Tampere University

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EFFECTS OF DISRUPTIVE INNOVATIONS ON VALUE PROCESSES IN BUSINESS ECOSYSTEMS

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ABSTRACT

Emmi Welin: Effects of Disruptive Innovations on Value Processes in Business Ecosystems
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Disruptive innovations are a well-known but often poorly managed topic among both researchers and commercial companies. These innovations tend to disrupt whole industries and lead many firms to failures. When it comes to blockchains and distributed ledgers, many experts believe that these technologies have the potential to disrupt industries the same way the internet did. However, this time the disruption will not happen in the context of single organizations, since distributed technologies steer companies to work in business ecosystems. The problem is that the effects of these technologies on these networks of interrelated actors are mostly unknown. Because of the significant value proposition related to distributed solutions, firms want to understand the effects of these disruptive innovations in order to benefit from them.

This master's thesis studies the effects of disruptive innovations on value processes in business ecosystems. The aim of this study is to find out how these innovations affect value creation, delivery and capture, and how these ecosystems should be built and managed. These objectives were addressed by developing a framework for studying ecosystem roles in detail. The empirical study tested the assumptions of the framework by interviewing organizations in the finance industry, which could possibly establish a distributed ledger based ecosystem together. This provided a way to validate and deepen the understanding regarding ecosystem roles in the context of disruptive innovations. As a result, the researcher was able to define differences and similarities between roles, which led to find the answers to the research questions.

The findings of this study imply that disruptive innovations have various effects on value processes in business ecosystems. Value creation requires understanding of the needs of potential customers, value delivery trust and cooperation, and value capture clear roles, responsibilities and common rules. The ecosystem also needs a neutral and capable leader to manage the uncertainty, engage right actors and allocate enough resources to the network. This is especially important in the chaotic building phase. Furthermore, this study contributed to the existing research by justifying the categorization of ecosystem roles into developers and users. Thus, the framework of this study provides many opportunities to enhance the understanding related to ecosystems' roles and structures especially in the disruptive context in the future, too.

Keywords: disruptive innovation, disruptive technology, business ecosystem, value creation, value delivery, value capture, distributed technologies, distributed ledgers, finance industry

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TIIVISTELMÄ

Emmi Welin: Disruptiivisten innovaatioiden vaikutukset arvoprosesseihin liiketoimintaekosysteemeissä
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Disruptiivinen innovaatio on tunnettu mutta usein hankalasti hallittavissa oleva käsite sekä tutkijoille että kaupallisille toimijoille. Nämä innovaatiot ovat disruptoineet useita toimialoja ja aiheuttaneet vaikeuksia olemassa oleville yrityksille. Useat asiantuntijat uskovat, että uudet lohkoketjuihin ja hajautettuun kirjanpitoon perustuvat teknologiat saattavat mullistaa liiketoimintakentän jopa samaan tapaan kuin internet aikoinaan. On kuitenkin tärkeää huomata, että tällä kertaa disruptio ei koske vain yksittäisiä yrityksiä – hajautetut teknologiat siirtävät liiketoiminnan useiden toimijoiden muodostamiin ekosysteemeihin. Ongelmaksi nousee kuitenkin se, että näiden teknologioiden vaikutuksia liiketoimintakentässä ei juurikaan tunneta. Koska hajautettujen ratkaisujen potentiaali on merkittävä, tarve ymmärtää näiden disruptiivisten innovaatioiden vaikutuksia ja hallita niihin liittyvää arvoa on suuri.

Tämä diplomityö tutkii disruptiivisten innovaatioiden vaikutuksia arvoprosesseihin liiketoimintaekosysteemeissä. Työn tavoite on selvittää, miten nämä innovaatiot vaikuttavat arvon luontiin, sekä sen liikkumiseen ja jakautumiseen eri toimijoiden kesken. Lisäksi tutkitaan, miten tällaiset vahvasti disruptiivisiin innovaatioihin kytkeytyvät ekosysteemit tulisi rakentaa ja kuinka niitä voidaan hallita. Teoriakatsauksen pohjalta kehitettiin viitekehys, joka pyrki määrittelemään ekosysteemin toimijoille aiempaa tarkemmat roolit. Tätä viitekehystä testattiin haastattelemalla kolmea eri finanssialan organisaatiota, jotka voisivat muodostaa yhdessä hajautetun kirjanpidon sovelluksiin perustuvan ekosysteemin. Haastattelut tarjosivat mahdollisuuden syventää tietämystä ekosysteemien rooleista ja tutkia niitä disruptiivisessa ympäristössä. Eri roolien välillä tunnistetut erot ja yhtäläisyydet tarjosivat vastauksia tutkimuskysymyksiin.

