the ecosystem part-time in parallel to their work in their organization and as a result there are strong time constraints for ecosystem activities and foresight. It takes too much time to conduct foresight compared with its benefits but with the advancement of AI, big data analysis and other computer-based tools, foresight may become faster and more economic. Public institutions can provide foresight instruments and networks, present examples and inspiration as well as support smaller players in building their foresight capabilities. Small businesses could be invited to join ecosystems and benefit from its foresight information. To build foresight competencies of ecosystem players and bring-in market insights, players can be brought together into networks and partnerships where large companies can take with smaller companies into innovation and foresight activities. It can be worth hiring a researcher for each business to bring closer research and practice to have a futurist as a strategic advisor. Easy to access and practice-relevant foresight services could also be offered.

> "Large companies have business intelligence and foresight organizations and plan long term. However SMEs plan only on a mid and short term and they have no resources for foresight: No time, no foresight capability nor money to use external foresight resources as well as no motivation to conduct foresight. Motivate them by presenting future business opportunities and show the benefits of foresight that they value. Public institutions can provide foresight instruments and networks, provide examples and inspiration as well as support smaller players in building their foresight capabilities. Small businesses should be invited to join ecosystems. We should focus on building foresight competencies of ecosystem players and bring-in the market insights we have. Bring players together and build networks and partnerships, large companies should take with smaller companies into innovation and foresight activities. Hire a researcher for each business to bring closer research and practice. Offer easy to access and practice-relevant foresight services. Have a futurist as a strategic advisor." (I-7, Head of Strategy and Foresight at a Finnish business accelerator and funder)

Like in strategy, the challenge of foresight is its implementation. This indicates that gaps in foresight capabilities are mainly on level 3 of futures literacy (Rhisiart et al. 2015, 127) that refers to making choices and decisions as well as to taking appropriate action. Foresight processes can start broadly at the landscape level and progressively be narrowed down and concretized till being transformed into decisions at the decision points, into action plans and into actions. Foresight needs to be on the right level for the companies to use and differ from their current plans to uncover needed changes to plans.

> "First of all, setting the scope for the foresight work together with the partners to warranty that we are tackling the right problem in a way and then of course communicate the [foresight] results so that we can exploit the work. Communicating with all partners both ways to get the insights and disseminate the results to others. That comes very much through us in the ecosystem leadership. […] We need to make sure with all partners that we are making a study that has relevance to us, ensuring the right questions. […] That [foresight] gives us the vital understanding of the context where we are working and supports the real work. […] To understand what we need to do, which things we need to solve on the next phase of the project and then, which kind of new competences we need, which kinds of partners we need to take in as part of the plan. […] Foresight results need to be connected to practical actions. […] The foresight helps us ensure that we are doing the right things but the impact comes from the actions that we do, from the R&D. […] Scenario work, I feel, is very important to build different scenarios and evaluate them as well, not only qualitatively but also the business potential and different aspects that are taken into account and then kind of make brave choices for ecosystems. Scenarios should be both qualitative and quantitative with

business prospects and trend developments figures. […] Everybody should get the same understanding and we use it qualitatively as well to make some choices and validate some thoughts." (I-6, an ecosystem orchestrator and consultant)

In a business ecosystem following actions were taken to address different timing and degrees of commitment among ecosystem players:

"We created a roadmap for the R&D efforts and planned pilots. We realized how we should influence standards and policies. Then had foresight about the timing of revenues: Who will get revenue in 3 years? Who in 5? Who in 10? Since in SMEs the resources are limited, the directors ask: When are you bringing back the money? They may not be able to wait for so long and may leave the ecosystem. Their businesses and industries are so different. We tried to give everybody faith that in 20 years everybody will get new business. How high is the ecosystem on a company´s agenda: for some very high, for others not. There are different degrees of resource investment, speed and commitment. The companies´ top management should the ecosystem on the company´s agenda and makes the decisions about investments of resources. […] Ask top management to change people who do not care about the work in the ecosystem, have the wrong attitude and weak performance." (I-9, CEO of a NPO that orchestrates ecosystems)

Challenges, solutions and best practices related to business aspects

The market-solution fit is a typical issue. Foresight can be utilized for a proper future market research about the future market needs and the product fit for the market. Ecosystems could choose the right direction before making the choices and doing large investments. In a large ecosystem investments are large.

