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PROFILING BUSINESS ECOSYSTEMS: A PROCESS APPROACH

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ABSTRACT

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The concept of ecosystem has raised an interest in many areas of research over the decades. There is a growing need to model and guide business operations, not just in single companies but in ecosystem-level. To be able to do this, new and better tools are needed. The purpose of this thesis was to examine which components are needed to build and Ecosystem Profile and to illustrate the process by which an Ecosystem Profile can be generated. Ecosystem Profile aims to be a 'tool' that tries to make sense of the complex ecosystems and to give data-based insights of the ecosystem under review.

In this thesis, a process for Ecosystem Profile creation is constructed. The process divides into three phases: creating the map, identifying the scenarios and collecting company specific information. Design Science Research is used, to create the process. The process steps utilize methods from Social Network Analysis and Web farming. Using case-examples, an illustration of the Ecosystem Profile is built. Further researcher will focus on automating the created process.

The created Ecosystem Profile simulates the structure and relationships of the case ecosystem. The Profile itself can be utilized for many purposes in research as well as in management. By profiling ecosystems, it is possible to detect the strength or weaknesses that a certain ecosystem has. It can help managers to analyze existing ecosystems and plan totally new ones. Ecosystem Profiling provides valuable insights, of the ecosystem under review that can be used to improve decision-making.

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Viime vuosikymmeninä ekosysteemin käsite on herättänyt mielenkiintoa useilla tutkimusalueilla. Uusia ja parempia työkaluja tarvitaan, jotta yritysten liiketoimia voidaan mallintaa ja ohjata sekä yritys- että ekosysteemitasolla. Tämän diplomityön tarkoituksena on selvittää, mitä komponentteja tarvitaan ekosysteemiprofiliin rakentamiseen sekä kuvata prosessia, jolla ekosysteemiprofiili voidaan luoda. Ekosysteemiprofiilin on tarkoitus olla ’työkalu’ jonka avulla voidaan kuvata kompleksisia ekosysteemejä mahdollisimman ymmärrettävässä muodossa ja esittää dataan pohjautuvaa tietoa tarkasteltavasta ekosysteemistä.

Diplomityössä kehitetään prosessi ekosysteemiprofiilin luomiseksi. Luotu prosessi jakautuu kolmeen vaiheeseen: kartan muodostamiseen, skenaarioiden tunnistamiseen ja yritystietojen keräämiseen. Prosessin rakentamista lähestytään suunnittelututkimuksen keinoin. Prosessivaiheissa hyödynnetään sekä sosiaalisen verkoston analyysistä, että ’Web Farming’ menetelmiä. Case-esimerkkien avulla luodaan esimerkki ekosysteemiprofiilista. Jatkotutkimus keskittyy rakennetun prosessin automatisointiin.

Rakennettu ekosysteemiprofiili simuloi tutkittavan ekosysteemin rakennetta ja suhteita. Ekosysteemiprofiilia voidaan käyttää moniin tarkoituksiin sekä tutkimuksessa että johtamisessa. Profilointi mahdollistaa tutkitun ekosysteemin vahvuuksien ja heikkouksien tunnistamisen. Se voi auttaa johtajia analysoimaan jo olemassa olevia ekosysteemejä tai suunnittelemaan kokonaan uusia. Ekosysteemien profilointi tarjoaa arvokasta tietoa, tutkittavasta ekosysteemistä, jota voidaan käyttää päätöksenteon tukena.

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Lappeenranta, September 18, 2019

Ninni Ylönen

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

1 INTRODUCTION

1.1 Background

Physical or digital dimensions no longer define the competitive arena. Competition is increasingly determined by the quality of strategic thinking, rather than time, space and resources. The ability to understand companies' opportunities, challenges, core competences, capabilities, and competitive arena has become an important factor. Nowadays the competitive arena is comprised by global networks and ecosystems, so managers are forced to navigate through the constantly changing environment. (Zahra & Nambisan, 2012, p. 219). For companies to survive, grow and maintain competitive advantage in the future, they must systematically monitor and evaluate their business surroundings. (Basole 2014, p. 26) As time has passed and the business world has gone through significant changes, companies have realized that "they can't change the world alone" or as Håkansson and Snehota (2006, p. 1) said, "No business is an island". By observing, the world we are living it is notable to realize that for you to have electricity in your home or for you to send an email from your laptop, dozens or even hundreds of companies are needed to join forces. (Iansiti & Levien 2004b, p. 70) For companies to thrive they need others around them. Success cannot happen in isolation. (Adner 2006, p.1)

Over the last decades, the concept of 'ecosystem' has become an emerging phenomenon in many areas of research. (Adner 2017; Böger & Lingens 2019; Jacobides et. al 2018) The concept of business ecosystem was initially presented by Moore in 1993 (p.75-76). Moore defined the business ecosystem based on natural ecosystem. He described companies in business ecosystem as predators and prey who live in the same environment, interacting with each other. Many other researchers have also explained the concept of business ecosystem, each in a slightly different way. (see e.g Adner 2017; Iansiti & Levien 2004a; Wulf & Butel 2017) Generally, networks are seen as structural entities inside larger business ecosystem, but it is still often unclear where the network ends and business ecosystem begins. (Wulf and Butel 2017, p. 1416) **Figure 1** presents how business ecosystem structure. They form around different entities and network relations. (Heikkilä & Kuivaniemi, 2012, p. 19) Business ecosystem offers a vision for actors of varying interest to join in for a common

cause. When hundreds of likeminded companies share a vision, it can contribute to a powerful align. The aim of working in an ecosystem is to create “distributed creativity”. (Moore 2006, p. 34)

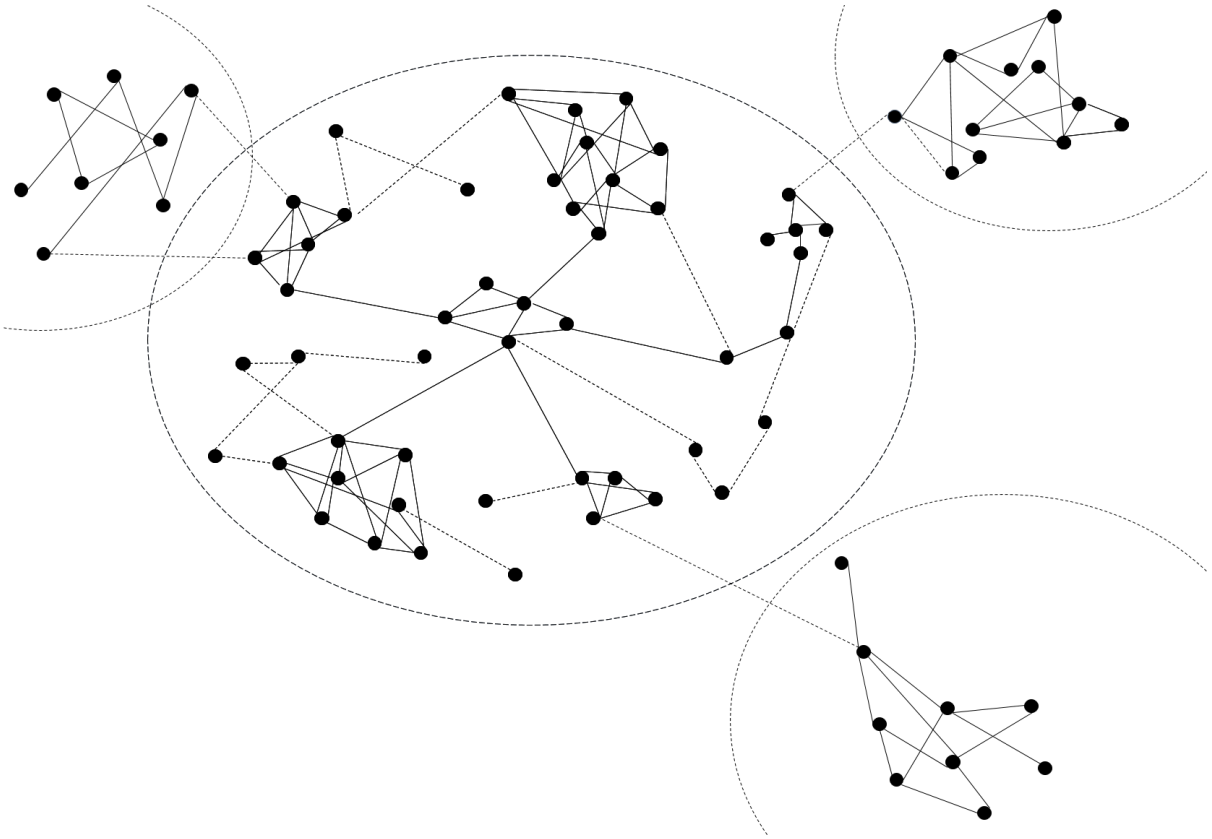


Figure 1 Business ecosystem forms around structural entities and network relations. (Adapted from Wulf & Butel 2017, p. 1421)

When “our world keeps shrinking” and the pace of business change accelerates, no company can survive all on its own. Everybody needs partners and allies to be sustainable and successful, despite the continuous rivalry and need for innovation. Many of the partners do not fit to the traditional value chain of suppliers and distributors that have a direct input to a product or service (Iansiti & Levien 2004b, p. 70). It can be said that the traditional industry boundaries are fading away. This industrial transformation is a result of shift in competition. (Moore 1993, p. 76) Competition between individual companies has shifted to competition between ecosystems (Iyer & Basole 2016, p. 27). As a result, of the shift in competition the management of ecosystem needs to be developed. An understanding of the ecosystem is needed in many decision-making situations involving business. Better understanding of

ecosystems, enables managers to make better decisions. Because “ecosystems redefine the way companies manage and govern their business” (Davidson et al. 2018, p. 26), the management of ecosystems needs to be more systematics than before. By understanding ecosystems, managers can improve their strategic decision-making and make the access to new markets and customer propositions easier. (Davidson et al. 2018, p. 26; Iyer & Basole 2016, p. 27)

To stay successful companies need to systematically analyze and question the situation they are in: can we improve our operations in some way?; do we need a new strategic direction?; who are the best partner for us in the future? The need to model and guide business operations, in an ecosystem level, is growing and at this time, there are not many ecosystems that have been fully researched and visualized. The problem is that business ecosystems are hard to research and describe, new and better tools are needed. Some know ecosystem, like Microsofts computing ecosystem and Wal-Marts retail ecosystem, have been examined (Iansiti & Levien 2004a, p. 83-105), but not many visualizations have been made. By profiling ecosystems, they can be observed and monitored better. Ecosystem Profiling aims to make sense of the complex systems that business ecosystems are. Ecosystem Profiling opens new possibilities for research and management. It supports decision-making and as a result enables better management.

1.2 Objectives and Research Question

This study explores ecosystems of organizations and the aim is to examine the creation of an Ecosystem Profile. The purpose is to describe the components needed in Ecosystem Profile and to illustrate the process by which an Ecosystem Profile can be generated. The aim of ecosystem profiling is to be able to understand ecosystems more deeply. Better understanding enables the development of ecosystem management. Ecosystem Profile aims presents an illustration of a certain ecosystem by simulating its structure and relationships. The purpose is also to create company specific profiles for the ecosystem actors.

This thesis explores the creation of an Ecosystem Map, Ecosystem Scenarios and Ecosystem Information through case example(s). The three dimension will form the basis for an

Ecosystem Profile. Ecosystem Profile aims to give a visual representation of the complex relationships in an ecosystem, by illustrating the connections between ecosystem actors. Without visualizing the collected data, Ecosystem Profile would just be a file full of data. The purpose of an *Ecosystem Map* is to create a preliminary view of the ecosystem. The Map aims to visualize an ecosystem by illustrating the connections between ecosystem actors. *Ecosystem Scenarios* widens the ecosystem view. Scenarios are used to define the direction to the information that needs to be collected to make the map more precise. This phase specifies the object of profiling and redefines the map according to the decided scenario. *Ecosystem Information* can be constructed after the Ecosystem Map and Scenarios have been created. Without any additional information about the ecosystem actors, Ecosystem Profile would be just a visual presentation of ecosystem relations. To understand the examined ecosystem and the actors in it more deeply, the Profile must contain some information about the actors industry, production, financial situation, company structure and so on. Ecosystem Information focuses on formatting companies 'basic situation' based on public information.

This thesis has one research question that divides into three sub questions:

*RQ: How to profile ecosystem of organizations***?**

- *How to map ecosystem of organizations?*
- *How to utilize business scenarios in profiling?*
- *What kind of information should Ecosystem Profile contain?*

1.3 Research Design

Research approach

Design science Research (DSR) is based on the thought that, if something is not quite right with the world it needs to be changed (Johannesson & Perjons 2014, p. 7). Mainly, DSR can be described as a research strategy (van Aken & Berends 2018, p. 228). It aims to develop valid and reliable knowledge to understand and design solutions to problems or to improve the performance of existing artifacts. Artefacts can be described as human made objectives that are used as solutions to practical problems. DSR studies existing artefacts and develops

new ones. The goal is to solve practical problems that people experience. (Johannesson & Perjons 2014, p.7; van Aken 2004, p. 225) Hevner (2007, p. 88) presents three cycles of DSR that must be presented and clearly identified when doing a DSR project. The cycles can be seen in **Figure 2**. The Relevance Cycle connects the context of the research with the design science activities. Relevance cycle also includes the evaluation of the artefacts effect. The knowledge base of scientific foundations, experience and expertise that inform the research is connected to the design activities through the Rigor Cycle. The knowledge base ensures the process innovation. Design cycle builds and evaluates the design artefact(s) and the processes of the research. (Hevner 2007, p.88-91)

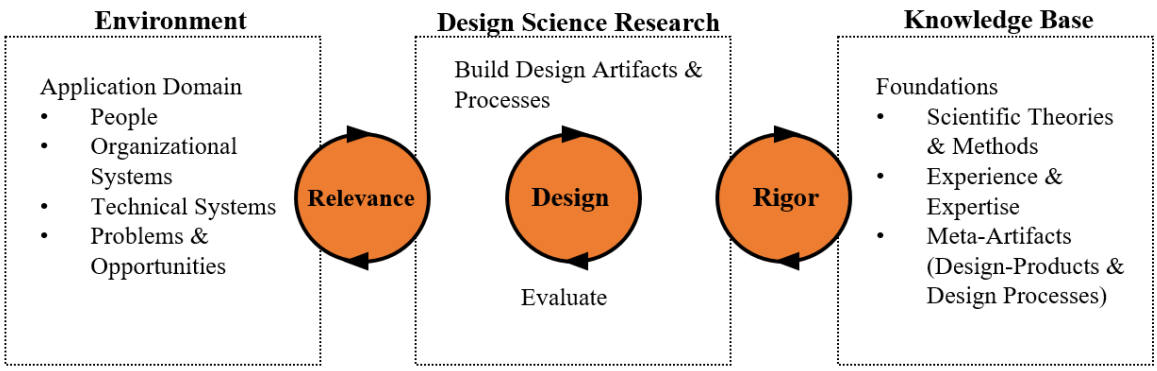


Figure 2 Design Science Research cycles. (Hevner 2007, p. 88)

This study uses DSR for researching ecosystems of organizations and creating the process for building an Ecosystem Profile. Creating a process for Ecosystem Profile is based on the need to understand and manage complex ecosystem better. **Figure 3** shows the three DSR cycles for creating a process for Ecosystem Profile construction.

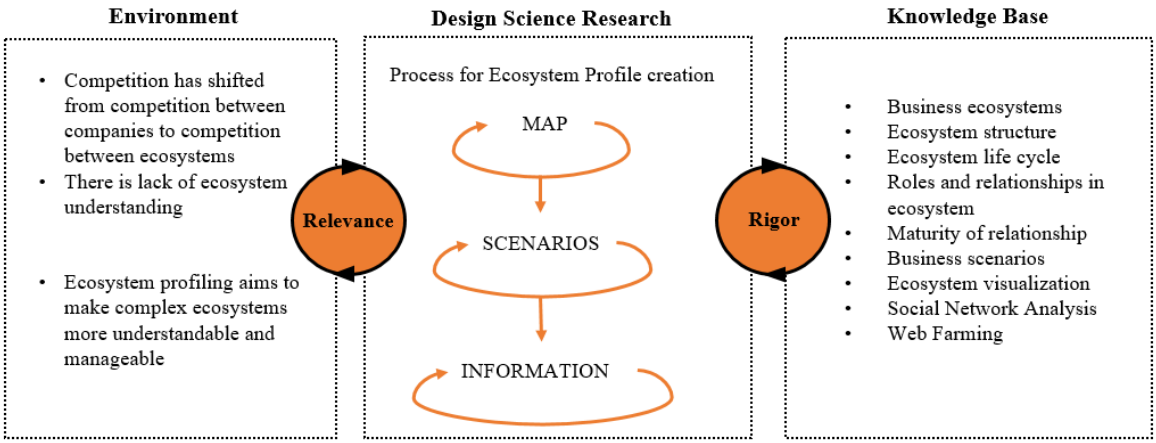


Figure 3 Design Science Research cycles for Ecosystem Profile.

The relevance cycle presents background for the study. The problem, that ecosystem profiling tries to tackle, is that companies do not necessarily understand the ecosystems they take part in. The lack of understanding leads to a lack of managing. Better understanding of ecosystems enables managers to make better decisions involving business. The created artefact was built on research and literature on ecosystems, Social Network Analysis, Web Farming and company specific information that was extracted from public sources. In this case, the artefact is the created process for Ecosystem Profile construction. The process is created through case-examples.

Methods and data collection

Figure 4 presents the research approach and methods utilized in this study. DSR has been utilized as an approach for the research. Social Network Analysis as well as Web Farming are methods that have been used to accomplish the set research objective. These methods were used alternately when the Ecosystem Profile was built. The process steps (research artefact) was created with case-examples.

Research Approach	Design Science Research		
	Used Methods	Social Network Analysis Web Farming	
		Creation of the Artefact	Case-examples

Figure 4 The Research approach and methods utilized in this study.