Työn tulokset osoittavat, että disruptiiviset innovaatiot vaikuttavat usealla tavalla arvoprosesseihin ekosysteemeissä. Arvon luonti vaatii tietoa potentiaalisten asiakkaiden vaatimuksista, arvon välitys yhteistyötä ja luottamusta verkon toimijoiden välillä, ja arvon tasavertainen jakautuminen selkeitä rooleja, vastuita ja yhteisiä sääntöjä. Ekosysteemi tarvitsee myös puolueettoman johtajan, joka kykenee hallitsemaan disruptiivisten innovaatioiden aiheuttamaa epävarmuutta, sitouttamaan oikeat kumppanit ja kohdentamaan tarpeeksi resursseja verkon kehittämiseen. Tämä on erityisen tärkeää ekosysteemien rakennusvaiheessa, jossa toimijat ja rakenteet eivät ole vielä järjestäytyneet. Tässä työssä perusteltiin myös ekosysteemin roolien jakaminen sekä kehittäjiin että käyttäjiin. Näin ollen työssä kehitetty viitekehys tarjoaa mahdollisuuden tutkia ekosysteemien rooleja ja rakenteita erityisesti disruptiivisessa ympäristössä myös tulevaisuudessa.

Avainsanat: disruptiivinen innovaatio, disruptiivinen teknologia, liiketoimintaekosysteemi, arvon luonti, arvon välitys, arvon jakautuminen, hajautetut teknologiat, hajautettu kirjanpito, finanssiala

Tämän julkaisun alkuperäisyys on tarkastettu Turnitin OriginalityCheck –ohjelmalla.

PREFACE

It has been quite a journey to reach this point, where I am about to hand in my thesis and to graduate. This master's thesis project included many ups and downs, and sometimes it felt like a never-ending project. However, writing the thesis has taught me a lot, pushed me out of my comfort zone and despite the challenges, given me a lot of confidence regarding my skills and capabilities. This thesis gave the final touch to my university career, which has been the best time of my life so far.

Now, it is time to thank all the people who have made this master's thesis project possible. First, I am grateful to the case company for providing me the opportunity to study such interesting and current topics. I did not just learn about distributed technologies but also a lot about the whole finance industry and its principles in general. Special thanks to my thesis supervisor Niko, and all the people I got to interview during the process. Your enthusiasm towards the topic motivated me to try my very best.

Second, I would like to thank the university Professor Saku Mäkinen for insightful comments, valuable feedback and trust during the thesis project. Your advice were a good combination of challenges and guiding, and they helped me to get insights and to find the right track. Third, a big thank you to my wonderful colleagues and friends. You listened and shared the pain of the thesis – you helped me more than you probably know. Finally yet importantly, I would like to thank my family. You have always supported me, believed in me when I have not, and been there for me whenever I have needed. I could not have finished this thesis without you.

Lahti, 19.1.2019

Emmi Welin

CONTENTS

APPENDIX A: INTERVIEW STRUCTURE

LIST OF FIGURES

LIST OF TABLES

LIST OF SYMBOLS AND ABBREVIATIONS

API	Application Programming Interface
BMI	Business Model Innovation
Corda	Open Source Distributed Ledger Platform by R3
DLT	Distributed Ledger Technology
DT	Disruptive Technology
DVD	Digital Versatile Disk
ID	Identification
IPR	Intellectual Property Rights
JV	Joint Venture
KYC	Know Your Customer
MVE	Minimum Viable Ecosystem
MVP	Minimum Viable Product
R&D	Research and Development
R3	Consortium of Financial Institutions, Developer of Corda
RPI	Radical Product Innovation
SBU	Strategic Business Unit
VAT	Value Added Tax
VHS	Video Home System