Another issue emphasized by the interviewees was that no foresight is usually made well in time to ensure the continuity of the joint offering of the ecosystem and reality hits when the ecosystem tries to move to the business stage. A novel joint offering does not fit into the business model of any of the ecosystem companies and a new business model needs to be built, responsibilities in implementing the business model need to be agreed as well as supply chains and maintenance. Also fair agreements about distribution of revenues and value-add have to be in place.

> "I have not seen any successful cases of an ecosystem that is consisting of X number of companies where you have few people from a certain department of an organization of the companies taking part in an ecosystem. It is not just the way how you can sustain a new business model, but that you have basically random people on a part-time-basis from different organizations and trying to maintain a business model that has been created among the ecosystem participants. That rarely or never works. You need to build something that is somehow not permanent. Let´s put it this way: It cannot be project-based. There has to be something more than that. And that is the reason there has to be a foresight element. You need to look further in the future and be able to sustain and manage the things that will be co-created and giving a shared responsibility. Foresight to build continuity for the partnership of the ecosystem and to make sure that people taking part in the ecosystem will be aware that there is going to be this kind of challenges after some time that you will be need to be able to sustain whatever that is that you are creating. And I think this is especially important when you are talking about business ecosystems. Maintaining the co-created solution is the key even when there is a clear business opportunity." (I-4, a researcher and ecosystem orchestrator at a research institute)

Part of the business-related challenges can be explained by the regime inhibiting the innovation co-created in the ecosystem at the niche level, because the regime is not yet ready to absorb the innovation, as Vähäkari et al. (2020) explain. Applying their foresight framework that combines scenarios with MLP can help prevent of part of the business challenges.

Challenges, solutions and best practices related to ecosystem dynamics

Other challenges originate for ecosystem dynamics such as coopetition and conflicting interests as well as multi-lateral interdependencies and alignment issues. Ecosystem company players that stand in strong competition may not be willing to share their business intelligence and foresight results because they may lose their competitive advantage. In the worst case some ecosystem players may take dynamic-related roles and engage in behaviors that are undesirable for the functioning of the ecosystem, such as dominator and landlord roles (Iansiti and Levien 2004b, 107-122). A potential solution for challenges in ecosystem dynamics can be to have an external neutral orchestrator that ensures open communication, trust, engagement, alignment among players and goals and a fair distribution of the value and revenues created in the ecosystem. Also conducting foresight

jointly at the ecosystem level would keep the attention on the joint goal and value co-creation. Additionally a skilled facilitator can encourage companies to share foresight information and their insights and engage into joint networked foresight at the ecosystem level.

> "One issue in that business ecosystem is that it has strong competing companies and the joint foresight activities were the common nominator for the member companies and when they looked at the systemic change of having self-driving vessels, they realized that they have common interests and the benefits of openly sharing instead of looking at each other as competitors. Building trust and how to balance between confidentiality and openness. At the pre-study stages of building an ecosystem our institution has open confidential separate discussion with the companies to help them realize what is worth keeping confidential and what is worth sharing to join the co-creation activities. The metaphor for this is *open poker game*. In the innovation poker you grow the pot by creating more customer value and you have more to share of the joint offering so that there is clearly a win-win-win situation and there is additional value that can be shared for everybody compared to lose-win. Our institution organizes round table meetings to prepare projects and build ecosystems and organizes the poker table and wants to see the hidden cards of the companies in order to understand the win-win-win and advice them when to show the hidden card and when to keep it hidden." (I-1, Ecosystem Lead at a Finnish business accelerator and funder)