Social Network Analysis

This study utilizes principles from Social Network Analysis (SNA) to visualize the connections in an ecosystem. SNA is a set of methods that can be used to explore and analyze social structures, especially the relation aspect (Scott, J. 2000, p. 38). There are many researches, who can be said as sociological pioneers, but Jacob Moreno is most often seen responsible for the growth of social network analysis (SNA). Moreno did the first attempts to visualize networks, and the 'sociograms' he made were hand-drawn. The basic insight of Moreno was to represent "groups as collections of points connected by lines". The graph (or sociogram) that was created, represent a network of relations. The graph could be utilized for example, to visualize certain events or relationships (e.g. channels of information flow) or to analyze the network, using mathematical ideas of graph theory. (Conway 2014, p. 108, Scott, J. 2000, p. 10, 13)

In recent years, the amount of network literature and the interest towards SNA has increased. (Carolan 2014b, p. 2, Conway 2014, p.102) The need to understand the complexity of social life has influenced the development of SNA. (Carolan 2014, p. 4) Numerous strands have influenced the development of SNA. Despite the complex history of SNA development, there are three main traditions that can be recognized: the sociometric analysts, which explored small groups; the 1930s Harvard researchers, who researched interpersonal patterns and 'cliques'; and the Manchester anthropologists, who utilized both of the previously described strands and investigated the structure of community relations in tribal and village societies. The contemporary perception of SNA was formed in 1960-1970 when the three traditions were all brought together. (Scott 2000, p. 7) SNA aims to visualize and explain social phenomena by exploring particular entities (e.g. people) and their interconnectedness in systems. (Carola 2014b, p. 4) Social networks consists of actors, links and flows. The networks are constructed by identifying and connecting links between different entities. The most common tool to collect network data is through questionnaires. The data collection has its own challenges, because the design can affect to 'completeness' and 'reliability' of data. Most often, the problems in collecting data are related to the non-response of network members. Missing data can also arise from questionnaire design or the data can be inaccurate because of informant bias. There are also other methods for data collection, besides

questionnaires for example, interviews, observation, biographies and social networking sites, such as Facebook. (Conway 2014, p.104, 106-108)

SNA has four distinguishing features: (1) emphasis is on structuralism – focus on the relations within and between the actors, (2) the basis is on empirical data – systematic collection and analysis (3) the use of graphical images as a part of its tools and (4) the use of mathematical models to reach as high objectivity as possible. (Carola 2014a, 2, Carola 2014b, p. 4) **Figure 5** shows an example of a social network graph. The figure is adapted from Carola's research (2014a, p. 4) and modified into a simpler form. The data, for the original graph, was collected from middle school students in four science classes. 27 nodes represent the students and lines represent relations ("best friend" or "friend"). (Carola 2014a, p. 4-5)

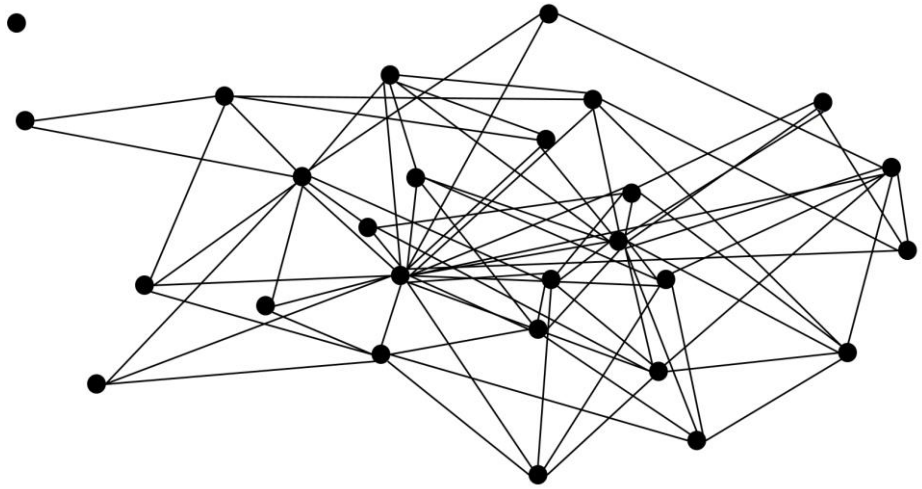


Figure 5 A Social Network Graph. (Adapted from Carola 2014a, p. 4)

Later on, Carola (2014a, p. 4-5) processed the graph, to make it more informative. Adding colors to the graph or arrowheads to the lines (pointing to the direction of relationship nomination), modifying shapes (e.g. different node shape for girls and boys) and adjusting the nodes size to be proportional, for example to the number relationships it has, the graph will give more information to its reader. The added information enables analysts to make more detailed analysis about the illustrated situation.

Data Collection through Web Farming

In 1999, Richard Hackathorn proposed a methodology called 'web-farming'. 'Web-farming' means, "acquiring business-related information from the web, maintaining it and turning it into useful and actionable knowledge" (Masand 2000, p. 1). Constructing the Ecosystem Profile can be seen as "web-farming project" of some sort. The case-example *Ecosystem Profile of Ponsse Oyj* was created, by only using information that is available in public sources. The Profile was built on literature review and company specific information that was extracted from public sources. The company data was extracted from companies' webpages and different databases and publications. The data collection process began by examining the focal company. Gradually the area of research widened, when dependencies to other actors were found. The found dependencies, enabled to widen the research. Simple internet searches were used to collect the data. Chapters three (Ecosystem Map), four (Ecosystem Scenarios) and five (Ecosystem Information) utilize references from this data collection process. All the references can be seen in Appendix I and all the company descriptions, figures and tables have been constructed based on these references. Because most of the companies in this ecosystem were Finnish, almost all the references in Appendix I are in Finnish

1.4 Structure of the Thesis

The first chapter, introduction, presents the background for the research, objectives and research question, research design and structure of the thesis. Chapter two, Ecosystem of Organization, is a literature review on business ecosystems. The purpose is to build up knowledge and understanding, so that process for Ecosystem Profile can be created. Chapters three (Ecosystem Map), four (Ecosystem Scenarios) and five (Ecosystem Information) explore Ecosystem Profile creation through case-examples. Utilizing the Case examples from previous chapters, process steps for Ecosystem Profile creation can be generated in Chapter six. Chapter seven compiles main findings and discusses about future research to be conducted and presents ideas for future development. The final chapter is a short summary of the thesis and it answers the research questions presented in chapter 1.2. The structure of the thesis is presented with an input-output chart and it can be seen in **Figure 6.**

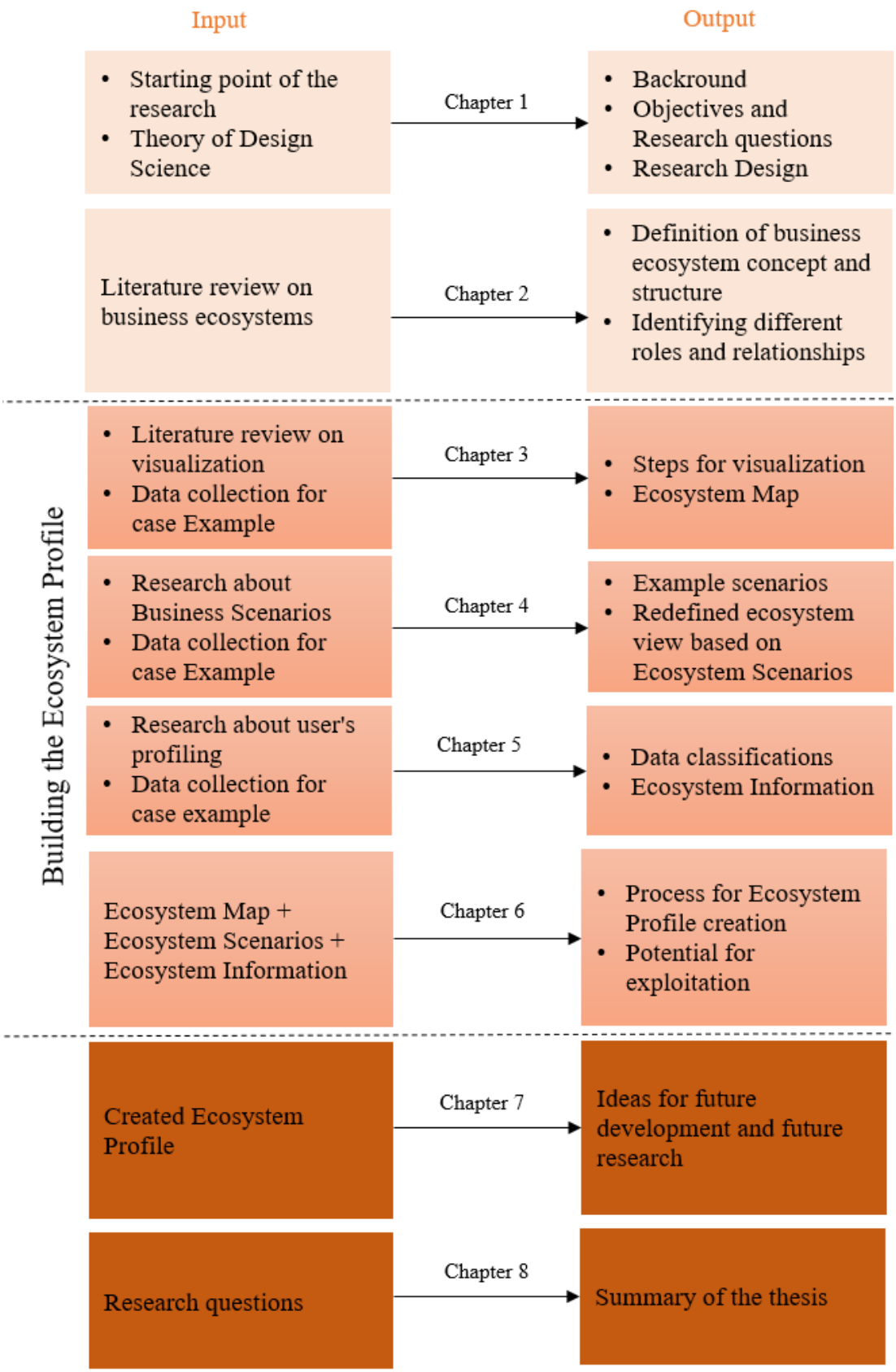


Figure 6 Input-output chart of the thesis.

2 ECOSYSTEM OF ORGANIZATIONS

2.1 Concept

Creating and delivering value to customers requires a careful consideration and planning between different companies and individuals. It is quite unlikely for a single company or even a single market have all the required knowledge and resources to complete every customer need by themselves. For example, a smartphone without a platform and different applications would be just a useless toy and a high definition TV without proper signal compression technologies and broadcasting standards would not add any additional value compared to a normal TV. (Adner 2006, p.1; Basole et. al 2015, p. 2) For every invention, there are always complementary innovations that can enhance the customer benefit. Companies cannot solely rely on their own abilities, when a solution for a customer need may require participation of multiple diverse actors. (Iyer & Basole 2016, p. 27; Moore 2006, p. 33) The concept of business ecosystem, introduced by Moore (1993, p. 76), proposes companies to be seen as a part of business ecosystem and not just as members of a single industry. Business ecosystem crosses a variety of industries to provide a solution for customer need. (Moore 1993, p. 74; Moore 1996, p. 29) Many researchers have studied and explained the concept of 'business ecosystem' in their own way. The concept is often defined suitable for the purpose it is used, and therefore there are many definitions for it. In this thesis, the term business ecosystem is used to describe a network of varying actors that interact with each other. The actors can be profit or non-profit organizations and they can be small or large. The structure 'beneath' the ecosystem is referred as a network; network means the nodes and connections that create the whole ecosystem. Next, is presented some definitions of the business ecosystem from recent decades:

"Business ecosystem is an economic community supported by a foundation of interacting organizations and individuals – the organism of the business world." (Moore 1996, p.26)

Moore's (1996) idea of business ecosystem is based on natural ecosystem. Just as natural ecosystem business ecosystem can sustains itself. Moore's definition emphasizes the

interaction between different actors. Business ecosystem is a community, where the actors continuously work and interact with each other.

"Like business networks, biological ecosystems are characterized by a large number of loosely interconnected participants who depend on each other for their mutual effectiveness and survival. And like business network participants, biological species in ecosystems share their fate with each other" (Iansiti &, Levien 2004, p .8)

Like Moore (1996), Iansiti and Levien (2004) defines business ecosystem through natural ecosystem. They use the term business ecosystem as an analogy that can be used to explain and understand business life.

"Business ecosystem is a dynamic structure which consists of an interconnected population of organizations. These organizations can be small firms, large corporations, universities, research centers, public sector organizations and other parties which influence the system." (Peltoniemi & Vuori 2008, p. 13)

This view, from Peltoniemi and Vuori (2008), takes into account all organizations that affect the ecosystem. The public sector is also included.

"The alignment structure of the multilateral set of partners that need to interact in order for a focal value proposition to materialize" (Adner 2017, p. 40)

Adners (2017) vision of business ecosystems focuses on pursuing the focal value proposition. In order to materialize the proposition, actors need to collaborate with each other.

When comparing a biological and a business ecosystem, there are clear parallels to be seen. For example, a rapid change in the environmental conditions might collapse the natural ecosystem, just like in business environment. (Moore 1993, p. 76) The concept of business ecosystem has originated from the biological sciences and overtime it has expanded into various fields. (Moore 1993, Mäkinen & Dedehayir 2012, p. 1) Nowadays researchers have

recognized multiple ecosystem types. For example, in 2010 (p. 39-43) Briscoe defined the conceptual framework for generic ecosystem and utilized it to illustrate other ecosystems (e.g. digital ecosystem, social ecosystem, knowledge ecosystem and business ecosystem). The basis for Bricoes' generic ecosystem also came from the definitions of biological ecosystem. Each of the ecosystem type operates differently and the underlying value creation process determines the behavior of individual ecosystem. (Abreu & Camarinha-Matos 2008, p. 257) For example, knowledge and business ecosystem have fundamentally different value creation processes. (Clarysse et al. 2014, p. 1175)

Comparing cluster, value network and business ecosystem

Nowadays when companies collaborate across traditional industry boundaries and the importance of geographic location and concentration is disappearing, the business world needs to be seen differently. (Moore 1993, p. 76; Moore 1996, p. 29; Peltoniemi 2005, p. 59) There are various models that affect on how we observe the world around us. Cluster, value network and business ecosystems are all interpreting the business world in a slightly different way. (Peltoniemi 2004, p. 2) When technological solutions are constantly taking huge steps forward and "our world is shrinking" as a result of globalization, it would seem odd to stick with the old business models. Being innovative and developing new interesting products and services requires more and more collaboration between different companies. Focusing only on companies in a particular cluster or value network, might affect on the ability to evolve and succeed. Compared to business ecosystem, when making analysis of organization population, cluster and value network present more limited view to the dynamics and behavior of such entities. (Peltoniemi 2005, p. 59) The comparison of the key features of the three models can be seen in **Table 1**. This study focuses on the concept of business ecosystem, as it best describes the dynamic structure of the business world.

Table 1 Comparing cluster, value network and business ecosystem. (Peltoniemi 2005, p. 62)

	Cluster	**Value network**	**Business ecosystem**
Geography	Geographic concentration	Anything from local to global	Rejects the role of geography
Competition and collaboration	Fierce rivalry	Collaboration	Both simultaneously
Industry	Companies represent the same industry	Different industries complement each other	Finds the term "industry" obsolete
Knowledge	Rivalry limits the willingness to share	Limited to operative information	Interconnectedness as the enabler and shared fate as the motivator of collaboration
Control	Members fairly independent	One powerful actor	Decentralized decision making

Unlike clusters, ecosystems are not limited to geographic locations. "Business ecosystem rejects both regionality and the concept of industry" (Peltoniemi 2005, p. 57). For over 20 years ago, Moore (1996, p. 13) stated that we are seeing "the end of industry. When companies are interacting across traditional industry boundaries on a daily basis, he sees that the concept of industry is no longer useful, thinking about business. (Moore 1996, p. 28) Even though the 'principle' of cluster has been the strong concentration in geographically, the importance of geographic location and concentration is disappearing. Global competition has reduced the importance of geography because companies can build relationships and collaborate worldwide. When comparing a value network and business ecosystem the concept of ecosystem refers to a much larger entity than the concept of value network. Network can be a part of a broader ecosystem. These models are also distinguished by their attitude towards competition and collaboration. Clusters success is based on fierce rivalry; value network is focused only on collaboration while in business ecosystem both, competition and collaboration are seen significant for success. The attitude towards competition and collaboration affects for example, on how willing companies are to share knowledge. (Peltoniemi 2005, p. 59-62)

Collaborating towards a common vision

Currently businesses are struggling with rapid changes and continuous innovation. Ecosystems may collapse and it can cause new species to take over and previous dominant species may lose their leadership. The trend of co-evolving across varying industries has caused the focus from competing on efficiency and effectiveness move towards chasing continuous innovation. To be successful businesses need to evolve continuously. However, it is not possible to evolve all on one's own. (Moore 1993, p. 75-76; Moore 2006, p. 32-33) Companies need to need to complement their abilities with other companies' abilities through different alliances and relationships. (Iyer & Basole 2016, p. 27) Business ecosystem starts as a random set of actors and moves towards more structured community that crosses multiple industries. (Moore 1993, p. 75-76) It forms around network of companies and individuals that together provide a unique value proposition. (Basole et. al 2015, p. 2; Moore 2006, p. 34)

For some time collaboration between companies in a networked environment has raised increasingly more interest among researchers (Wulf & Butel 2017, p. 1407). Like species in biological ecosystems, also the actors in business world interact with each other in a complex way. Companies are concurrently influenced by their internal capabilities as well as the complex interactions with the other ecosystem actors. In biological- as well as in business ecosystem, the actors are dependent of each other; the overall wellbeing and performance of each actor is dependent on the wellbeing and performance of the whole. (Iansiti & Levien 2004, p. 35) Being responsive to changes in the operating environment requires continuous realignment of knowledge, resources and talent. (Basole et. al 2015, p.2) The success of business ecosystem is based on competition and collaboration, and co-creation can be seen as one of the most essential ecosystem characteristics. (Basole et. al 2015, p.2; Peltoniemi 2005, p. 57) The collaboration in ecosystem is not intended to restrict or prevent competition between companies. Competition is a necessary driving force for development; sometimes one actor may be replaced, to achieve cost-savings or better effectiveness. Companies work collaboratively and competitively to promote new products, satisfy customer needs and to chase continuous innovation. The creation of collaborative networks is dependent on the business's attraction of resources: capital, partners, suppliers and customers. (Moore 1993, p. 75; Peltoniemi 2005, p. 57) Sharing of resources enables companies to build competitive

advantage sustainably and develop new innovative ideas. (Wulf & Butel 2017, p. 1407-1408) Companies must co-evolve their goods and activities together towards the common vision in a supportive and synergistic way. (Moore 2006, p. 34)

Business ecosystem enables companies to exchange knowledge, make decisions and compete in a sustainable way. (Wulf & Butel 2017, p. 1408) Ecosystem approach enables companies to analyze their own business and also the strength and success of their suppliers, partners and competitors. (Mäkinen & Dedehayir 2012, p. 2) It also makes it possible to form alliances and succeed in an ecosystem and to be protected from potential invaders at the same time. Even though, being a part of business ecosystem has its benefits, there are also some dangers that are often related to the interconnectedness. There is an unpredictable factor when everything is connected directly or indirectly to everything else. When something changes, it can have a significant effect to others as well, even on the scale that sometimes companies may go extinct without their own fault. (Peltoniemi 2005, p. 57)

2.2 Structure

Not all Ecosystems have the same structure. Operating environment as well as the knowledge sharing mechanisms shape how ecosystems structure. Ecosystems form around smaller structural entities, networks. Ecosystem may consist of several different network structures. The environment where an ecosystem operates can have a significant impact on the type of relationships maintained. The type of relationships affects on how willingly knowledge is shared and this in turn affects the ecosystem structure. Region, industry, technologies the company employs and the evolutionary stage of a company are “environmental influences” than can affect the stability of an ecosystem. Each environment has its own challenges: whether it is “stable or variable”, “low or high velocity”, with “smooth” or inconsistent development”. Depending on the environment the company is in, the knowledge required is also different. For example, in the early stages of development uncertainty can be reduced with “a great stock of knowledge”. Different inter-organizational relationships are required depending on whether the ecosystem is stable and mature, or unstable and developing. (Wulf & Butel 2016, p. 171; Wulf & Butel 2017, p. 1412, 1417, 1420)

According to Adner (2017, p. 43) ecosystem constructs of four elements: activities, actors, positions and links. These elements and their descriptions can be seen in **Table 2**. In a simplified manner, it can be said that ecosystems consist of nodes and connections. Iansiti and Levien (2002, p. 66) stated there is a recurring 'formula' when thinking of ecosystem structure: "a small number of nodes in the network are much more richly connected than the vast majority of the members of the (eco)system". New, small or highly specialized companies are often working with fewer suppliers and partners compared to the key companies.