1. INTRODUCTION

1.1 Background

In recent years, the hype around blockchain, robotics, artificial intelligence and other new technologies has been significant in many industries. When it comes to blockchain, some experts assume that it will disrupt the world the same way the internet did (Wright and De Filippi, 2015; Collomb and Sok, 2016) – the technology saves the world by saving democracy and even preventing climate change (Lahti, 2016). Even the more moderate advocates believe that the technology can remove the need for centralized authorities like banks (Wright and De Filippi, 2015; Lahti, 2016; Hawlitschek *et al.*, 2018). As this example illustrates, one of the industries that blockchains will affect a lot in the upcoming years, is the finance sector (Collomb and Sok, 2016; Cocco *et al.*, 2017; Pazaitis *et al.*, 2017). Thus, understanding the effects of these technologies on this industry helps all companies to respond to disruption in their own areas of expertise.

As the examples above illustrate, blockchain and other distributed solutions represent possible disruptive innovations. These innovations change the value emphasis of customers (Bower and Christensen, 1995), which causes troubles for existing market players and often leads to failures (e.g. Bower and Christensen, 1995; Adner, 2002; Danneels, 2004). Since the disruption in the finance sector seems to be inevitable, market players need to know, how to make the best out of it. According to Gartner (2018), blockchain solutions will have a business value of $3,1 Trillion by 2030. Thus, in order to utilize this potential, it is crucial to be able to manage the value of disruptive innovations.

Managing value can be seen as operations related to value creation, delivery and capture (Corsaro, 2014). Blockchains and other distributed technologies steer companies to work in ecosystems (Pazaitis *et al.*, 2017). Thus, in order to manage the value of these disruptive innovations, one need to focus on value processes in ecosystems. However, there are no existing ecosystems based on distributed technologies at the moment (Hallamaa, 2018). That is why no one really knows, how the business will organize around these new technologies. Furthermore, even if disruptive innovations and business ecosystems are popular topics among researchers (e.g. Moore, 1993; Bower and Christensen, 1995; Iansiti and Levien, 2004; Danneels, 2006), there are not many studies, which would focus on these innovations and their effects in the context of business ecosystems. Thus, there is a clear need to find out, how disruptive innovations affect value processes in business ecosystems in order to survive the disruption and capture value. This master's thesis aims to fill this research gap by conducting a research in the finance industry.

1.2 Objective of the study

This thesis focuses on new and emerging technologies and their effects in ecosystem context. It is conducted in a global IT-service and consulting company, who is currently investigating business possibilities of ecosystems and distributed technologies. In addition to these activities of this company, the researcher's own interest and experience affected the choice of the topic. The researcher has working experience from technology and innovation management, and she is interested in new technologies, such as blockchain, artificial intelligence and robotics. Furthermore, she wanted to focus on themes, which could have significant impacts on business in the future. Many assume that these new technologies might soon disrupt the whole way we do business. In order to study these potentially disruptive innovations in ecosystems, the researcher focused on the effects they have on value processes. Thus, the objective for this thesis is

… to explore, how disruptive innovations affect business ecosystems in the finance sector. In detail, this study investigates, how disruptive innovations affect value creation, delivery and capture in business ecosystems, and how these ecosystems should be built and managed.

After identifying this objective, it was divided into four research questions. These questions define in detail, what the goals for this thesis are:

RQ1: How do disruptive innovations affect value creation in a business ecosystem in the finance sector?

RQ2: How do disruptive innovations affect value delivery in a business ecosystem in the finance sector?

RQ3: How do disruptive innovations affect value capture in a business ecosystem in the finance sector?

RQ4: How to build and manage a business ecosystem based on disruptive technologies in the finance sector?

In order to answer to these questions, this thesis builds a framework for different ecosystem roles. The first question aims to define, what kind of value the business ecosystem creates for different roles and how disruptiveness affects the value creation process. The second question aims to find out, how disruptive innovations affect value delivery, and what kind of duties different ecosystem roles have, when it comes to this process. The third question studies, how the value created is divided between different roles in the ecosystem. The focus is on finding out, what kind of expectations and strategies different roles have to capture value, when the environment is disruptive and unstable. The fourth question sheds light on the success factors of ecosystems. This question aims to answer,

what should be taken into consideration when building ecosystems based on disruptive technologies (DT) and what roles and responsibilities are needed in these networks.