> "I would start by saying that it starts with the preselection of the ecosystem participants. You have to make sure that the motivation of the partners to take part in an ecosystem is a correct one and fitting for the whole group. So before you invite any party into the ecosystem that you are all on the same page and at least you have initially the same kind of goals for the cooperation" (I-4, a researcher and ecosystem orchestrator at a research institute)

> "By building an ecosystem culture of open communication and trust so that the players dare to share their business intelligence and strategy information for foresight; set the scope of foresight together, conduct foresight first with a broader scope and gradually narrow the scope down, focus on ecosystem actions and link foresight questions and results to ecosystem actions. Make it very practical. Bring-in the right new ecosystem members to address the challenges of the next phase." (I-6, an ecosystem orchestrator and consultant)

5 DISCUSSION

5.1 Implications of the Results

The approach in this sub-chapter is mainly normative. It aims at considering ways to resolve challenges in foresight in ecosystems and to maximize effectiveness and benefits of foresight in the context of ecosystems.

Foresight supports design, leadership and development of ecosystems. However much is still to be done to extract the maximum benefits of foresight.

Building foresight capabilities

In order to increase the utilization and benefits of foresight in ecosystems, the foresight capabilities of ecosystems players need to be enhanced.

Since ecosystem orchestrators are the ideal persons to facilitate foresight as part of their leadership activities, improving their foresight capabilities is essential and urgent. Orchestrators ideally should have a good understanding of dynamics in ecosystems and co-creation, ecosystem specific leadership skills, good foresight capabilities and enough subject matter expertise in the topics related to the activities of the ecosystem.

Furthermore, awareness of the functions and benefits of foresight in general, for a particular ecosystem as a whole and for each of its players enables an ecosystem orchestrator or ecosystem futurist to “sell” foresight activities to ecosystem players and to motivate them to actively participate in foresight.

Design skills are required for designing and customizing foresight for a particular ecosystem, including awareness and selection of relevant theories that may enhance effectiveness of foresight for the ecosystem case at hand. Additionally capabilities related to utilization of foresight processes and to selection and usage of the most suitable sources, methods and tools are essential.

The implementation of foresight activities demands the ability to facilitate different types of futures workshops and to structure, visualize and communicate futures knowledge and foresight results in the complex ecosystem context. Furthermore one of the challenges is to cascade down and gradually narrow-down foresight results until they are linked to actions. For that reason, an ecosystem orchestrator or ecosystem futurist needs the capability of maintaining an uninterrupted and consistent chain in the flow of foresight results from the landscape level into visions, plans and actions,. This capability

is supported by systems thinking and project management skills and with subject matter expertise in the topics related to the activities of the ecosystem.

Finally, skills related to design of balanced scorecards for foresight and assessment of foresight benefits and impacts are required for continuous improvement of foresight practices and to later demonstrate the impacts and benefits of foresight. In that way the credibility of foresight and the motivation to invest resources in foresight can be increased.

To build a set of foresight capabilities for ecosystem orchestrators, training programs can be designed and offered. The programs can be integrated with wider ecosystem leadership programs. A light joint foresight training program can be offered at the level of the entire ecosystem. Experiential and reflective learning as well as guided doing would be powerful learning methods.

The Futures Literacy – Hybrid Strategic Scenario (FL-HSS) method by Miller (2007) presented by Rhisiart et al. (2015) can be an optimal element for enhancement of foresight capabilities in ecosystems, since it provides first-hand experience, creates foresight results while learning and minimizes the time spent on foresight theory. Such a learning-by-doing method would meet the expectations of busy ecosystem players. Foresight capabilities and the FL-HSS) method are briefly explained in sub-chapter 2.11.

Leveraging the benefits of foresight

According to Pombo-Juarez et al. (2017, 279-283) networked foresight at the ecosystem level as a whole promotes understanding of the contexts of the other ecosystem players and provides multiple perspectives as well as enhances knowledge sharing and building of capabilities. Ecosystem orchestrators use foresight results to create a shared vision, plan the ecosystem´s projects, decide which ecosystem players should be invited to join and to assess whether potential players have a good alignment with the goals of the ecosystem and the right motivation (serving the ecosystem´s purpose, co-creation of the joint offering and having a positive impact on the planet, society and the economy rather than increasing own business opportunities). Foresight provides input to actions roadmaps, technology roadmaps and R&D roadmaps, supports definitions of roles and coordination of actions. It originates modifications to the ecosystems plans if foreseen changes in the landscape make modifications necessary. Moreover foresight is leveraged for risk management.