Table 2 Ecosystem elements. (Adner 2017, p. 44)

Element	Description of element
Activities	Specifies the discrete actions to be undertaken in order for the value proposition to materialize.
Actors	The entities that undertake the activities. A single actor may undertake multiple activities; conversely, multiple actors may undertake a single activity.
Positions	Specifies where in the flow of activities across the system actors are located and characterize who hands off to whom.
Links	Specifies transfers across actors. The content of these transfers can vary - material, information, influence, funds. Critically, these links need not have any direct connection to the focal actor.

It is important to understand that ecosystems change over time. The quantity and nature of elements vary in different stages of evolution. For example, in mature industries the activities, actors, positions and links are quite stable most of the time. (Adner 2017, p. 44) The foundation of ecosystem is built on platforms. Platforms are 'set of solutions to problems". Keystone companies share value through platforms and other members of the ecosystem can utilize the platforms for building their own products. As platforms evolve over time, they will shape ecosystem dynamics. New platforms arise and old ones may lose power and become irrelevant. (Iansiti & Levien 2004a, p.148-149, 153-154)

According to Moore (1996, p. 26-27) ecosystems form around core business. Moore's perception of business ecosystem structure is presented in **Figure 7**. This perception highlights the chain-relations that are built around the core business. The ecosystem consists of layers, and the different layers are differently committed to the core business. The core forms the heart of the business and it may consist of a single company coordinating the supply chain or several companies in a networked group. The second layer is called the extended enterprise. This layer widens the business view and includes customers, complementors, second layer suppliers and standard bodies. The outer layer of ecosystem consists of businesses that might not directly be involved in the core businesses operations, but might still have a significant effect on the survival and success of the business. (Heikkilä & Kuivaniemi 2012, p. 19-20)

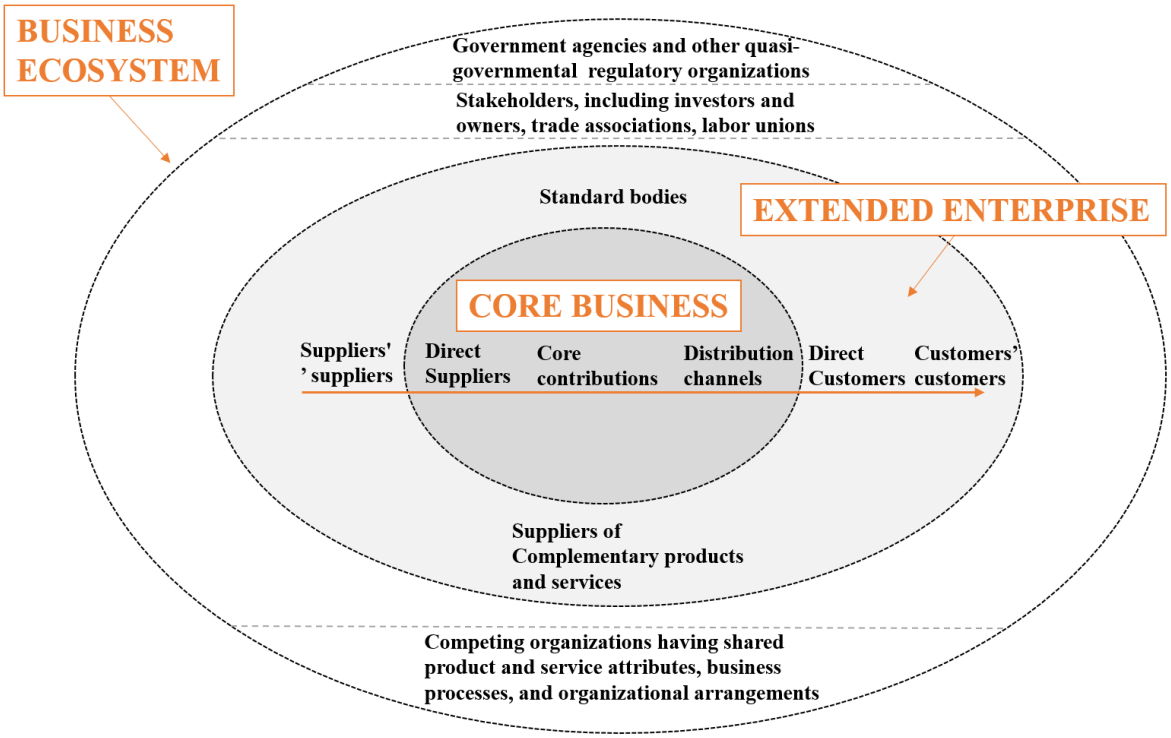


Figure 7 Structure of a business ecosystem. (Moore 1996, p. 27)

Adner's (2017) perception extends Moore's ecosystem view. Adner (2017, p. 40) defined ecosystem concept around the focal value proposition instead of the focal company. He divides the term "ecosystem" into two general views: ecosystem-as-affiliation that focuses on actors, and ecosystem-as-structure, which is focused on activities. Considering these two

approaches, they follow the opposite directions in strategic construction: affiliation approach begins with the actors, continues to consider the links between the actors and ends with the possible value proposition. In turn, structure approach begins with the value proposition, then moves to consider the required activities and lastly the actors needed to align are recognized. Although the approaches are conceptually different, they are mutually consistent. That is to say, that one does not rule out the other and in a certain situation features of both of the approaches might be appropriate to utilize. (Adner 2017, p. 40-43)

There are many things that affect the success of a business and they have been illustrated in **Figure 8**. The most typical ones are technological change, research insight, customer demand, competition/ co-opetition, social environment and policies and legal environment. Dividing the ecosystem map into these smaller sectors, 'sub-ecosystems', helps it to recognize which actors should be contacted in case of expanding. It should be noted that there are clear differences in the general velocity of change in the sectors. For example, changes in technological environment often happen quicker than changes in legal environment. The faster the specific environment changes, the more there are actors to be found to collaborate. (Heikkilä & Kuivaniemi 2012, p. 22-23)

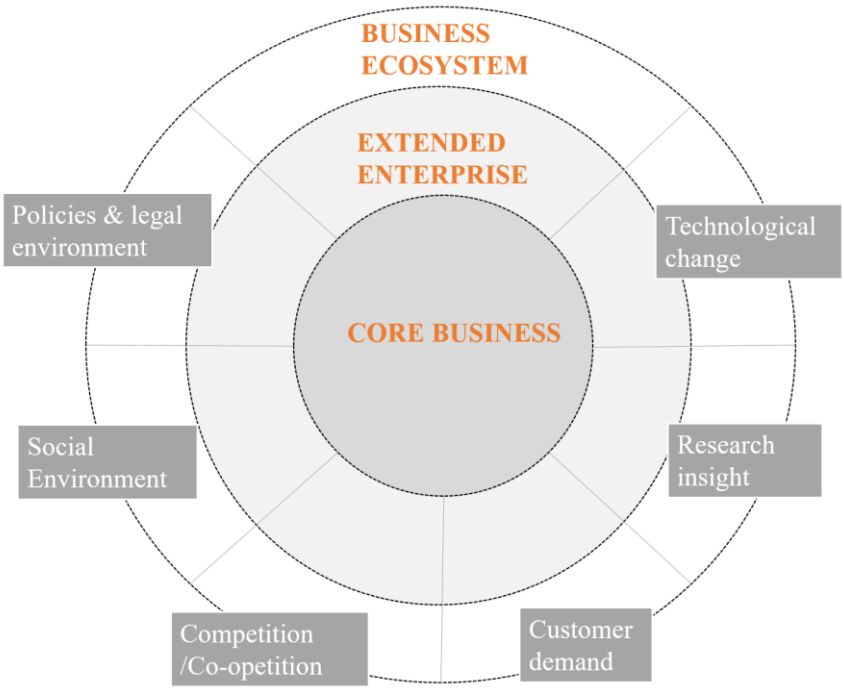


Figure 8 Sub-ecosystems within the business ecosystem. (Heikkilä & Kuivaniemi 2012, p. 22)

When considering the expansion of the ecosystem, the sub-ecosystems should be considered. In **Table 3** can be seen descriptions of the sub-ecosystems. (Heikkilä & Kuivaniemi 2012, p. 23)

Table 3 Descriptions of the sub-ecosystems. (Heikkilä & Kuivaniemi 2012, p. 23)

Technological change	The decrease in information and communication costs make new processes and ways of working possible. This provides new business possibilities and challenges the existing businesses.
Research insights	In addition to the business aspects, ecosystems should attract research.
Change in customer demand	Customer co-creation is increasingly adopted to gain knowledge on the changing demand.
Competition/ Co-opetition	Competitors cause pressure. Sometimes collaboration between competitors is needed, turning competitors into co-opetitors.
Social change	Changes in attitudes, work practices, processes, culture, and social mood in general might have an effect on the business.
Policies and legal environment	Legal issues are something that always needs to be taken into consideration.

2.3 Evolution and Development

Companies, relationships and ecosystems are developing continuously. Development does not necessarily happen straightforwardly or after a certain period, because different stages might take longer with one company (or ecosystem) than another. It is also possible that development skips a phase, slows down, stops, or does not even start in the first place. To be successful and to stay successful companies need to observe their own actions as well as the whole ecosystem around them.

Evolution of a single company

Companies undergo several stages of development during its existence, but there is no clear ‘rule‘ on how many of the stages a company will experience. Typically, lifecycle models form around periodic stages such as company’s birth, growth, maturity and recession.

Researchers define the steps in different ways, so the number of steps varies depending on the lifecycle model. (Aho & Kaivo-oja 2014, p. 11-12) Churchill and Lewis (1983, p. 31) have described company's lifecycle with S-shape curve and the curve can be seen in **Figure 9**. The lifecycle model consists of five stages: (1) existence, (2) survival, (3) success, (4) takeoff and (5) resource maturity. Companies do not always develop straightforwardly. Some of the stages may fail or company's strategy may change and development returns to a previous stage. It is also notable that the age of a company does not determine the development stage. By understanding the challenges that a company can face at different stages of its lifecycle, it is possible to get prepared and make plans to modify strategy if needed. (Churchill & Lewis 1983, p. 30- 31)

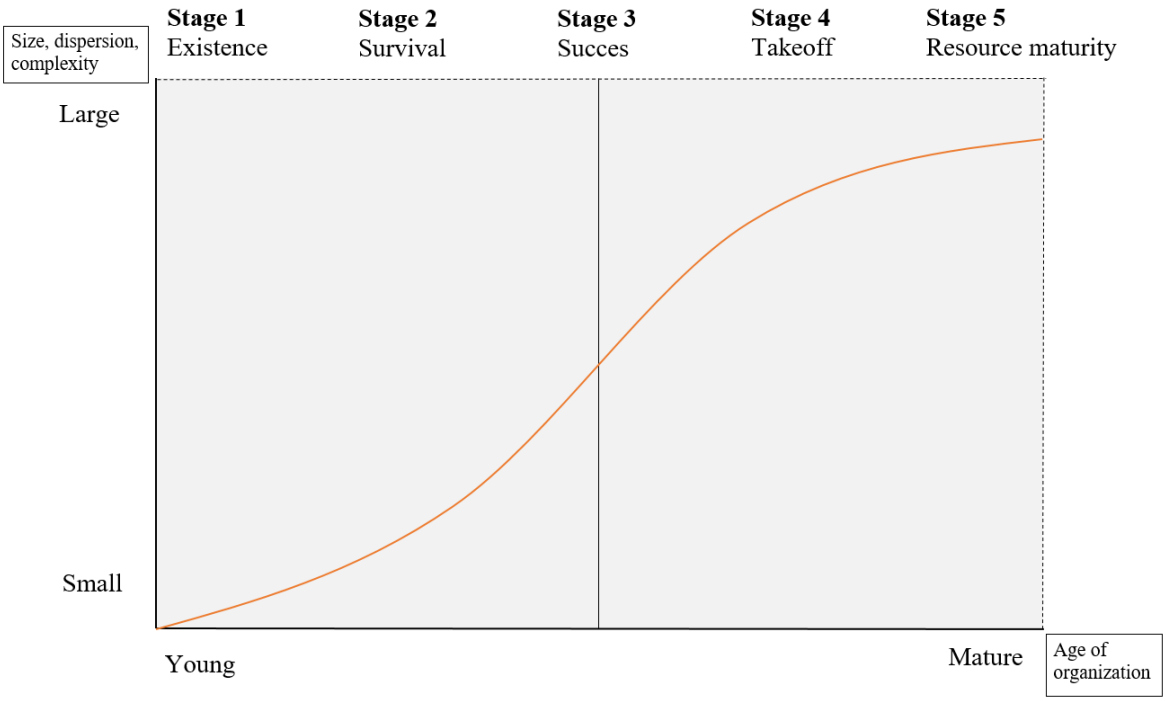


Figure 9 Company's lifecycle. (Churchill & Lewis 1983, p. 31)

Development of relationships

Just like companies, relationships can also evolve. However, it is important to note that if a company itself is in a mature stage, it does not automatically reflect to its relationships. Kalliokoski et al. (2003, p. 18-19) defined five different customer-supplier relationship positions for the industrial services: machine supplier, system supplier, maintenance partner, performance partner and a value partner and they can be seen in **Figure 10**. All the positions

are at different level of customer intimacy. Moving from one role to another does not happen 'by itself' over time. For example, it is possible that some relationships will never develop, but will remain forever in the first level. Each position needs a different strategy and a step from one role to another needs thorough planning. (Kalliokoski et al. 2003, p. 18-20)

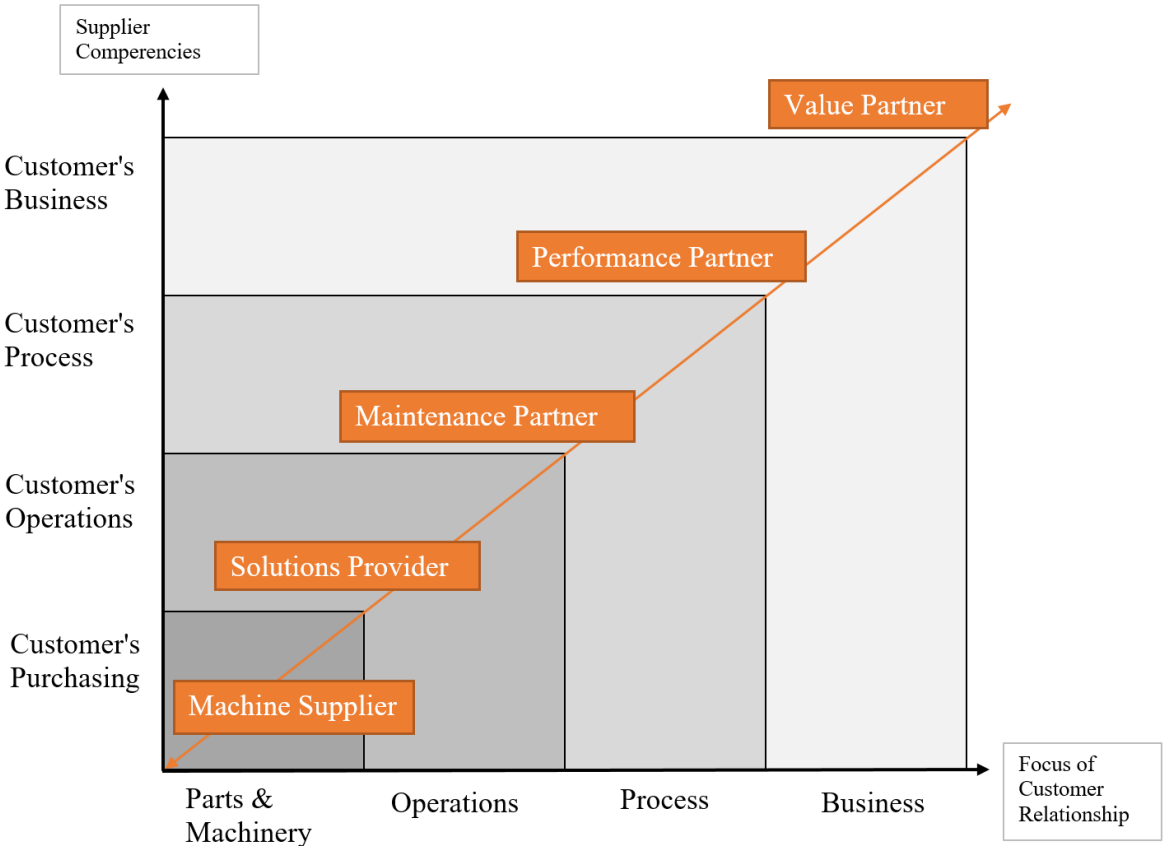


Figure 10 Supplier competencies and roles. (Kalliokoski et al. 2003, p. 20)

Evolution of business ecosystem

Business ecosystems typically go through four stages of maturity. To be successful and to stay successful managers must understand the evolutionary stages that business ecosystems passes through, and most importantly how to manage the upcoming changes. Being ready and prepared for the changes could mean for example, bigger investments to new technology, contracting more suppliers to expand the business, developing the core business to maintain leadership or innovating new ideas to avoid obsolescence. (Moore 1993, p. 76) The ecosystem lifecycle does not necessarily develop straightforwardly. Some phases can be really short in time, while some may last much longer. Internal and external forces influence ecosystem development. Platform governance that affects to decision-making and

control is an example of an internal force. Technological changes and changes in social and economic environment are examples of external forces. These external forces generally come from the ecosystems environment. (Mäkinen & Dedehayir 2012, p. 4) Moore (1993, p. 75) recognized that ecosystem lifecycle divides into four evolutionary stages: birth, expansion, leadership and self-renewal or death. **Table 4** summarizes Moore's (1996, p. 83) vision of the most typical leadership challenges in the evolutionary stages. Later on Rong and Shi (2014, p. 137-138) examined dynamic business ecosystems and they defined five sequential phases: emerging, diversifying, converging, consolidating and renewing. These phases adapt Moore's evolutionary stages.