Since this thesis is conducted in a commercial company, it has both practical and academic purposes. From practical perspective, this thesis provides valuable information for the IT-service provider about facilitating the ecosystem and improving competitive advantage. This study provides important information for different participants about the benefits and challenges related to ecosystems, too. It promotes the understanding, how the ecosystem would look like, if a distributed solution was built in the finance sector. From academic perspective, this thesis creates a framework for different roles in business ecosystems and utilizes this categorization to answer to the research questions. With the help of this categorization, the thesis aims to contribute to the existing field of research and demonstrate the effects of disruptive innovations on value processes in business ecosystems.

1.3 Description of the industry

As mentioned before, this study is conducted in the finance sector in Finland and thereby limited to this industry. Finance sector can be defined to include firms that provide financial services and are involved in financial transactions (Lindley and McIntosh, 2017; Kenton, 2018). Thus, the sector includes banks, insurance companies, funding and financing institutions, and brokers (Lindley and McIntosh, 2017; Finanssiala ry, 2018; Kenton, 2018). Banks are responsible of granting credits, receiving deposits and taking care of investments and wealth management of their customers. There are more than 200 banks operating in Finland, and the number includes both national and foreign companies (Finanssiala ry, 2017). Insurances secure the financial activities of individuals, companies and communities. In Finland, insurance companies can be divided into companies providing life, non-life and employment pension insurances (Finanssiala ry, 2016c). Funds offer a wide range of possibilities to invest in different investment objects in a distributed manner. Stock markets refer to business of securities operated by brokers and dealers.

Rules and regulations are one defining factor for the whole finance industry. Operations of banks, insurance companies, funds and brokers are regulated on national, European and global level. An authority called Finanssivalvonta regulates the Finnish finance sector. After the financial crisis at the end of the first decade in the 21st century, the regulation politics have been even tighter. (Finanssiala ry, 2016b, 2016c, 2016a, 2017) However, the finance industry is facing many changes at the moment. For example globalization, digitalization, new technologies, economical insecurities, changes in customer behavior and population structure, increasing competition and blurring lines between financial actors are changing the industry (Rajander-Juusti, 2012). Especially distributed technologies, robotics, artificial intelligence and digital platforms will have a great impact on the industry in upcoming years (Sitra, 2017). The changes also create a need for updating regulation and developing new rules.

This master's thesis is conducted in a company focusing especially on the finance sector. This company is a Finnish strategic business unit (SBU) of a global organization providing IT-service and consulting. Even if this study is conducted in the SBU, it concentrates on the perspective of the global parent company. From now on, this company is referred as IT-service provider in this paper. The global organization's customers are large and medium-sized public and private companies and institutions. As a joint venture (JV), the SBU concentrates on providing services and maintenance to a bank, which is the other party of this JV relationship. This bank is also interviewed in this research project. Furthermore, national tax authority complements the group of target organizations in this study.

In 2017, the SBU of the IT-service provider launched an ecosystem concept based on distributed technologies. This concept worked as a spark for this thesis and demonstrated the need for deeper understanding regarding disruptive ecosystems. The concept aims at bringing retail, banking, insurance, financing, repairing, transporting and taxation together in order to create more value for customers. Figure 1 illustrates this ecosystem of six actors, and its interface with the customer.