Well before the joint offering is prototyped foresight can help in deciding on the right business model and the responsible player for the supply chain and delivery channels of the full solution to customers as well as to plan maintenance of the joint offering. The joint offering is so novel and extensive that it usually does not fit the business model of any of the ecosystem´s commercial players. The customers however look for a turnkey project and a single point of contact. Commercial players of ecosystems want to know what will be the time-to-revenue and this timing can be estimated with foresight. Small and mid-sized enterprises (SMEs) need to get revenues as soon as possible and, due to their limited resources, they look for short term revenues. They have difficulties to wait for long-term business opportunities to materialize.

Regarding ecosystem development, foresight contributes to the diagnosis of the state and health of an ecosystem and therefore to the planning of its development. After the key ecosystem project is ready, the ecosystem may engage in new endeavors and therefore renew its players, whereas some players change their role or leave the ecosystem and new players join. The ecosystem also may split into several ecosystems. The way to its new lifecycle phases can be paved with plans founded on foresight.

Along the foresight process and the ecosystem lifecycle phases, foresight has different purposes and accordingly employs different methods. The highest intensity of foresight activities was detected at the initial phases of an ecosystem (Phase 0 Pre-birth and phase 1 Birth) and at the later phases related to ecosystem self-renewal. Most of the literature case studies and interview responses indicated that foresight activities are constant and iterative along the entire ecosystem lifecycle.

The output of foresight methods first used flows as input into the next methods. The selection of methods is also impacted by the geographical, social, historic and cultural context of the continent, country, region and organization for which foresight was conducted.

Example of a full-fledged foresight process for business ecosystems and innovation ecosystems

Below are listed the foresight methods in a potential full-fledged ecosystem foresight process:

1. To explore the landscape in which the ecosystem operates, legal regulations, standards and socio-cultural aspects, horizon/environmental scanning is utilized. Relevant megatrends, trends, drivers, barriers and weak signal are analyzed and their impacts on the ecosystem´s purpose and goals evaluated. In order to organize and prioritize these information for scenario planning futures wheel, futures table, axes of uncertainty and high impact, quadrant with selected high uncertainty and high impact variables along which scenarios will be constructed.
2. Before the scenarios are constructed, a Delphi and interviews may be conducted to gather more details from experts and identify the probability and desirability of different development paths. Sometimes a Delphi is arranged after the scenarios have been constructed and narrated to evaluate their probability, desirability, details and feasibility in order to improve the scenarios.
3. Scenarios are created. In cases when the context is characterized by socio-economic inequality and where socio-cultural aspects are specially influential, and where ecosystem players had very different perspectives and visions, Caused Layered Analysis is utilized to explore in depth the explicit and symbolic relationship within the socio-cultural context and between the different actors involved in value co-creation processes (Ketonen-Oksi 2018; Birtchnell et al. 2020) and/or deliberative foresight and inclusive innovation that identify preferred futures and involve all the actors affected by these futures (Karjalainen and Heinonen 2018). Where ecosystem players have differing visions, expectations and interests, Social Network Analysis was combined with foresight (Battistella et al. 2013). In large international foresight projects for innovation ecosystems that co-create innovations with high complexity and multiple layers, Multi-Layered Perspective analysis and multi-layered foresight can be used (Geels and Schot 2007; Vähäkari et al. 2020; Pombo-Juarez et al. 2017).