Table 4 Leadership challenges in different evolutionary stages. (Adapted from Moore 1996, p. 83)

Evolutionary stage	**Overall leadership challenges**
Birth	Define the new *value* proposition
Expansion	Bring the new offer to a large market by working with suppliers and partners to increase supply and to achieve maximum market coverage and *critical mass*
Leadership	*Lead coevolution*, provide compelling vision for the future
Renewal	*Continuous performance improvement*, work with innovators to bring new ideas to the ecosystem

The first stage, birth, pioneering or emerging, aims to propose a new solution for the emerging market. (Rong & Shi 2014, p.137-138). This stage focuses on defining what customers want and the mission is to find out what is the value of new product or service proposal and what is the best way delivering it. At this stage, collaboration with other companies is mandatory to be able to create something of real value, while still protecting your own ideas. The leader of the emerging ecosystem must lead the existing community towards greater future with ongoing improvements. (Moore 1993, p.76, 79; Moore 1996 p. 82-83) The first stage can often be more fuzzy, iterative and chaotic than the later phases of the lifecycle. (Dedehayir et al. 2018, p. 27)

The next evolutionary stage after birth is expansion. Rong and Shi (2014, p. 137) have divided Moore's (1993) expansion phase into two stages: diversifying and converging. At

this stage, the core value of the ecosystem has already become well known. (Moore 2006, p. 66) The main goal of this stage is to "expand to conquer broad new territories" (Moore 1993, p. 79). The idea is to expand into new potential markets before others. Rival ecosystem may be interested in the same business sector, 'territory', so the expansion might cause some resistance and even battles of the market share may break out. The rapid expansion of ecosystem may push competing ecosystems to the margin. (Moore 1993, p. 79-80; Moore 2006, p. 66) To achieve the maximum market coverage, increase supply and block alternative ecosystems at the same time, companies need to work together with partners and suppliers. (Moore 1996, p. 82-83) To stay successful and keep the leading position, managers need to continuously develop supplier and customer relationship around the core value and innovation. (Moore 1993, p. 30)

According to Moore (1993, p. 81), evolutionary stages, two and three are crucial for dominant companies: they can either make or break them. The third evolutionary stage, leadership or authority, focuses on leading the co-evolution. At this stage of evolution, the ecosystem is quite stable and a shared vision motivates the community to work together towards a common future. (Moore 1996, p.82-83; Rong & Shi 2014, p.137) It is important for the companies to be able to maintain bargaining power. To have something the ecosystem needs, and being the only practical source to deliver it, gives you power. When the other members of ecosystem cannot live without you will be able to bargain better. (Moore 1993, p. 81)

Rising new ecosystems and innovations as well as rapid changes in existing conditions can threaten the mature business communities. Stage four in business ecosystem evolution means either self-renewal or death. (Moore 1996, p.82-83) At this stage of maturity, the growth slows and obsolescence might threaten. (Moore 2006, p. 67) Emerging new markets may replace the original market and the challenge is to improve ecosystems performance continuously. (Moore 1996, p.82-83; Rong & Shi 2014, p.138) As Moore stated in 1993 (p. 86), "only fittest will survive". To stay alive and be successful in long-term, companies are forced to invest in innovations and renew themselves when needed. Managers also need to question their current situation and always strive for better suppliers, partners, relationships, ideas and innovations. (Moore 1993, p. 85-86) It is also important to remember to develop

customers and supplier relationships so that they do not end up changing to newer thriving ecosystems. (Moore 1996, p.82-83) If the original market gets replaced, the existing companies return to phase one to repeat the life cycle. (Rong & Shi 2014 p.138)

2.4 Roles and Relationships

Roles in ecosystem

Nowadays competition happens between ecosystems (Iyer & Basole 2016, p. 27). The concerns of competitiveness of the ecosystem and its members guide the ecosystem strategy (Adner 2017, p. 49). Companies should not solely rely on stable situation and ignore strategy, because nowadays the operating environment can change very quickly. To be able to stay successful requires understanding of the ecosystem and your company's role in it. (Iansiti & Levien 2004b, p. 74) The operating decisions reflects to company's strategy and by understanding ecosystems, managers can improve their strategic decision-making (Iyer & Basole 2016, p. 27). Company's strategy needs to match the environment it operates. The role a company chooses to play must reflect to the company's current state or future goals. (Iansiti & Levien 2004b, p. 74) Like Davidson et al (2018 p.28) said, "It's not what your ecosystem role is, it's how valuable you make it". The decisions that are made, should match the operating environment, be influenced by business ecosystems structure and dynamics and be consistent with the role the company plays and the capabilities it decided to develop (Iansiti & Levien 2004a, p. 62).

A 'role' can be described as a characteristic set of behaviors or activities undertaken by ecosystem actors (Dedehayir et al. 2018, p. 18). Researchers have identified different roles in ecosystems. For example, Dedehayir et. al. (2018, p. 22-25) defined the roles based on their activities and they recognized four major roles in ecosystem: leaders, direct value creators, value creator supporters, and entrepreneurs. They also divided the roles into even more specific sets of activities. According to Iansiti and Levien (2004a, p. 68) ecosystem members can be separated into keystones, dominators and niche players. This study uses Iansiti's and Levien's (2004a) definition of ecosystem roles.

Keystone also known as, platform leader or ecosystem leader is the most vital member in business ecosystem. The success or failure of an ecosystem can be determined by the

keystone company and its activities. (Mäkinen & Dedehayir 2012, p. 3) The leader of an ecosystem has a chance to shape the ecosystems development to match its own strengths, but the attempt to take the role of a keystone, often requires massive investments. There is a great risk in making the investments without knowing the result. There are also tough choices when taking a less ambitious role in the ecosystem. For example, it's crucial to decide which keystone candidate to follow and how to stand out from the other companies. (Adner 2006, p. 9) Keystones only represent small part of the ecosystem, but they have a great impact to the overall wellbeing and chance of survival to the ecosystem it operates. Keystones can increase ecosystem productivity, robustness and niche creation. Keystones often enhance the stability of an ecosystem to ensure its survival. Diversity affects positively to the stability. Because of this, keystones offer platforms, services, tools and technologies for other ecosystem members to utilize. (Iansiti & Levien 2004a, p. 68-72) Wal-Mart and Microsoft are examples of well-known keystone companies. These companies have been successful because they have been able to provide a stable foundation for others ecosystem members to rely on, and at the same time enable the continuous development of the ecosystem. (Mäkinen & Dedehayir 2012, p. 3) Keystones utilize their central position in the ecosystem to create and share value with its ecosystem. (Iansiti & Levien2004a, p. 68-72)

There are two factors that separate dominators from keystones: physical size or abundance and the ability to encourage diversity. Unlike keystones, dominators are often a big part of the ecosystem. Dominators eliminate competitive businesses by taking over the functions or completely eliminating the whole business. There are two types of dominators: physical dominators and value dominators. Physical dominators, like IBM at one time, aim to own and control large proportions of an ecosystem. By contrast, value dominators create only little value for the ecosystem. They extract as much value from the ecosystem as they can. This strategy may end up in ecosystems collapse, like happened in energy company's Enron case. Dominated ecosystems can be recognized by the lack of diversity. Highly dominated ecosystems can be unstable and vulnerable because their ability to respond to changes is rather weak. (Iansiti & Levien 2004a, p. 73-73; Iansiti & Levien 2004b, p. 75)
Majority of the ecosystem members follow niche strategies. Even tough niche players individually do not affect much to other ecosystem members, they form the bulk of the ecosystem. Niche companies focus on developing specialized capabilities. They aim to

differentiate themselves from the other ecosystem members. Niche companies utilize the platforms of keystones to enhance their own expertise. (Iansiti & Levien 2004a, p. 76-77) When the niche companies are allowed to thrive, they create most of the ecosystems value and innovations. Niche companies are also often called 'complementors' (i.e. complementary companies). They help the keystone company to expand its power, by supporting its mission. (Mäkinen & Dedehayir 2012, p. 3) Nvidia is an example of a company that uses a niche-strategy. It has no plants of its own, but it leverages the platforms of keystone companies to enhance its business. (Iansiti & Levien 2004a, p. 77).

Relationships between actors

Companies can have relationships that are collaborative as well as competitive. This leads to co-opetition among ecosystem members. (Mäkinen & Dedehayir 2012, p. 4) Because the operating environment is continuously changing, companies are developing more collaborative relationships to be able to respond the changing conditions more effectively (Huang & Wilkinson 2013, p. 455). Increasingly more specific requirements from the customers, force companies to build relationships and work together (Håkansson & Ford 2002, p. 133). Companies develop relationships with customers, suppliers, complementors and competitors because they affect, directly or indirectly to their performance. Ritter et. al. (2004, p. 178) recognizes four different types of relationship: (a) no relationship, (b) leadership relationship, (c) followship relationship and (d) mutual relationship. The types have been defined according to companies' dependencies on each other. For example, if company A is highly dependent on company B, B has power over A. Below is presented a short description of each relationship type.

a) No relationship, companies are not dependent on each other.
b) Leadership relationship, a company has power over the other company. The powerful, nondependent, company can affect development of the relationship.
c) Followship relationship, the other company is highly dependent on the other and becomes a follower of the more powerful company.
d) Mutual relationship, neither of the companies have more power.

However, it is good to remember that relationships do not always fit properly into these ideal types. Relationships evolve over time and they can vary in different issues. (Ritter et al. 2004, p. 178) Developing relationships provides various benefits like knowledge and access to other relations, resources and competencies. That is why it is crucial to manage and develop company's relationships. (Ritter et al. 2004, p. 175-176) The main reason for collaborative relationships is to gain competitive advantage in long term. Maintaining the competitive advantage is vital to the survival and success of a business. Knowledge is often seen as the most valuable resource to create new capabilities and innovative strategies. As a result when building a collaborative relationship knowledge sharing plays a central role. (Wulf & Butel 2017, p. 1407-1409, 1417) Relationships between companies develop gradually and, networks can be seen as the 'final product'. To share knowledge, one has to trust the other. As the members of an ecosystem are dependent upon each other, trust can be seen as a key dimension for building relations. (Huang & Wilkinson 2013, p. 455). According to Anderson and Narus (1991) collaborative relationships develop through partnering. They see it as a process where two companies "form strong and extensive social, economic, service, and technical ties over time, with the intent of lowering total cost and/or increasing value, thereby achieving mutual benefit" (Anderson & Narus 1991, p. 96).

Abreu and Camarinha-Matos (2008, p. 256) did a survey about the possible benefits in collaborative networks. All 45 participants were experts from industry and academia. From the results, Abreu and Camarinha-Matos (2008, p. 255) could recognize multiple potential benefits that can be achieved through collaborative networks. These benefits and some examples can be seen below in **Table 5.**

Table 5 Benefits from collaborative networks. (Abreu & Camarinha-Matos 2008, p. 255)

Target	Examples of advantages
Share and reduce costs	Having access to new markets and/or businesses without the need of high investments; Share R&D costs; Financial stability; Capability for SMEs to compete with large competitors.
Share risks	Sharing knowledge among partners reduces uncertainty; In collaborative project the responsibilities are shared; solidarity mechanisms might emerge among partners; Allows competition of SMEs with larger companies.
Decrease the dependence level in relation to third party	Companies are depend on others to some extent for products, services, raw materials, resources and competencies. When uncertainty increases, transaction costs arise. These cost can be reduced by collaborating with other companies; Enabling SMEs to compete with larger companies.
Increase the innovation capacity	Utilizing existing resources and diversity of cultures and experiences to generate new idea; Emergence of new sources of value to be gained; Improvements in the life-cycles of products and technologies; Developing products to fulfill customers' expectations better.
Defend a position in the market	Sharing resources to achieve economies of scale; Setting up defensive coalitions to defend themselves against dominant company or newcomers; Setting up offensive coalitions to develop competitive advantage and to strengthen their market position; Increase the negotiation power amongst suppliers and customers outside the network, allowing SME's to compete with larger companies.
Increase flexibility	Sharing resources and skills among partners, enabling more flexible respond to market demand variations; Possibility to offer wider range of products/services.
Increase agility	React faster to business opportunities by increasing agility in procedures; Establish norms to increase the interoperability between processes and products.
Increase specialization	Concentrating resources to critical activities
Establish proper regualtions	Conflicts and opportunistic behavior are avoided by defining rules; Increase of common culture of trust.
Share social responsibilities	Obtain recognition from others; Develop social responsibility and reinforce common values; Altruism.

3 ECOSYSTEM MAP

The following chapters, 3 Ecosystem Map, 4 Ecosystem Scenario and 5 Ecosystem Information, explore the creation of an Ecosystem Profile through case-examples. The process for Ecosystem Profile creation utilizes methods from SNA and Web Farming alternately. Visual representation of the ecosystem under review is formed as a result of the process.

3.1 Visualization

Ecosystem visualization and network map creation can be used for the collection and verification of relational data or as a tool that can be used to analyze different patterns (Jaspersen & Stein 2019, p. 5). Data-driven, visualization is used to transfer and represent data, not to eliminate human insight and foresight. Visualization utilizes human's visual ability to see patterns, spot trends and identify deviation. Visualization can bring additional information alongside with the analytical approach, and help users to spot the most important things from enormous amount of data. (Basole et al. 2015, p. 11) Compared to traditional business reports and indicators, visualization moves beyond it. Visualization provides a method for improved communication. (Basole 2014, p. 26) Basole et al. (2016, p. 276) presents three different visualization representation types: list view, matrix view and network view. The different types are presented in **Figure 11**. This study focuses on the network view, which can be used to illustrates the complex network structure of an business ecosystem

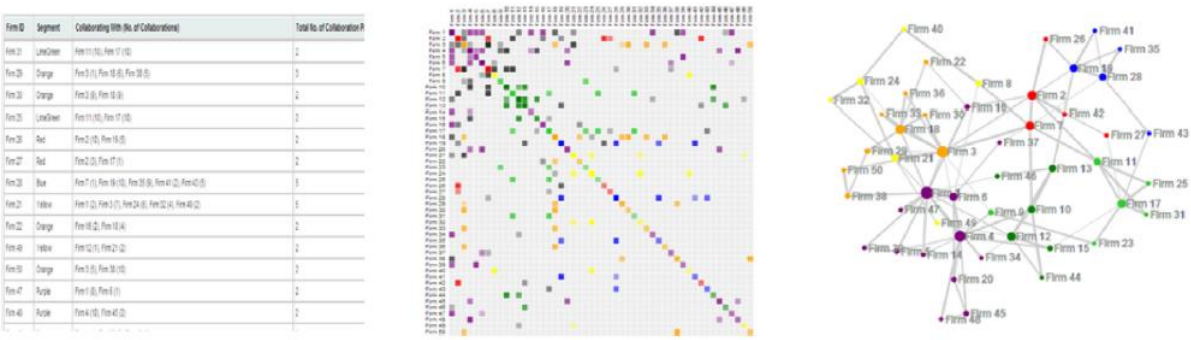


Figure 11 Different views for business ecosystem analysis: list, matrix and network. (Basole et. al 2016, p. 276)

There are two notable approaches when visualizing ecosystems and creating graphics: (1) ‘graphical excellence’ and (2) ‘visual argument’. Graphical excellence means communicating complex ideas in a graph with clarity, precision and efficiency. This can be achieved by using visual variables, such as size, color and shape to describe individual actors, links and flows. About the second approach, ‘visual argument’, Levine (1972, p. 14) argues that “the value (or deceptiveness) of a representation lies in what it suggests, in its ability to stimulate thought”. Even though these approaches can be complementary, there is disharmony when the graphical excellence approach is based on telling the absolute truth and the visual argument approach can emphasizes just some version of the truth. (Conway 2014, p. 110)

Gathering the data

Increasing amount of digital data enables business ecosystems to be analyzed more thoroughly than before. However, quantity does not replace quality and the increasing amount can also cause some problems. The validity of ecosystem analysis depends on the nature and quality of the used data. (Basole et al. 2015, p. 4-5) If the data is not good, the analysis is worthless. (Conway 2014, p. 113) “A network of just ten companies can be connected by up to 45 ties (90 if one considers direct relationships)” (Jaspersen & Stein 2019, p. 13). For this reason, there is a challenge in determining how many subsequent levels of nodes should be included to the ecosystem visualizations: should there only be nodes that are directly connected to the central, node or should there be nodes that are connected by x number of steps? The bigger the x, the more entities will be included and the risk of including irrelevant nodes to the analysis rises. If the selected x is rather small there is a risk of ignoring some of the important actors. (Basole et al. 2015, p. 7) The quantity of data can become a problem, when working with a large networks or even ecosystems. When there is almost an endless amount of information available, the collection of ecosystem data can quickly become unmanageable. At some point, the researcher just must stop collecting the data; otherwise, the ecosystem boundaries will just keep expanding. If the area to be studied is not specifically limited, ‘snowball-effect’ might occur. (Conway 2014, p. 105)

Setting up some boundaries for the research is necessary, but there is a struggle trying to distinguish the major outlines and to distinguish the important links from those that are not (Levine 1972, p. 14). If the boundaries are set too tight, some interesting linkages may remain hidden, but if the boundaries are too loose the collection of information might take an absurd amount of time. (Conway 2014, p. 105) Delimitation of the research can be done for example, by defining a specific geographic location, market segment, supply chain or relationship type to be searched for or by setting up some rules that will narrow the data. (Basole 2014, p. 32) The aim is to limit the research data. Of course, it is essential to make sure that the limitations are made in a way that the results will still serve the original research question in the best possible way. (Conway 2014, p. 105) Sometimes in the beginning of doing an ecosystem analysis, it is too difficult to decide which segment are important and which are not. In this case, it is possible to start the research from a key company and then add certain amount of subsequent level of related companies. (Basole 2014, p. 32)

Utilizing visualization

Ecosystems are complex systems that are affected by various actors (Iyer & Basole 2016, p. 27). Because of the dynamic nature of ecosystem and its complex networks, drawing precise boundaries for an ecosystem is impossible (Iansiti & Levien 2004b, p. 71). Because of the complex structure, visualizing ecosystems effectively requires varying resources: entities, activities and tools, a sponsor to learn about the company or industry, a data scientist to collect the data and prepare it for analysis and a domain expert (Iyer & Basole 2016, p. 27). Typically, ecosystem visualizations have been utilized by different analysts and experts, companies' decision makers, venture capitalists and investors and management researchers (Basole, et al. 2016, p. 272).

Visualizations can be utilized in number of ways: for example to map relationships between stakeholders to analyze business issues, to structure a specific industry or to explore new actors in an ecosystem. (Basole et al. 2015, p. 5; Iyer & Basole 2016, p. 27) Visualization may reveal some features within the ecosystem, such as 'clusters', 'structural holes' and 'bridges'. By being able to identify some key features of the ecosystem under review, practitioners, managers and consultants can guide the development of the ecosystem towards a particular goal. (Conway 2014, p. 109) The created graphics can be used to highlight

desired parts or features of the ecosystem. These features can be for example, clusters of actors, bridges between clusters, or the diversity and size of the ecosystem. The ‘size’ is most often used to highlight quantitative features like the amount of sales or the years of experience. Instead, ‘color’ and size are best suited to describe the qualitative features, such as gender or functional location. By emphasizing certain features, there is a danger in misleading the viewer intentionally or accidentally. There is also a possibility that the viewer will interpret the graph and highlighted features in a wrong way. (Conway 2014, p. 110-111)

Process for visualization

Generating visual material and collecting relational ecosystem information often happens in four stages. The first step is about identifying the actors on a given ecosystem. In the second stage, the actors are placed on a map (the visual representation can be done with a paper and a pen or with digital tools). Drawing relations between the ecosystem actors happens in the third stage. In the third stage, it is notable to consider if adding different colors or shapes would make the map more informative. For example, different line colors could illustrate the quality or type of the relationship. In the last step, the actors and found connections are visualized. This thesis utilizes a four-step process presented by Iyer and Basole (2016, p. 28). The process includes following steps: (1) determine industry structure, (2) Identify companies and their attributes, (3) Finalize semantics for nodes and dependencies, and (4) Visualize, analyze and interpret. The process steps can be seen in **Figure 12**.

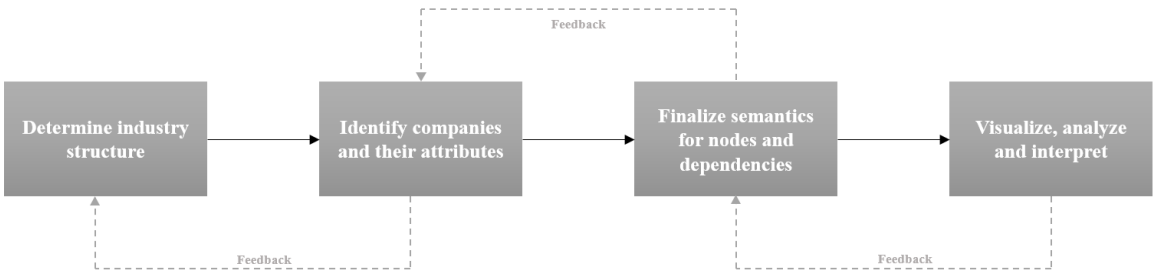


Figure 12 Four steps for ecosystem visualization. (Iver & Basole 2016, p. 28)

The first step, determine the industry structure, means identifying the value chain or activities that deliver benefit to customer. This is done by inferring the information from industry publications and company websites. Structuring helps analysts to identify the key companies. Because in business ecosystem there are companies constantly emerging and

dying, refinements to the existing data needs to be made as time passes. (Iyer & Basole 2016, p. 28)

Identifying companies and their attributes is the second step towards a visualized ecosystem. Key companies should be recognized first. This can be done by researching and utilizing industry publications, internet searches, news portals and websites and social media sources. When the key companies have been identified, the next step is to look up for actors that provide services or components to the platform and to identify dependencies. Most company website list at least some information about their partners, suppliers, strategic alliances or relationship types (e.g. R&D, marketing, licensing) to other actors in the ecosystem. (Iyer & Basole 2016, p. 28)

Third step is about finalizing semantics for nodes and dependencies. The data collected in the previous steps can now be prepared for visualization. Different software's often need specified information about the visual encoding: which attributes drive color, shape, size or dependencies, and in what form the data is presented. (Iyer & Basole 2016, p. 28) At this point, there can be made many specifications about the visualization. Often the node size is based on companies' revenue or the number of employees. It can be determined that the color of the node represents a certain segment or that the thickness of the line can correspond to the number of collaboration between two companies. In addition, it is possible to position the companies that have most connections to other companies at the central of the ecosystem visualization. (Basole, et al. 2016, p. 276) Defining the nodes, node types and –relationships can sometimes be a difficult task because companies evolve and develop their activities constantly. Companies can change and evolve new capabilities and relationships can change over time for example, from supplier to partner

Visualize, analyze and interpret is the fourth and final step. Ecosystems can be visualized in multiple ways. **Figure 13** shows the same (IoT) ecosystem visually in three different ways. In the first picture, red dots represent the platform companies and grey circles represent the component providers. In the second picture, color-coding is used to distinguish different clusters. The last picture illustrates the core of the ecosystem. (Iyer & Basole 2016, p. 28-30)

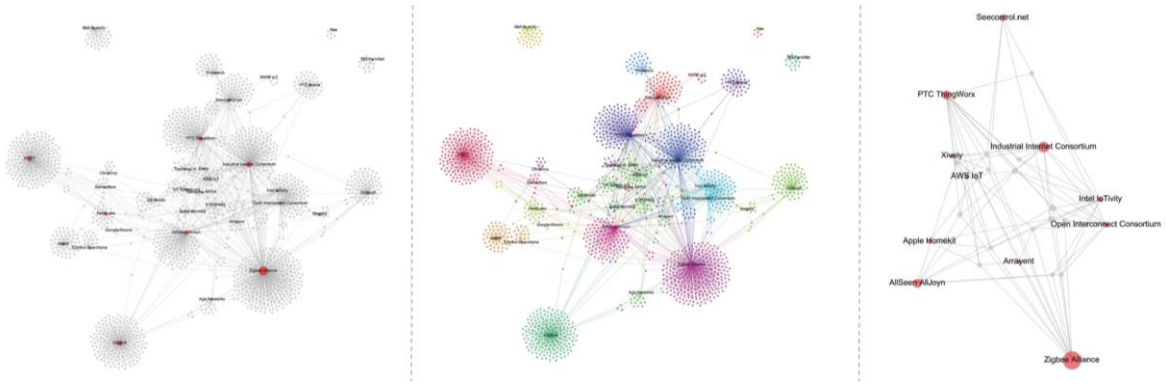


Figure 13 Different ways to visualize an ecosystem. (Iyer & Basole 2016, p. 28-30)

Different visualization packages offer different algorithms for ecosystem layout. Usually the most relevant nodes are drawn closest to the center and not so relevant nodes are pushed to the sides. At this stage, it is especially important to ask feedback or insights from the companies in key positions. It is very possible to find new and relevant information about the actors or connections. Iterative process improves quality of visualization. (Iyer & Basole 2016, p. 28)

3.2 Creating an Ecosystem Map for the Case Ecosystem

This section aims to create an 'Ecosystem Map' by visualizing the actors and connections in the selected ecosystem. The purpose is to map relations between ecosystem actors so 'an initial guess' of the ecosystem structure can be created. At this stage, the purpose is only to visualize the connections so the nature or quality of the relationship is not relevant. Defining the quality or type of relationship would be very challenging, because only material from public sources is used. The process for Ecosystem Map creation utilizes Iyer and Basoles (2016, p. 28) four-step process for ecosystem visualization that was presented in the previous chapter. For the following example, a few modifications were made. The first step, determining the industry structure, is a bit contradictory when talking about ecosystems. The ecosystem concept itself breaks traditional industry boundaries, and as said before, already in 1996 Moore (1996, p.13) stated that the term industry is outdated. For example, it would not be easy to define a specific industry around multinational technology company Apple Inc. It would be a lot easier to define the business ecosystem that has been built around it. This thesis tries to emphasize the ecosystem-approach, so in this example the first step begins

at determining the key company and the perspective for the ecosystem that will be examined. The last step has been shortened to only 'visualize', because the aim of this example is just to create an Ecosystem Map, not to make any further analysis about the ecosystem. The modified steps can be seen in **Figure 14.**

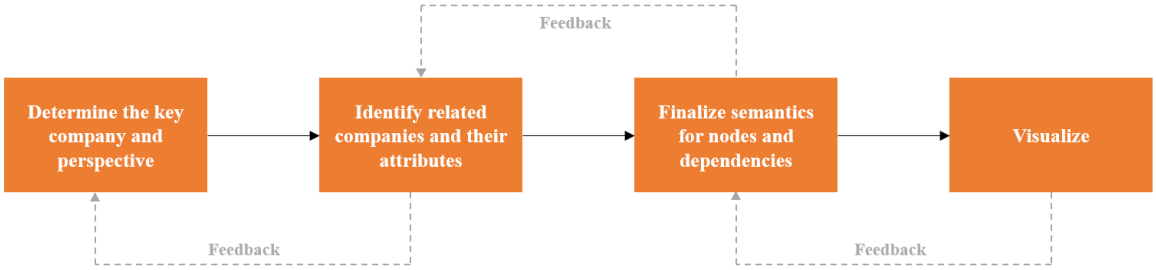


Figure 14 Four-steps of Ecosystem Map creation.

1. Determine the key company and perspective

The first step determining the key company and the desired perspective is necessary to be able to define some kind of preliminary boundaries for the research. Ponsse Oyj, a forest machine manufacturer, was chosen to be the 'key company' where the research began. For the research not to expand uncontrollably, a specific perspective (i.e. value proposition), to be studied more, was chosen. In this case, the perspective was chosen to be a value proposition that forms around fleet management. The purpose was to examine how does the fleet management-operations form around Ponsse and its suppliers, partners and customers. The research began by examining the actors in Ponsse fleet management ecosystem. Searching company websites and other publications it was possible to detect three key roles:

- Equipment provider
- IT service provider
- Customer

2. Identify companies and their attributes

The second step, identify companies and their attributes, aims to identify the most important actors, behind the roles found in step one. **Table 6** shows the found key companies and their roles in this ecosystem. Ponsse has more than 200 forest machine entrepreneurs as

customers. Finding all entrepreneurs would have taken an enormous amount of time so only one entrepreneur, Veljekset Hokkanen Oy, was chosen to be presented in this case.

Table 6 Key companies and their roles in case ecosystem. (Data gathered, appendix 1)

Key companies in case ecosystem	
Ponsse	Equipment provider and Fleet management service provider
Herman IT	IT service provider
Veljekset Hokkanen Oy	Forest machine entrepreneur
UPM-Kymmene & Metsä Group	Customer

After being able to define the core, it was time to start to widen the ecosystem view by exploring the actors around the key companies. All the companies and their business surroundings were searched manually utilizing simple internet searches. Because all the previously found companies were Finnish, the search words were also in Finnish. The name of the company (that were examined) was added before the search word. The used search words can be seen below:

- Customer
- Supplier
- References
- Collaboration
- Fleet Management

Most of the companies found did not add any significant information to the map or existing relations considering the value proposition. But Epec Oy, had connections to both Ponsse and Herman IT. Because of these connections, companies around Epec was chosen to be examined more later on.

3. Finalize semantics for nodes and dependencies

Often the softwares for visualization need some specific information about the nodes, dependencies and data type. This case example was created with Microsoft Excel, which has not been designed for this particular purpose. However, to make the map as visual as possible, some specifications on how the companies and relationships are presented, needed to be made. Nodes represent companies and lines represent relationship between them. To emphasize the key companies around the value proposition, the major companies were colored with dark grey. In addition, the size of the node, of the key companies', correspond to the net sales volume: the bigger the node, the bigger the sales. The net sales volume may reflect something of the bargaining power between the companies. The companies around the key companies were decided to be colored with different colors to separate the dependencies better.

4. Visualize

The final steps was to construct the actual Map. Following **Figure 15** presents the created Ecosystem Map. According to Basole (2014, p. 31) decision makers prefer visualizations that are based on both private and open data. So if possible, the map could be complemented with information from the ecosystem actors. This would make the map more accurate. Notable is that in this stage the map does not distinct how does the value chain proceed, the map only visualizes the connections around the key companies.

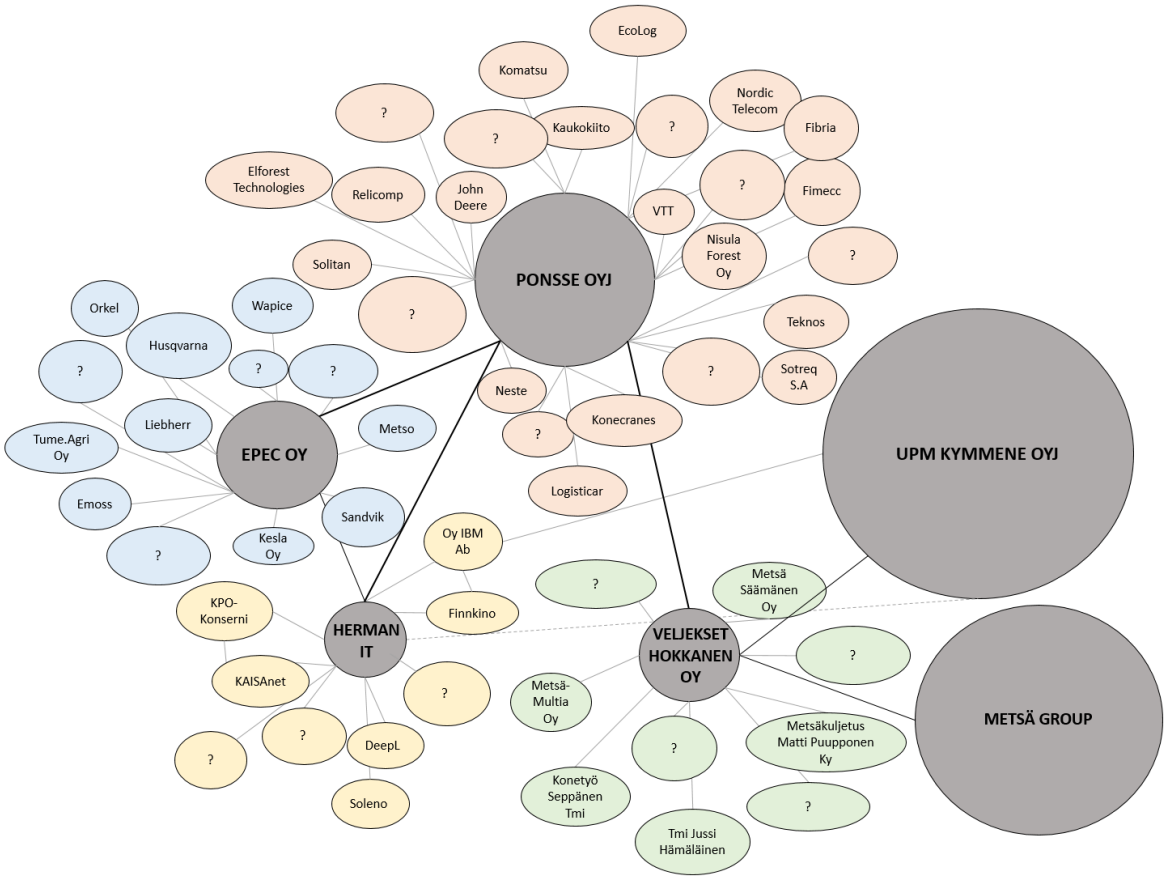


Figure 15 Ecosystem Map of the case-ecosystem. (Data gathered, appendix I)

4 ECOSYSTEM SCENARIOS

4.1 Building Scenarios

Analyzing different scenarios, much can be learned from the ecosystem. It can enable managers to see new opportunities or to discover threats. Change of view would affect on the key companies and to the relationships that are primarily examined. For example, when exploring the possibilities to expand into a new market segment, or to begin a new R&D project or considering to outsource some operations, the key companies around Ponsse would be totally different. The collaboration benefits table (Table 5 in page 37) can be used as a starting point for scenarios that can be utilized to study the constructed ecosystem in a new way. **Table 7** presents the benefits that can be achieved through collaboration, as well as possible projects/scenarios that could be used as a starting point to further explore a certain ecosystem. The idea is that all the example scenarios require collaboration and, therefore are suitable when studying the ecosystems. Ponsse, as all the other companies as well, has multiple customers, suppliers and partners. In this example only the companies and relationships around Ponsse's fleet managemet ecosystem was chosen to be examined. By defining a new value proposition or utilizing the fictitious scenarios in Table 7, the viewed perspective would changes.

Table 7 Example scenarios and search words.