4. Scenarios are evaluated, fine-tuned and detailed in futures workshops. In the workshops also the implication of the scenarios for the ecosystem activities are analyzed and preferred future scenarios selected.
5. From the preferred futures selected in scenarios back-casting from these futures to the present is done to identify the paths and actions that would lead to reach desired states of the future and avoid undesired developments and events. These information flows into the shared vision of ecosystems, goal setting, project plans, actions roadmaps as well as in technology and science roadmaps. Business opportunity prospects, revenue prospects, market fit of the joint offering and suitable business models, delivery channels and maintenance models for the joint offering are ideally derived from scenarios that are both qualitative and quantitative. Such scenarios can also help to estimate the right timing for decision points and for market launch as well as the time-to-revenue for the commercial players of the ecosystem.
6. The results of foresight in ecosystem also generate recommendations for political decisions and programs, business acceleration strategies, funding decisions, policy and standardization.
7. Community building and dissemination measures are taken to broaden and prolong the impact of foresight.

There is much to be done in order to support and improve foresight in business ecosystems and innovation ecosystems, as the literature and interview responses indicate.

In addition to future research to address the gaps identified by this study, some practical tools can be created for practitioners who facilitate foresight and/or apply foresight results in practice. Researcher-practitioners who are competent both in research and in the practice of orchestration and foresight in ecosystems are in a good position to bridge gaps between research and practice and design such tools. A modular foresight process and a foresight toolkit specific for ecosystems need still to be created.

Demonstrating foresight impacts and success

Since one of the challenges identified was the lack of credibility of foresight in the eyes of some of the ecosystem players, collections of success stories of foresight in business ecosystems and innovation ecosystems need to be presented, in order to add credibility and to inspire ecosystem orchestrators and players with case examples and best practices.

The purposes of foresight along the foresight process and the ecosystem lifecycle need to be made explicit. Increased awareness of the practical relevance and benefits of foresight is to be build and the impacts of foresight on ecosystems´ success need to be demonstrated. As a consequence, in order to measure the impact of foresight key performance indicators and metrics are to be developed.

Following the example of the Ecosystem Handbook (Kola et al. 2020, 101-117), toolkits, canvases for design of foresight and balanced scorecards to measure the impacts of foresight could be developed. The functions and benefits of foresight suggested by Rohrbeck and Schwarz (2013, 1594-1598) and by Amanatidou (2014, 277-278) and summarized in Chapter 2.7. of this Master Thesis can serve as inspiration for the design and customization of foresight balanced scorecards for business ecosystems and innovation ecosystems.

Foresight can be made more efficient and affordable by leveraging the possibilities that emerging technologies and digital tools offer. Examples of such tools are the ones utilized by NISTEP and the ones presented in Foresight 2.0 by Schatzmann et al. (2013) offer. However technologies evolve fast and new tools for foresight emerge. It is required to constantly follow-up relevant technology roadmaps and assess emerging technologies and tools in regard to their applicability in foresight and suitability for different types of foresight activities.

5.2 Limitations

5.2.1 Limitations in General

Due to the small size of the data sample, the results of this research are not conclusive. They rather provide a holistic systemic view of the current state of foresight in business ecosystems and innovation ecosystems. Moreover it rather shows tendencies in foresight and uncovers some of the gaps and advancement opportunities in research of foresight in business ecosystems and innovation ecosystems.

5.2.2 Validity of Empirical Data

The interviews were planned for duration of two hours. However, only one of the interviewees could allocate two hours for the interview. Due to very busy schedules eight interviewees could reserve one hour and one interviewee half an hour. The researcher had to select the most relevant questions for the specific interviewee and the amount and content of the data collected was not equivalent between interviews. The level of foresight capabilities among interviewees varied and that impacted the level of detail and the quality of the responses. Since the interviewees had been carefully selected, all had relevant qualifications and experience in the field and provided valuable input.

Regarding the risk of bias, it became apparent that interview interviewees and their responses are impacted by bias related to the worldview, goals and perspective of the ecosystem player they represent as well as to the organizational culture and values of their organization, including the personal values of the interviewee. In this research undesired impacts of bias have been minimized by explaining the goals and roles of the ecosystem players and making explicit their perspective. In that way possible bias turned into valuable perspectives that foster a holistic and deeper understanding of the approach, focus and contributions the different kinds of players do in foresight.