Collaboration benefit	Example scenarios
Share and reduce costs	• Utilizing existing links and relationships to reach out to new markets without the need of high investments • Sharing R&D project costs
Share risks	• Starting a joint project (e.g. product development) • Sharing information between the key members • Expansion to a new market segment
Decrease the dependence level in relation to third party	• Collaborating to reduce uncertainty and thereby cost.
Increase the innovation capacity	• Utilizing the varying resources to enhance innovation • Focusing to improve products life-cycle in the chain • Co-marketing project
Defend a position in the market	• Maintaining negotiating power by sharing platforms for others to utilize • Trying to preventing new entrants from entering the market
Increase flexibility	• Expand / develop / improve product range • Respond to market changes faster when resources are shared
Increase agility	• Common standards and procedures for partners • Focusing to improve ecosystem logistics
Increase specialization	• Focusing on your company's main idea. Considering to outsource others. (e.g. maintenance, IT-services, payroll)
Establish proper regualtions	• Generating trust and creating common rules
Share social responsibilities	• Investing to sustainable development

4.2 Defining Scenario for the Case Ecosystem

This section aims to examine Ponsse's fleet management ecosystem more deeply. Therefore, the value proposition, which was set up in the previous example, stays the same. To make

the map more informative, the existing relations needed to be examined more. The purpose was to reorganize to map, in a way that the most important relations could be more easily detected. In this example, the chain-relations are presented in a general level, but the chain could be value chain, supply chain or any other chain. In accordance with Moore's 'layered ecosystem', **Figure 16** presents the chain relations and illustrates the core business of Ponsse's fleet management ecosystem. Ponsse who manufactures the forestry machines creates the core of the business. Ponsse is the keystone company in this particular ecosystem. Ponsse utilize softwares and servicers from Herman IT and Epec. Herman IT provides IT services and Epec has created systems for modern forest machine monitoring and data transferring. Both companies follow niche strategies. Veljekset Hokkanen Oy provides logging services and is a customer for Ponsse's harvesters and forestry machines. Veljekset Hokkanen Oy also follows niche strategies. UPM-Kymmene Oyj and Metsä Group are major players in the Finnish forest industry. In this particular ecosystem, they purchase logging services from Veljekset Hokkanen Oy. Because of their major influence the forest industry, they can be seen as dominators in this ecosystem.

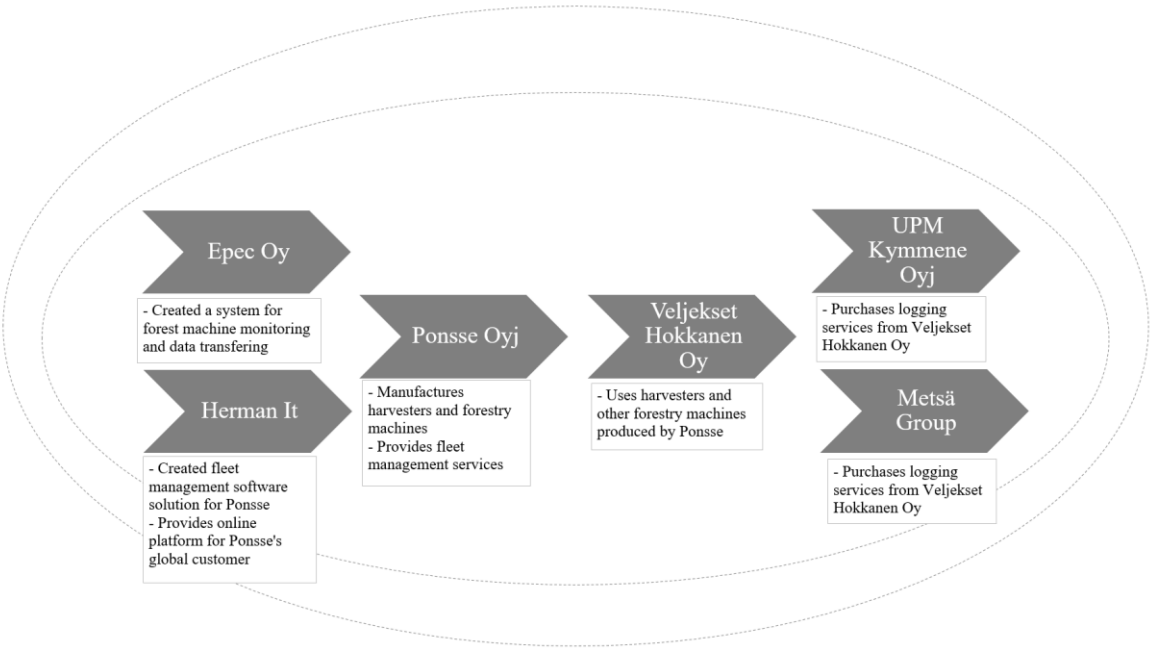


Figure 16 Key companies and chain relations. (Data gathered, appendix I)

After the chain relations between the key companies were clarified, the ecosystem view needed to be widened more. The aim was to explore Ponsse's business environment This

was done by searching actors that have connections to the key companies. Again, simple internet searches were used to collect the data. In addition to the search-words presented before, the used search words in this step were:

- Business Environment
- Collaboration
- Competitor
- Fleet Management
- Management System

During the research, new interesting actors and relations were found. For example, the research revealed that Epec is Ponsse's subsidiary and it also collaborates with Herman IT. In addition, a new interesting link between Epec, Ponsse and Kesla Oy was found. Epec has connections to Kesla, which is a competitor for Ponsse. Considering the relations of Epec, Kesla and Ponsse, there must be some struggles. For example, how much later are new ideas presented to Kesla, after Ponsse has already had them? At this point of the research, the Ecosystem Map that was created in the previous stage could be redefined. To make the Scenario-map more informative and understandable, some specifications needed to be made. First and foremost, nodes represent companies and lines represent connections between the companies. The core companies are colored with grey and other ecosystem actors have been colored with different colors, according to who they are connected. The extended enterprise, according to Moore's vision, is depicted on the outermost layer. The companies in the outer layer are Ponsse's competitors or other ecosystem actors such as universities or research centers. The ecosystem that forms around Ponsse's fleet management ecosystem can be seen in **Figure 17.** The illustration of Ponsse's fleet management ecosystem is in line with Moore's (1993) way of describing the ecosystem.

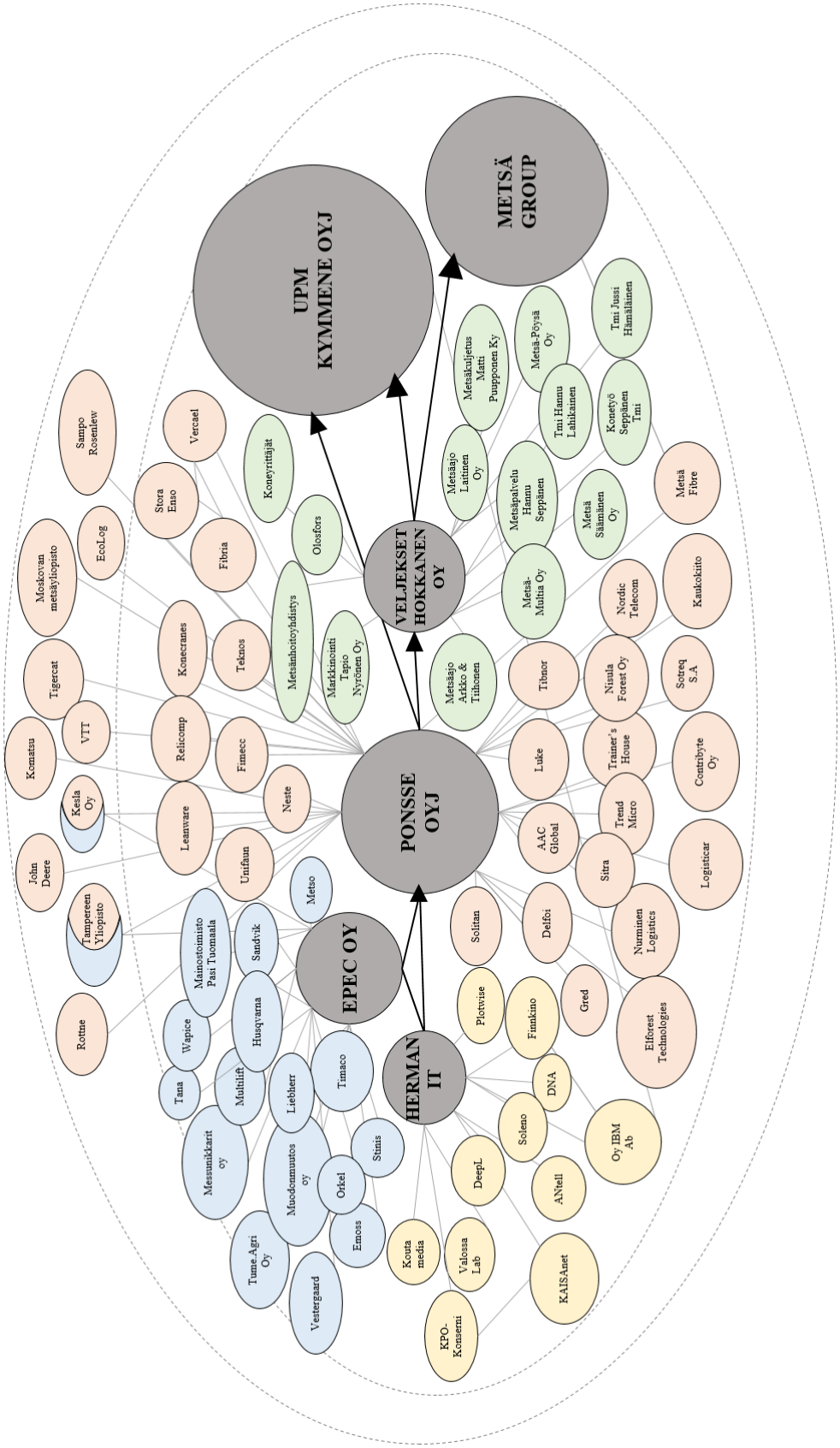


Figure 17 Case ecosystem according to the Ecosystem Scenarios. (Data gathered, appendix I)

5 ECOSYSTEM INFORMATION

5.1 Structuring Information

In the previous stages of the research, an illustration of the examined ecosystem was created. The intention of an Ecosystem Profile is to be more than just a map that illustrates ecosystem actors and links between them. For this reason, more information needed to be added to Profile. This process utilizes some principles from criminal- and users profiling. (Kocsis 2006b; Mannens et al. 2013) To the **Table 8,** presented below, has been listed what kind of information criminal- and users profiles typically contain. The last column lists the information that Ecosystem Profile could contain.

Table 8 Information that different profiles can contain.

Information that criminal profiles typically contain: (Kocsis, 2006b, p. 6)	**Information that user's profiles typically contain (Mannens et al., 2013, p. 412)**	**Information that an Ecosystem Profile could contain:**
• Likely demographics • Legal history • Vocational background • Family characteristics • Habits and social interests • Mode of transport • Various personality characteristics	• User's birthdate, address, favourite books, etc • What is the user listening to, what is the user's current location, feedback of the user on offered content, etc. • All the user's connections to other users, e.g., a friendlist.	• Products and services company size • Financial status of the company, key figures, balance sheet • How the company structures? Subsidiaries? • Relations with other actors, key partners and customers • What is said about the company? How does the company report itself? (news on company webpage, stock releases, other publications)

The classification of information used in this research reflects to users-profiling. The purpose of users profiling is to collect data from users, so it can be utilized in different settings (for

example in targeted marketing). According to Mannens et al. (2013, p. 412) users profile consists of three types of information: (1) static information, (2) dynamic information and (3) the social graph. To construct the Ecosystem Information, this thesis utilizes the same classification. The social graph was already created in the previous chapters (Ecosystem Map + Ecosystem Scenarios). **Figure 18** illustrates how the Ecosystem Profile constructs around the three information types. In Ecosystem Profile, static information could contain information about the company's products and services, company size, number of employees, financial situation. The dynamic information part, would be focused on to present what is said about the company? What does the company say about itself? The aim would also be to be able to collect news, stock releases and other publications where the company is mentioned.

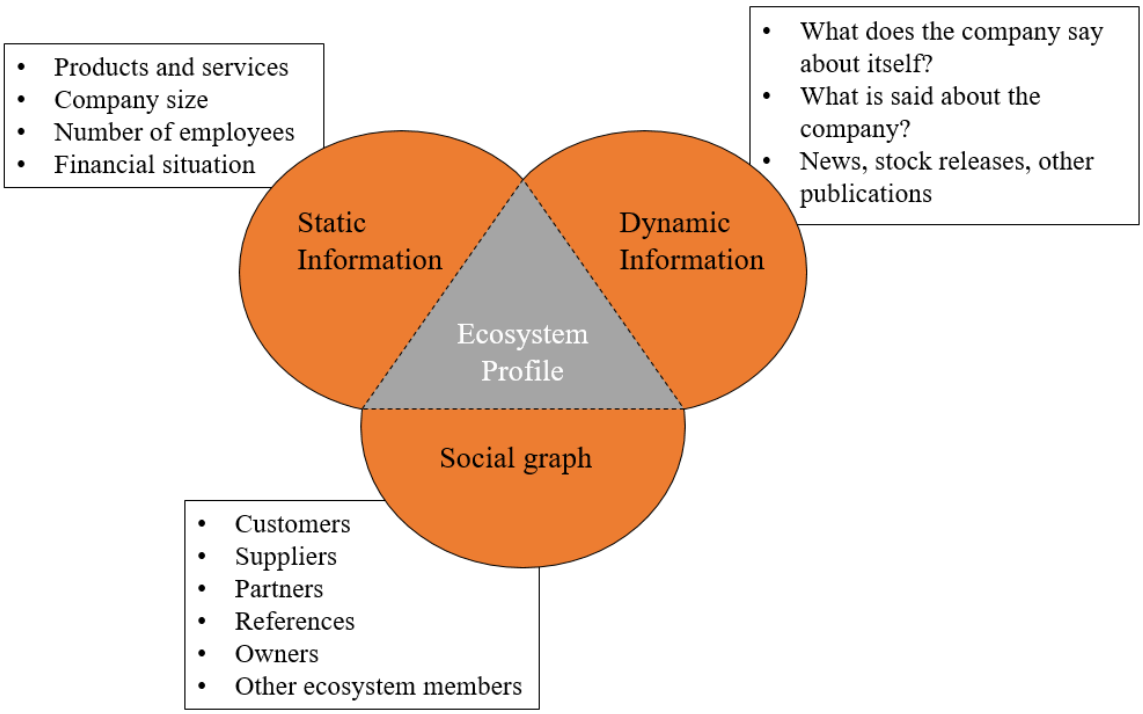


Figure 18 Classification of information and examples for ecosystem profile.

5.2 Building Company Specific Profiles for the Case Ecosystem

Figure 19 shows how the company specific profiles are created 'on top' of the previsously created Ecosystem Map + Ecosystem Scenarios. It is possible to see how the collected data divides into two parts: static information and dynamic information.

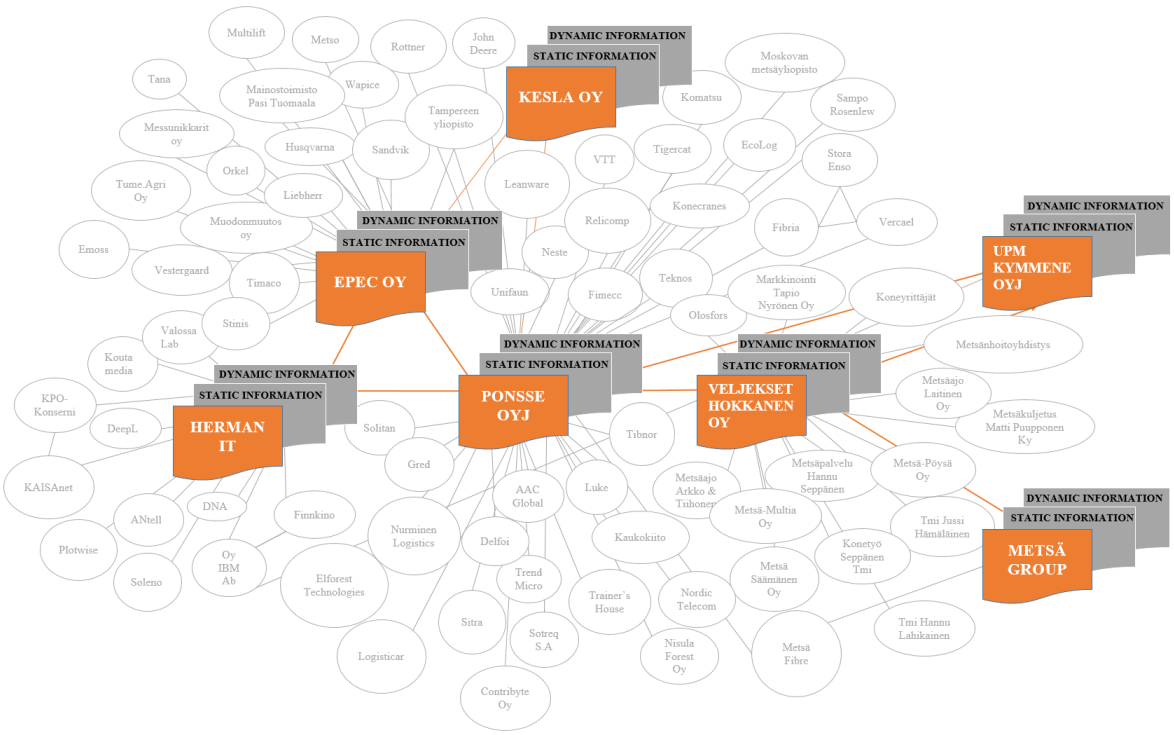
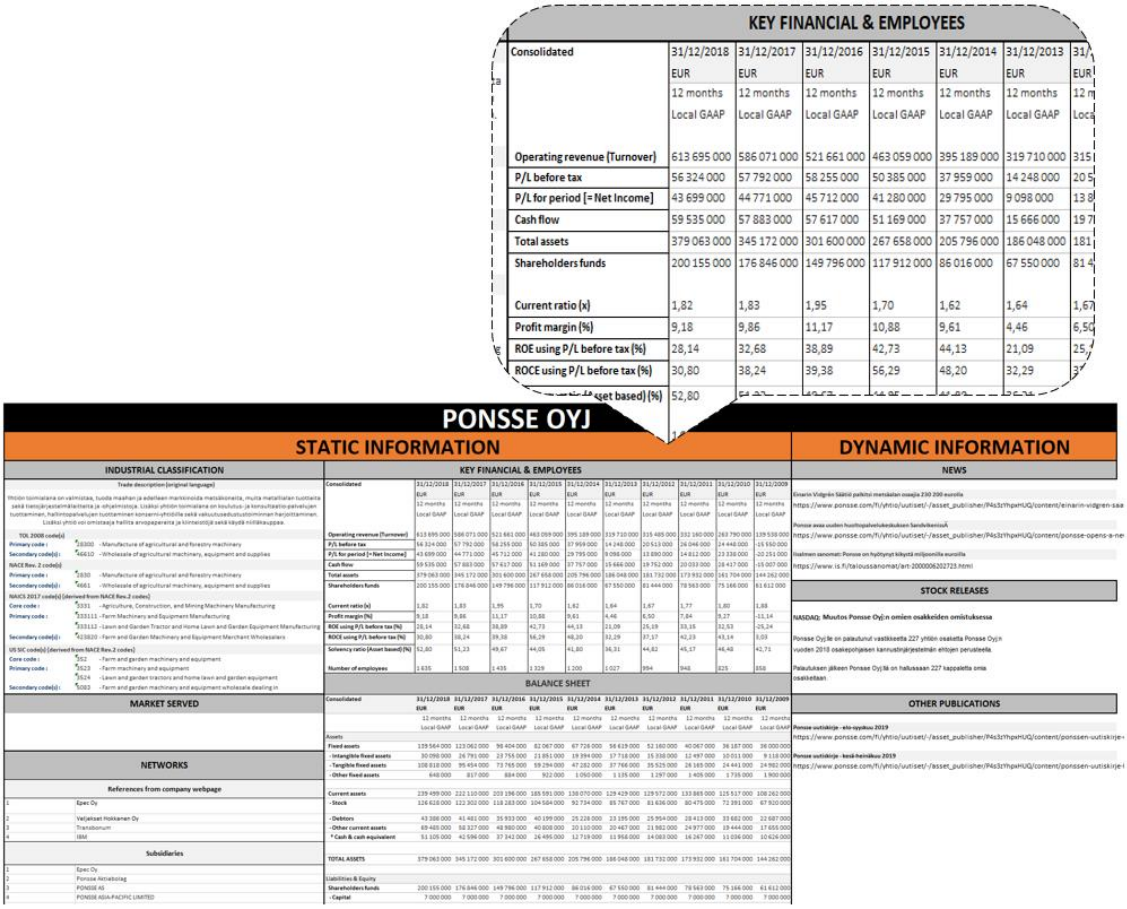


Figure 19 An illustration of Ecosystem Information. (Data gathered, appendix I)

To create the company specific profiles, more individual company data needed to be collected. The aim of Ecosystem Information is to create a more detailed understanding of the actors (and ecosystems) current situation. It is notable to remember that although the intention is to create similar profiles for all the companies, it might not possible. For this research, some of the data was extracted from Amadeus database, and some was collected from public sources, such as company websites and news. Therefore, the quantity and quality of the data varies in each case. **Figure 20** shows an example of a company profile. The profile has been divided into two sections: Static- and dynamic information. Both sections also have different subheadings.



KEY FINANCIAL & EMPLOYEES

Consolidated	31/12/2018	31/12/2017	31/12/2016	31/12/2015	31/12/2014	31/12/2013	31/
	EUR	EUR	EUR	EUR	EUR	EUR	EUR
	12 months	12 months	12 months	12 months	12 months	12 months	12 m
	Local GAAP	Local GAAP	Local GAAP	Local GAAP	Local GAAP	Local GAAP	Loca
Operating revenue (Turnover)	613 695 000	586 071 000	521 661 000	463 059 000	395 189 000	319 710 000	315
P/L before tax	56 324 000	57 792 000	58 255 000	50 385 000	37 959 000	14 248 000	20 5
P/L for period [= Net Income]	43 699 000	44 771 000	45 712 000	41 280 000	29 795 000	9 098 000	13 8
Cash flow	59 535 000	57 883 000	57 617 000	51 169 000	37 757 000	15 666 000	19 7
Total assets	379 063 000	345 172 000	301 600 000	267 658 000	205 796 000	186 048 000	181
Shareholders funds	200 155 000	176 846 000	149 796 000	117 912 000	86 016 000	67 550 000	81 4
Current ratio (x)	1,82	1,83	1,95	1,70	1,62	1,64	1,67
Profit margin (%)	9,18	9,86	11,17	10,88	9,61	4,46	6,50
ROE using P/L before tax (%)	28,14	32,68	38,89	42,73	44,13	21,09	25,
ROCE using P/L before tax (%)	30,80	38,24	39,38	56,29	48,20	32,29	3
(Asset based) (%)	52,80						

PONSSE OYJ

STATIC INFORMATION

INDUSTRIAL CLASSIFICATION

Trade description (original language)

Yhtiön toimialana on valmistaa, tuoda maahan ja edelleen markkinoida metsäkoneita, muita metallialan tuotteita sekä tiensirjaustelmälaitteita ja -ohjelmistoja. Lisäksi yhtiön toimialana on koulutus- ja konsultointipalvelujen tuottaminen, hallintopalvelujen tuottaminen konserni-yhtiöille sekä vakuutusedustustoiminnan harjoittaminen. Lisäksi yhtiö voi omistaja hallita arvopapereita ja kiinteistöjä sekä käydä niillä kauppaa.

TOL 2008 code(s)

Primary code : 28300 - Manufacture of agricultural and forestry machinery

Secondary code(s) : 46610 - Wholesale of agricultural machinery, equipment and supplies

NACE Rev. 2 code(s)

Primary code : 2830 - Manufacture of agricultural and forestry machinery

Secondary code(s) : 4661 - Wholesale of agricultural machinery, equipment and supplies

NAICS 2017 code(s) (derived from NACE Rev.2 codes)

Core code : 3331 - Agriculture, Construction, and Mining Machinery Manufacturing

Primary code : 333111 - Farm Machinery and Equipment Manufacturing

333112 - Lawn and Garden Tractor and Home Lawn and Garden Equipment Manufacturing

Secondary code(s) : 423820 - Farm and Garden Machinery and Equipment Merchant Wholesalers

US SIC code(s) (derived from NACE Rev.2 codes)

Core code : 352 - Farm and garden machinery and equipment

Primary code : 3523 - Farm machinery and equipment

3524 - Lawn and garden tractors and home lawn and garden equipment

Secondary code(s) : 5083 - Farm and garden machinery and equipment wholesale dealing in

MARKET SERVED

NETWORKS

References from company webpage

1	Epec Oy
2	Veljekset Hokkanen Oy
3	Transbonum
4	IBM

Subsidiaries

1	Epec Oy
2	Ponsse Aktiebolag
3	PONSSE AS
4	PONSSE ASIA-PACIFIC LIMITED

KEY FINANCIAL & EMPLOYEES

Consolidated	31/12/2018	31/12/2017	31/12/2016	31/12/2015	31/12/2014	31/12/2013	31/12/2012	31/12/2011	31/12/2010	31/12/2009
	EUR	EUR	EUR	EUR	EUR	EUR	EUR	EUR	EUR	EUR
	12 months	12 months	12 months	12 months	12 months	12 months	12 months	12 months	12 months	12 months
	Local GAAP	Local GAAP	Local GAAP	Local GAAP	Local GAAP	Local GAAP	Local GAAP	Local GAAP	Local GAAP	Local GAAP
Operating revenue (Turnover)	613 695 000	586 071 000	521 661 000	463 059 000	395 189 000	319 710 000	315 485 000	332 160 000	263 790 000	139 530 000
P/L before tax	56 324 000	57 792 000	58 255 000	50 385 000	37 959 000	14 248 000	20 513 000	26 046 000	24 440 000	-15 550 000
P/L for period [= Net Income]	43 699 000	44 771 000	45 712 000	41 280 000	29 795 000	9 098 000	13 890 000	14 811 000	23 338 000	-10 251 000
Cash flow	59 535 000	57 883 000	57 617 000	51 169 000	37 757 000	15 666 000	19 752 000	20 033 000	28 437 000	-15 007 000
Total assets	379 063 000	345 172 000	301 600 000	267 658 000	205 796 000	186 048 000	181 732 000	173 932 000	161 704 000	144 262 000
Shareholders funds	200 155 000	176 846 000	149 796 000	117 912 000	86 016 000	67 550 000	81 444 000	78 563 000	75 166 000	61 612 000
Current ratio (x)	1,82	1,83	1,95	1,70	1,62	1,64	1,67	1,77	1,80	1,88
Profit margin (%)	9,18	9,86	11,17	10,88	9,61	4,46	6,50	7,84	8,27	-11,14
ROE using P/L before tax (%)	28,14	32,68	38,89	42,73	44,13	21,09	26,19	33,16	32,53	-25,24
ROCE using P/L before tax (%)	30,80	38,24	39,38	56,29	48,20	32,29	37,17	42,23	43,14	3,03
Solvency ratio (Asset based) (%)	52,80	51,23	49,67	44,05	41,80	36,31	44,82	45,17	46,40	42,71
Number of employees	1 635	1 508	1 435	1 329	1 200	1 027	994	941	825	858

BALANCE SHEET

Consolidated	31/12/2018	31/12/2017	31/12/2016	31/12/2015	31/12/2014	31/12/2013	31/12/2012	31/12/2011	31/12/2010	31/12/2009
	EUR	EUR	EUR	EUR	EUR	EUR	EUR	EUR	EUR	EUR
	12 months	12 months	12 months	12 months	12 months	12 months	12 months	12 months	12 months	12 months
	Local GAAP	Local GAAP	Local GAAP	Local GAAP	Local GAAP	Local GAAP	Local GAAP	Local GAAP	Local GAAP	Local GAAP
Assets										
Fixed assets	139 564 000	123 062 000	96 404 000	82 067 000	67 726 000	56 619 000	52 160 000	40 067 000	36 187 000	36 000 000
- Intangible fixed assets	30 090 000	26 791 000	23 755 000	21 851 000	19 394 000	17 718 000	15 338 000	12 497 000	10 011 000	9 118 000
- Tangible fixed assets	108 818 000	95 454 000	72 765 000	59 294 000	47 282 000	37 766 000	35 525 000	28 165 000	24 441 000	24 982 000
- Other fixed assets	648 000	817 000	884 000	922 000	1 050 000	1 135 000	1 297 000	1 405 000	1 735 000	1 900 000
Current assets	239 499 000	222 110 000	203 196 000	185 591 000	138 070 000	129 429 000	129 572 000	133 865 000	125 517 000	108 262 000
- Stock	126 616 000	122 302 000	118 283 000	104 584 000	92 734 000	85 767 000	81 636 000	80 475 000	72 391 000	67 920 000
- Debtors	43 306 000	41 481 000	35 933 000	40 199 000	25 228 000	23 195 000	25 954 000	28 413 000	33 682 000	22 687 000
- Other current assets	69 485 000	58 327 000	48 980 000	40 808 000	20 110 000	20 467 000	21 982 000	24 977 000	19 444 000	17 656 000
* Cash & cash equivalent	51 105 000	42 596 000	37 542 000	24 495 000	12 718 000	11 958 000	14 063 000	16 267 000	11 036 000	10 624 000
TOTAL ASSETS	379 063 000	345 172 000	301 600 000	267 658 000	205 796 000	186 048 000	181 732 000	173 932 000	161 704 000	144 262 000
Liabilities & Equity										
Shareholders funds	200 155 000	176 846 000	149 796 000	117 912 000	86 016 000	67 550 000	81 444 000	78 563 000	75 166 000	61 612 000
- Capital	7 000 000	7 000 000	7 000 000	7 000 000	7 000 000	7 000 000	7 000 000	7 000 000	7 000 000	7 000 000

DYNAMIC INFORMATION

NEWS

Einarin Vidgrén Säätiö palkitsi metsäalan osaajia 230 200 eurolla

https://www.ponsse.com/fi/yhtio/uutiset/-/asset_publisher/P4s3z1hpxHUQ/content/einarin-vidgren-saa

Ponsse avaa uuden huoltopalvelukeskuksen SandvikenissäÄ

https://www.ponsse.com/fi/yhtio/uutiset/-/asset_publisher/P4s3z1hpxHUQ/content/ponsse-opens-a-ne

Iisalmen sanomat: Ponsse on hyötynyt kiöystä miljoonilla euroilla

https://www.is.fi/taloussanomat/art-2000006202723.html

STOCK RELEASES

NASDAQ: Muutos Ponsse Oyj:n omien osakkeiden omistuksessa

Ponsse Oyj:llä on paluuluvut vastikkeella 227 yhtiön osaketta Ponsse Oyj:n vuoden 2018 osakepohjaisen kannustinjärjestelmän ehtojen perusteella

Paluuluksen jälkeen Ponsse Oyj:llä on hallussaan 227 kappaletta omia osakkeitaan

OTHER PUBLICATIONS

Ponsse uutiskirje - elo-syyskuu 2019

https://www.ponsse.com/fi/yhtio/uutiset/-/asset_publisher/P4s3z1hpxHUQ/content/ponssen-uutiskirje-

Ponsse uutiskirje - kesä-heinäkuu 2019

https://www.ponsse.com/fi/yhtio/uutiset/-/asset_publisher/P4s3z1hpxHUQ/content/ponssen-uutiskirje-

Figure 20 Example of a company specific profile-page inside Ecosystem Profile. (Data gathered, appendix I)

6 ECOSYSTEM PROFILE

An understanding of ecosystems is needed in many decision-making situations involving business and currently companies understand and manage poorly the ecosystems they take part in. Ecosystem Profiling can be used to better understand why something happened, did not happen or probably should happen in the future. This can encourage managers to keep questioning their current situation and to help make better decisions. Ecosystem Profiling aims to make sense of the complex systems that business ecosystems are. By profiling ecosystems, they can be observed and monitored better. Ecosystem Profiling opens new possibilities for research and management. It enables companies to analyze their own business and also the strength and success of their suppliers, partners and competitors (Mäkinen & Dedehayir 2012, p. 2). Ecosystem Profiling helps to determine the compatibility of an existing ecosystem and to form new ecosystems from well compatible companies. Ecosystem Profiling can be utilized in many situations. For example, when starting a new business and outlining its business model, when generating a starting point for an ecosystem game, when managing working capital and investments in the value chain and in product development, purchasing, sales etc. Ecosystem Profiling makes it possible to identify problems and needs for development within an ecosystem and to make new findings about the business surroundings. Better understanding of a whole ecosystem or a certain company's role in it, helps to get prepared for sudden changes. Profiling can encourage managers to keep questioning their current situation.

Although, profiling has not yet been exploited in ecosystem-research, it has been utilized in many different fields: for example in targeted marketing, in criminal profiling and in geographic profiling. (Brusilovsky & Millán 2007; Kocsis, 2006b; Young et al. 2011) Principles of profiling, from the different research areas, can be reflected to ecosystem profiling. Primarily criminal profile can be seen as a descriptive template, a tactical suggestion or as 'a guide' for many situations. (Kocsis 2006b, p. 7-8) Utilizing this idea, the intention of ecosystem profiler is to to present a 'descriptive model' of the ecosystem under review. Just like criminal investigators utilize criminal profiling as a tool to understand the motives and behavior of a criminal (Kocsis 2006a), the aim of ecosystem profiling is to be able to understand ecosystems more deeply. Ecosystem Profile should be viewed as resource

that can assist to analyze ecosystems, not as a “complete solution” for ecosystem analysis. According to Kocsis (2006b, p. 8) the initial objective of a criminal profile is to characterize the information and to be as if, self-explanatory. Second objective can be considered to be the elaboration on how the information in a profile can be utilized. It is important to deliberate on how much and what kind of information is needed and what mechanism, processes or cognitive functions are mandatory in the construction of a profile. Reflecting this approach to ecosystem profiling, it can be said that the aim of an Ecosystem Profile is to define and describe companies in ecosystem. It is also important to understand how companies are utilizing the Profile data, so it can be constructed as accurate and effective as possible.

According to Kocsis (2006a, p.56) the availability of the case-material is clearly related to the proficient construction of a criminal profile. Few decades ago, it would have been impossible to create any kind of Ecosystem Profiles, utilizing only information from public sources. Nowadays when the latest news and publications and almost all the companies are available online, the data ‘just’ needs to be collected and presented in an understandable form. The increasing amount of information about companies and their relations has enabled the construction of an Ecosystem Profile. However, it is important to remember that the almost an endless amount of data is not always a good thing. Although the information itself might be valuable, the enormous amount of it limits its value. (Gauch et al. 2007, p. 54) When the volume of web data and usage has increased continuously, new means of discovering and obtaining information have emerged. Both web content and usage data can be seen as potentially precious knowledge. By analyzing the data, it’s possible to discover something valuable. (Masand, 2000, p. 1) Brusilovsky and Millán (2007, p. 5) discussed about adaptive systems that can collect data from various sources to create an user model. They emphasize the need to create an up-to-date model of the users’ interest. An Ecosystem Profile should be an updated picture of a current situation. Continuous data collection would enable the model to evolve with the ecosystem and that would improve the quality of the Profile.

6.1 Steps for Building an Ecosystem Profile

This chapter aims to create a ‘path’ for Ecosystem Profile construction. The creation of an Ecosystem Profile happens step by step. The Profile forms gradually after each step. Construction of an Ecosystem Profile requires construction of the Ecosystem Map, identification of the Ecosystem Scenarios and collection of the Ecosystem Information. The process for Ecosystem Profile creation utilizes Moore’s (1996, p. 26-27) ecosystem view, as well as both of the Adners (2017) ecosystem approaches. Visualizations correspond Moore’s layers ecosystem view. Adners ecosystem-as-affiliation approach emphasizes the actors and their dependencies, the traditional industry boundaries are useless. This approach has been utilized in the beginning of the process, where the focus is on finding ecosystem actors. The ecosystem as structure approach has been utilized when the most important chain relations, around the value proposition, needed to be examined. Building of the Ecosystem Profile can be seen as an iterative process where, the ‘view of the ecosystem’ keeps gradually getting more detailed. In the beginning of the process, the view of the ecosystem is quite narrow and even imprecise, because the only focus is only to find and map ecosystem actors. Later on, as the ecosystem and its actors are examined more and the most important relations are found, the view of the ecosystem gets more accurate.

The process for Ecosystem Profile creation utilizes SNA and Web Farming methods alternately. The construction of a Profile can be divided into three phases: (1.) Ecosystem Map, identifying the key company and defining the value proposition (2.) Ecosystem Scenario, exploring the chain relations and (3.) Ecosystem Information, creating the company specific profiles. In the first two phases, the aim is to create ‘an illustration of the ecosystem structure’. This means exploring and mapping the connections between ecosystem actors. In the third phase, the company specific profiles are built. The company profiles can for example, contain information about the company’s business area, industry, financial situation and company structure. **Figure 21** illustrates the six-steps for building an Ecosystem Profile.