Many of the ecosystems analyzed and people interviewed were from Finland. On one side it limits generalization of the results to other geographical and institutional contexts; on the other hand it provides higher consistency of the context, player constellation and roles in cooperation. To soften this limitation a governmental Asian player that contributes with its foresight to Finnish foresight for ecosystems was interviewed.

One of the public sector ecosystem player type was not interviewed: Cities that have piloted ecosystems´ innovations. An example is the City of Espoo with its pilots of the LuxTurrim5G and Smart Otaniemi solutions. Unfortunately the invitations to an interview sent to several relevant persons did not result into agreed interviews.

5.3 Suggestions for Future Research

Ecosystem theory can be developed to better support foresight in business ecosystems and innovation ecosystems.

For example ecosystem lifecycle models and some of the frameworks presented in this paper like Multi-Layer Perspective frameworks and ecosystem player roles theory

need development to be more consistent and applicable in foresight practice. In special, they require more empirical testing.

Moreover foresight can be creatively and purposefully combined with novel theories. As the case studies show this may turn into a fruitful line of development and improved foresight results.

Methodologies and metrics to measure and assess the benefits and impacts of foresight are in demand and will need empirical testing and analysis.

Many more case studies and success stories of foresight in ecosystems need to be created, including comparative studies.

Foresight in business ecosystems and innovation ecosystems is an emerging activity in an emerging type of organization. The foresight case studies took place in ecosystems too recent for the benefits and impacts of foresight to be patent and tangible and this is one of the reasons for lack of evidence and success stories of the benefits and impacts of foresight in business ecosystems and innovation ecosystems. However quick wins could systematically be measured already and longitudinal case studies be planned already now. Commitment can be generated in current ecosystems to conduct a high quality foresight process and re-visit and measure the benefits and impacts of foresight in time intervals of 3, 5, 10 and 20 years. The results of the foresight assessments and the longitudinal case studies would not only increase the trustworthiness of foresight and the motivation to engage into it but also help develop theory and foresight practices.

5.4 Conclusions

The pre-assumption made at the design phase of this research were supported by the research results. The potential benefits of foresight for business ecosystems and innovation ecosystems are manifold as shown by the theory, case studies and interviews.

The complexity, fluidity and temporary nature of ecosystems seem to be one of the reasons for foresight being underutilized and its benefits not leveraged at its maximum potential in ecosystems. Another reason for the limited use of foresight is the lack of futures literacy and foresight capabilities of part of the ecosystem orchestrators and of smaller ecosystem players. Building foresight capabilities of ecosystem orchestrators and of the ecosystem as a whole is an urgent solution to many of the challenges. However, the functions and benefits of foresight have to be made clear from the beginning in a foresight process, the mental models, attitudes and biases addressed and expectations of ecosystem players toward foresight managed. The credibility of foresight can be

increased by measuring and demonstrating afterward the benefits and impacts foresight had on the goals and results of the ecosystem and on the value created and captured. The publication and dissemination of success stories, case studies and best practices of successful foresight would be very beneficial.

Furthermore a variety of challenges emerging from the heterogeneity of ecosystem landscapes, contexts, industries including geographical differences and socio-economic and socio-cultural factors difficult the design and implementation of foresight in ecosystems. Ecosystem dynamics add their share of additional challenges.

Business contingencies and demands have to be attended by foresight.

Moreover there are gaps in research of foresight in ecosystems and in dedicated foresight processes and customized methodologies.

The case studies and interview interviewees contribute many potential solutions and best practices to address the challenges.

Emerging technologies and digital tools like Foresight 2.0 (Schatzmann et al. 2013) and the possibilities offered by AI, big data analysis, IoT, simulations and games, may make foresight more accessible, economic and efficient in a near future.

The fascinating ecosystem foresight journey is just at its beginning!