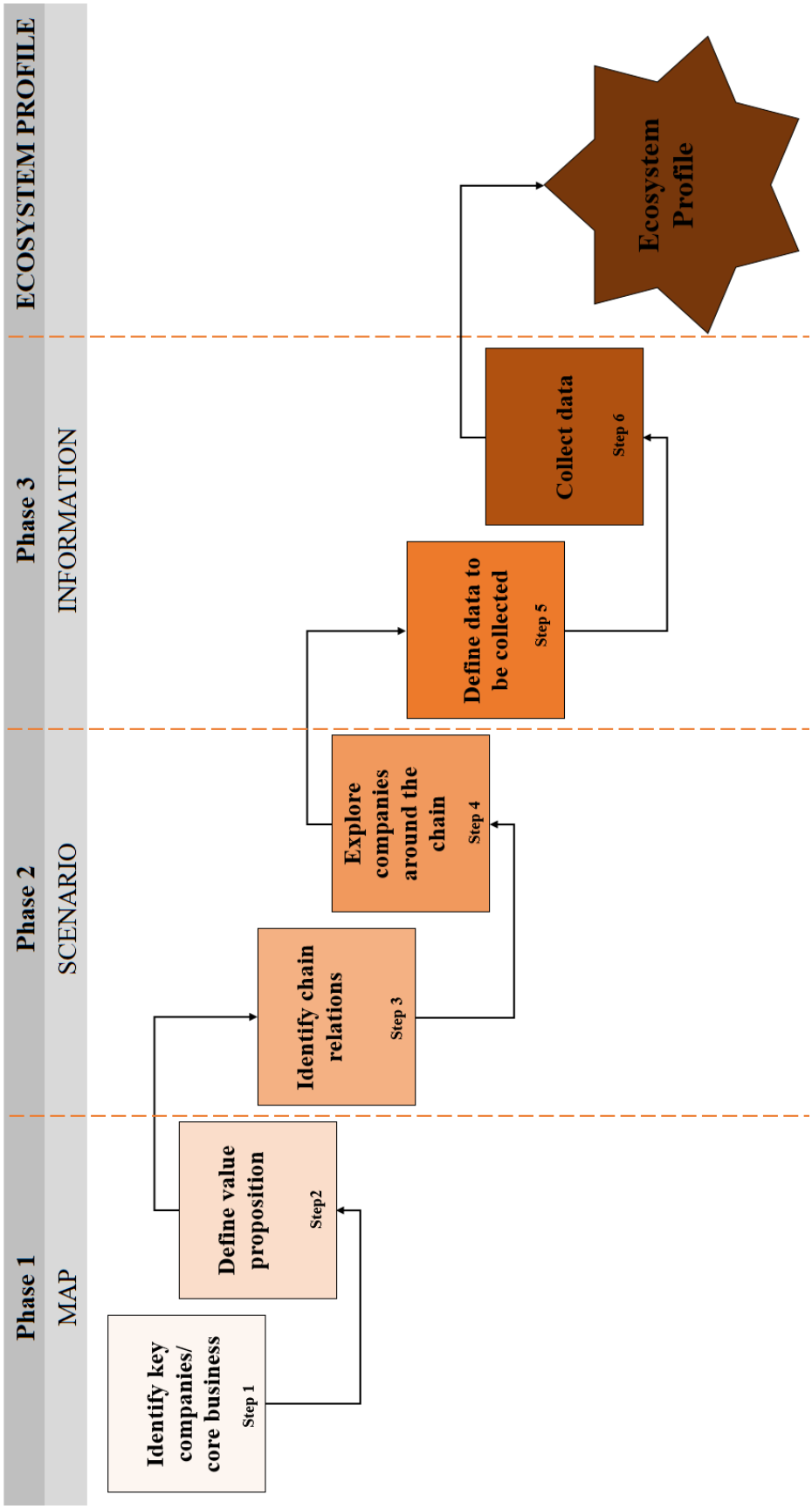


Figure 21 Steps for building an Ecosystem Profile.

6.2 Potential for Exploitation

Ecosystem Profile gives data based insights on potential or existing ecosystems. The research in this thesis was done manually and all the data was extracted from public sources one by one. In the future, the aim is to create an Ecosystem Profiler tool that can automatically retrieve information from different webpages and create profiles for different ecosystems. Nowadays there already are tools for visualizing networks and ecosystems. Anyhow, none of the tools automatically retrieve information from different sources and create a visual representation of the actors and relations in an ecosystem. The existing tools (see e.g. Ecoxight 2016; Gephi Feature 2017; Tableau 2019) can only map relationships between nodes, when the data is entered in a right form. The Ecosystem Profiler intends to be a tool that can be used and utilized in various situations. The tool could for example, be made as a web service that allows managers to profile their own company's business ecosystem.

Ecosystem analysis

Addition to those using purposes listed above, Ecosystem Profile could be utilized for making different kind of analysis. By making ecosystem analysis, it is possible to explore ecosystems development more thoroughly. It is for example, possible to follow the ecosystems development on size and density. Basole et al. (2015, p.7) proposes a four-stage process for analyzing the dynamics of business ecosystems. The stages are: (1.) boundary specification, (2.) metrics identification, (3.) computation, analysis, and visualization and (4.) sense making and storytelling. The process can be seen in **Figure 22.**

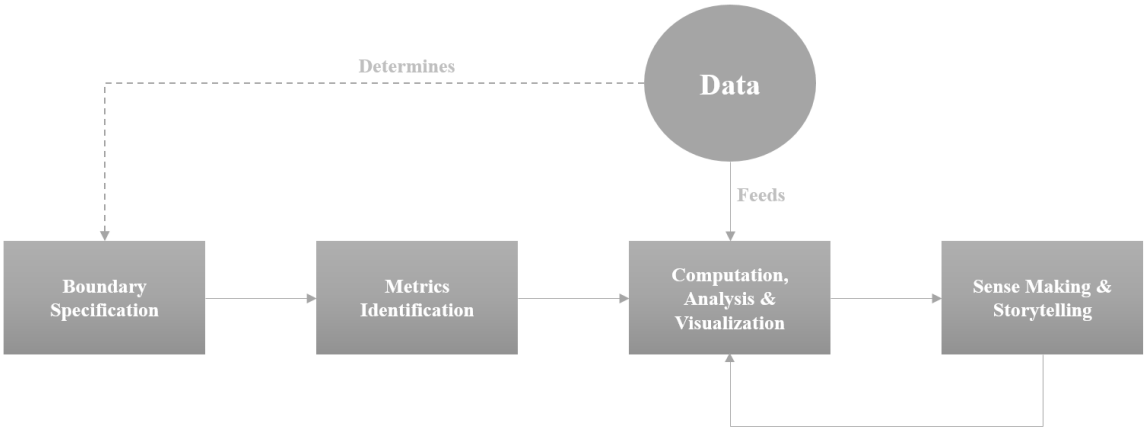


Figure 22 A four-stage process for analyzing the dynamics of business ecosystems. (Basole et al. 2015, p.9)

The first step, *boundary specification*, is about determining the rules for ecosystem architecture. This includes determining the used nodes, node types (e.g. companies, people, and universities) and relationship types (e.g. R&D, supply chain, marketing, licensing, and investing.) and some specifications of the desired time period of the analysis (e.g. start/end date). When choosing the parameters to be used, there are things to be taken into considerations: nature and objective of the problem, the questions being asked and the associated costs (Basole et al. 2015, p.7)

After the boundary specification, the next step is *metrics identification*. The selection of metrics for ecosystem analysis is guided by insight objectives and decision processes. To understand ecosystem dynamics, metrics about social networks as well as information- and graph-theoretic can be useful. Basole et al. (2015, p. 7) categorize the metrics into two levels: whole network (ecosystem) and node-level (company/individual). These metrics and their description and formula can be seen in **Table 9.** To understand better the types of links there are in an ecosystem, metrics about size, number of components and degree can be used. Metrics about density, betweenness centrality, and clustering coefficient can be used to find out how the ecosystem structures. (Basole et al. 2015, p.7, 9)

Table 9 Metrics of ecosystem dynamics. (Basole et al. 2015, p. 10)

Level	Metric	Description	Formula	Parameter Description
Network	Size	Change in the size of the network is reflective of the overall growth of the relevant ecosystem	$DENS = \frac{L}{\frac{N \times (N-1)}{2}}$	Where N represents the total number of companies in the ecosystem and L represents the total number of relationships (links) in the ecosystem
	Density	Change in density (the proportion of ties that are realized in the network relative to the hypothetical maximum possible) represents how tightly the network is connected		
	Number of Components	A component is a subgraph in which any two nodes are connected to each other by paths, and which is connected to no additional nodes in the supergraph.		
Node	Degree	Change in the degree is reflective of the number of new connections a company has gained or established.	$DEG = n_i$	Where n_i represents direct partners of focal company i
	Betweenness Centrality	Change in betweeness centrality measure is reflective of the positional prominence of a company (node) in a networks	$BC_i = \Sigma_{q,i} \neq j\ p_{q,i,j}$	Where $p_{q,i,j}$ represents the proportion of shortest paths between q and j that run through i
	Cluster Coefficient	Change in the cluster coefficient is reflective of the level of connectivity between a company's directly connected partners.	$CC_i = \frac{n_p}{\frac{n_i \times (n_i - 1)}{2}}$	Where t represents the number of existing ties among all n_i direct partners p of focal company i.

Third step is *computation, analysis and visualization.* Ecosystem data can be visualized and and analyzed in many ways. For example, sometimes key metrics are understood best in a tabular description, another situation requires a visual layout (e.g bicentiric ecosystem), and sometimes a timeline representation is the optimal choice. It is important to consider and choose the most appropriate approach for each situation. (Basole et al. 2015, p. 9)

The last step, *sense making and storytelling*, is a process that aims to 'convert' the presented data into understanding. Human insight and foresight is needed, so that the data-driven visualization can be turned into something valuable. Even though primarily, visualization is about data transformation, representation and interaction, the ultimate goal is to exploit human visual ability to identify different trends patterns, and outliers. (Basole et al. 2015, p. 11)

7 DISCUSSION AND CONCLUSIONS

As the traditional industry boundaries are fading away, physical or digital dimensions no longer define the competitive arena. Competition between individual companies has shifted to competition between ecosystems. It is not possible for companies to only rely on their own knowledge and skills. Continuous need for innovation has forced companies to collaborate and form relationships. These relationships form the complex networks that create larger business ecosystems. Currently companies understand and manage poorly the ecosystems they take part in. There might be not enough knowledge to form relations from the most compatible companies in an existing- or in a new ecosystems. To be able to survive in a constantly changing and demanding environment, companies need to monitor their own situations as well as their partners and rivals situation. By profiling ecosystems, it is possible to discover new things about the surroundings.

The need to model and guide business operations, even in an ecosystem level, is growing which means that new and better tools are needed. Ecosystem Profiling seeks to meet this growing need. Ecosystem Profile simulates the structure and relationships of an ecosystem. It makes sense of the complex ecosystems and it gives data based insights of the ecosystem under review. The Profile can be utilized for many purposes in research as well as in management. Ecosystem Profile can be used as a tool to understand and manage the ecosystems. Better understanding of ecosystems can open new possibilities for different functions that can provide support for decision-making. It is possible, that in the future, companies will have Ecosystem Controllers who will be processing ecosystem data into a more usable form. Profiling makes it possible to identify or build more complex research settings that go beyond the traditional organizational boundaries and dyadic relationships. Companies and connections that are not clear to all actors in the ecosystem can be detected. For example, in our case study, the connections found between Ponsse, Epec and Kesla were surprising because Epec provides software solutions to both Ponsse and Kesla, even though Epec is Ponsse’s subsidiary and Kesla is a competitor for Ponsse. These connections can certainly lead to situations where Epec has to contemplate whether to offer new technologies to both companies at the same time, or will Kesla have to settle for a small delay so Ponsse will get some competitive advantage. Ecosystem Profiling can be used to better understand

why something happened, did not happen or probably should happen in the future. Profiling makes it possible to recognize problems or targets for development within an ecosystem or to help to determine the compatibility of an existing ecosystem. It can help managers to find suitable partners when needed, or to spot unsuitable ones. With the help of ecosystem profiling, it is possible to detect the strength or weaknesses that a certain ecosystem has.

7.1 Future Development

Like many other visualization tools at the moment, this process needed a lot of manual work. In the future, the aim is to create an Ecosystem Profiler tool that can automatically retrieve information from different webpages and create profiles for different ecosystems. By automating the Ecosystem Profile construction, time releases to make new observations and to analyze the ecosystem more deeply. If the data collection and Profile construction process can be automated, the tool could possibly be turned into commercial services. Utilizing the ecosystem information got from the profiler, both companies themselves as well as different consultancy services could utilize the platform to illustrate ecosystems and to examine companies positions in it.

The Ecosystem Profile that was constructed in this thesis was built in three phases (1. Ecosystem Map, 2. Ecosystem Scenario and 3. Ecosystem Information). Each phase included a lot of manual work of retrieving information from varying sources. Needless to say the whole process was very time consuming. To release time from the data collection and mapping to the actual ecosystem analysis, at least some of the steps should be automated. There are several robotic process platforms in the market (see eg. UiPath) which functionalities to Ecosystem Profile construction could be explored. In the beginning of automatization development, these platforms could be utilized to examine how well can the simplest commands be executed. Currently as the construction of an Ecosystem Profile is completed manually, the process is more or less iterative. The Profile gets gradually more accurate. The first version, that is created using only information from public source, can also always be supplemented with data got from companies or from other analysts. Iterative creation process improves the quality of an Ecosystem Profile. As the initial data is always extracted from open sources, there might be some problems on how the automate data

retrieval and extraction will work. For example, each company has different kinds of webpages and the needed information is often found from completely different places. It is for example, not possible to say that all the companies have marked their most important partners and customer under the tab of ‘references’. Some companies have, but some do not have any mentions about their partners or customers. Notable is, that sometimes companies may have a page for references in their webpage, but all the references have only been marked with the ‘companies logos’. If there is no description text under the logo, it is quite possible that the automated research will just skip over it.

The validity of the information and the reliability of the Profile can (and should) sometimes be questioned. When the data is collected from open sources, it is not possible to create as accurate models as if using data got from different companies. In addition, when thinking about the reliability of the Profile there is always a possibility to mislead the viewer, either intentionally or unintentionally. The researcher might manipulate the graphics by removing or re-positioning the actors. Color-coding can also mislead the viewer by emphasizing certain parts more than others. The created ecosystem graph is always some people’s perspective of a certain situation. Visualization always has its challenges on creating a neutral picture of a situation.

7.2 Further Research

Power relations

Members of an ecosystem are dependent upon each other. Relationships develop and evolve over time. In chapter (2.4 Roles and Relationships), four different types of relationships were presented: (a) no relationship, (b) leadership relationship, (c) followship relationship and (d) mutual relationship. The types had been defined according to companies’ dependencies on each other. Examining how these ‘power-relations’ affect on the ecosystem, could add extremely interesting information to the Profile. Without a doubt, the dependencies have an effect on how willing (or forced) are companies to form relationships and partnerships. Sometimes an ecosystem actor may be able to dictate other actors to its own liking and others are just forced to hang on. This may for example, be possible if the dictator is a multi-million company and the suppliers, customers or partners are small or medium sized companies.

The Ecosystem Profiler created in this thesis does not contain any information of the nature or quality of the actors' relationships. It would be interesting to add these information's the so the ecosystems could be explored more deeply. In the first two phases of ecosystem creation, information about the dependencies or power relations could be added. The links between the nodes could be color coded to distinguish different relationship-types (e.g. supplier, partner). This way the person interpreting the graph could immediately understand something about the actors' relationships. 'Centrality' or 'path distance' could also be used to describe the closeness of actors' relationship. This could be done by physically placing the actors to the graph depending on the strength of the relationship. The closer the actors are to each other the closer their relationship is. Utilizing this method, it could for example, be possible to detect structural clusters or bridges within an ecosystem.

Ecosystem classification

By being able automate the construction of Ecosystem Profiling, time releases to analyze the created graphs. The Ecosystem Profile created in this thesis, required multiple hours to be completed. If the intention would be to illustrate for example, ten, thirty or 200 ecosystems, the construction process would take an enormous amount of time. By automating the construction process, it would be possible to create maps in more reasonable time. When multiple ecosystems could be illustrated, their abilities, similarities and differences could be examined and analyzed. Examining and comparing the different ecosystems, it could be possible to make some kind of classifications of the ecosystem types. Such classifications could be used in a way that different industry-classifications are used.

Ecosystem Profiles could also be utilized to follow the evolutionary development of an ecosystem. Ecosystems have quite clear evolutionary stages, but recognizing them and their transformation can be a challenge. By being able to create graphs of the ecosystems in a systematic way, it could be possible to analyze how the ecosystem are developing.

8 SUMMARY

The objective of this thesis was to examine the creation of an Ecosystem Profile. This thesis presented the creation of an Ecosystem Profile through case examples. As an end result, steps for Ecosystem Profile construction were created. Literature review was used to gain insights on business ecosystems, Social Network Analysis and Web Farming. Below is presented the research questions that were set in the beginning and answers that were discovered during the research.

RQ: How to profile ecosystem of organizations?

Ecosystem Profile forms around Ecosystem Map, Ecosystem Scenarios and Ecosystem Information. The construction of a Profile of can be divided into three larger entities: (1.) Ecosystem Map, identifying the key company and defining the value proposition, (2.) Ecosystem Scenarios, exploring the chain relations and (3.) Ecosystem Information, creating the company specific profiles.

How to map ecosystem of organizations?

In this thesis, the Ecosystem Map was created manually. The key is to start the research from a selected key company and then widen the search gradually. The data collection process itself is very time consuming. The amount of data is almost endless, so some boundaries must be set. Visualizing the relationships requires careful planning. It is good to consider how to present the actors and links and how to make the map as visual as possible. To improve the maps visual value, colors and different node-sizes can for example, be used.

How to utilize business scenarios in profiling?

Analyzing different scenarios, much can be learned from the ecosystem. Business scenarios can be used as starting point, when starting to examine an ecosystem more deeply. The scenarios affect on who are the key companies and what are relationships that will be examined. Change of view can enable managers to see new opportunities or to discover threats. They can be used for example, when exploring the possibilities to expand into a new market segment or when considering to outsource some operations.

What kind of information should Ecosystem Profile contain?

The information base for Ecosystem Profile consist of three parts: (1) static information, (2) dynamic information and (3) the social graph. Static information contains information about the company's products and services, company size, number of employees, financial situation. The dynamic information part is focused on to present what is said about the company and what does the company say about itself. The dynamic information also includes news, stock releases and other publications where the company is mentioned. The social graph (Ecosystem Map + Ecosystem Scenarios) contains information about the ecosystem actors and the relations between the actors.

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