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APPENDICES

Appendix 1: Interview Questions

Part 1: Background Questions

1. In which business ecosystems and innovation ecosystems have you participated?
2. To which kinds of ecosystem players did you belong?
3. What kind of roles did your players play in these ecosystems?
4. What roles did you play as an individual person in the ecosystems?

Part 2: Foresight in business ecosystems and innovation ecosystems in general

TOPIC 1a: Responsibility for foresight activities

1. Who usually leads foresight activities in ecosystems**?** (e.g. type of player and roles of individual persons)
2. Are there persons with foresight capabilities inside the ecosystem, or is there an external foresight firm or a foresight network supporting foresight?
3. Which players and individual persons´ roles participate in foresight in ecosystems?

TOPIC 2a: Foresight practices

4. How is knowledge about the future collected? (e.g. which processes, actions, methods and sources are used and are actions, methods and sources somehow linked to the ecosystem lifecycle phases)
5. Is foresight performed
    a. Only by individual ecosystem players from their external cooperation strategy point of view?
    b. Only at the ecosystem level as a whole jointly (as networked foresight) by all ecosystem players both internal and external?
    c. Both at individual player level and at the ecosystem level?
6. How is knowledge of the future structured and utilized in ecosystems? (e.g. what for, how integrated and structured, how shared)
7. What aspects of an ecosystem need to be taken into account when performing foresight for it?

TOPIC 3a: Challenges in ecosystem foresight

8. What challenges do you see in utilizing foresight in ecosystems?
9. What are the reasons behind foresight challenges in ecosystems?
10. How could the challenges be addressed?

TOPIC 4a: Benefits of ecosystem foresight

11. What are the benefits of foresight for ecosystems?
12. How well are ecosystems actually leveraging the potential benefits of foresight?
13. How do the foresight results contribute to reaching the goals and making impact in ecosystems?

TOPIC 5a: Improving ecosystem foresight

14. How could foresight better be performed and leveraged in ecosystems? What recommendations would do suggest?

TOPIC 6a: Sharing your thoughts and experiences

Please now share freely your thoughts and experiences about foresight in ecosystems

Part 3: A success story of foresight in a concrete business ecosystem or innovation ecosystem

TOPIC 7: Your place and role

1. What type of ecosystem was it? (business/innovation)
2. What type of ecosystem player were you placed in?
3. What role(s) did you play as an individual person in the ecosystem?

TOPIC 1b: Responsibility for foresight activities

4. Who led the foresight activities in the ecosystem? (E.g. kind of players and individual persons´ roles)
5. Were there persons with foresight capabilities inside the ecosystem, or was there an external foresight firm or a foresight network supporting foresight?
6. Which players and individual persons´ roles participated in foresight in the ecosystem?
7. Were you involved in foresight and how?

TOPIC 2b: Foresight practices

8. Was foresight performed
    - Only by individual ecosystem players from their external cooperation strategy point of view?
    - Only at the ecosystem level as a whole jointly (as networked foresight) by all ecosystem players both internal and external?
    - Both at individual player level and at the ecosystem level?
9. How was the knowledge about the future collected? (which processes, actions, methods and sources are used and are actions, methods and sources somehow linked to the ecosystem lifecycle phases)
10. How was knowledge of the future structured and utilized in the ecosystem? (e.g. what for, how integrated and structured, how shared)
11. What aspects of that ecosystem were taken into account when performing foresight for it?
12. What were the results of foresight?

TOPIC 3b: Challenges in ecosystem foresight

13. What challenges did foresight encounter? How were the challenges addressed?

TOPIC 4b: Benefits of ecosystem foresight

14. How did the foresight results contribute to:
    - A) Design and building of the ecosystem
    - B) Orchestrating the ecosystem
    - C) Reaching the goals and making impact in the ecosystem?
    - D) Developing the ecosystem

TOPIC 5b: Improving ecosystem foresight

15. What were the success factors and lessons learnt for foresight in that ecosystem?

TOPIC 6b: Sharing your thoughts and experiences

16. Please now share freely your thoughts and experiences about foresight in that ecosystem.