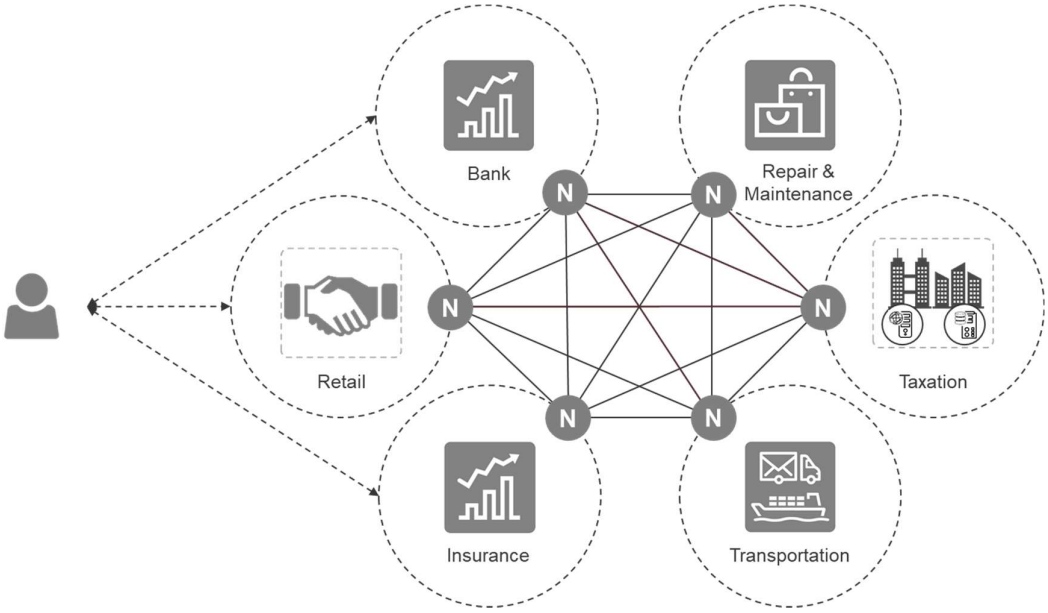

Figure 1. *IT-service provider's ecosystem concept (modified from material of IT-service provider)*

First, the idea in this concept is to engage different parties from different fields. Later, the competitors of these parties should be included to the system, too. Hence, there could be many banks and insurance companies participating in the ecosystem in the future. IT-service provider sees itself as a facilitator: the company manages nodes (marked as N in Figure 1), integrates applications, develops distributed solutions and ensures the ecosystem's functions and operations. From practical perspective, this new ecosystem should offer easier purchasing for customers and more efficient cooperation for companies. For

example, if the customer buys a new fridge, he or she can purchase a loan and an insurance for this fridge at the same time, when purchasing the item at the store. Thus, there is neither a need for visiting a bank nor an insurance company. Furthermore, at the time of the transaction, the information would automatically be sent to the tax office, who needs the information for value added tax (VAT) invoicing.

From technological perspective, the concept includes the development of an ecosystem application. This application is based on an open-source distributed ledger technology (DLT). From now on, the ecosystems based on distributed technologies are referred as DLT ecosystems in this study. Distributed ledgers are online databases, which save digital data across geographically spread sites and locations (Khan *et al.*, 2017). The data is synchronized and updated in real time without the need for a centralized party (Cocco *et al.*, 2017; Hawlitschek *et al.*, 2018). Blockhains are a specific application of distributed ledgers: the digital information is stored in interconnected blocks, which form a database (Pazaitis *et al.*, 2017; Li *et al.*, 2018). There are both permissionless and permissioned blockchains and DLTs. Permissionless systems are open for everyone to join, while permissioned systems require an authorization from a centralized authority or consortium, which all ecosystem parties acknowledge. Bitcoin is one well-known example of permissionless blockchains (Cocco *et al.*, 2017).

The IT-service provider builds the ecosystem by utilizing a specific distributed ledger technology called Corda. It is developed by R3, which is an international consortium of over 200 different banks and financial institutions providing DLT based platforms (R3, 2018). Corda was released 2016 and it is used for recording, managing and synchronizing agreements and legal contracts. It is especially designed and built for regulated financial institutions. Thus, it is a permissioned DLT. In the ecosystem, the technology combines different participants by utilizing nodes and application programming interfaces (API). These remove the need for common systems among ecosystem actors. Thus, the parties can use their own systems and link these to the network through nodes.

In this study, the concept works as an example of an ecosystem based on distributed technologies. However, this study focuses on these DLT ecosystems on a higher level and does not utilize the IT-service provider's ecosystem concept as a case. This is because there does not exist any ecosystem similar to the one presented in Figure 1 at the time of conducting this study. At the end of 2018, the concept is discussed with the potential participants and a demo environment has been developed. When referring to general ecosystem participants, the word actor is used in this study. If the actor has certain responsibilities in the ecosystem, it has a certain role. Thus, the combination of different responsibilities creates different roles. The customer in the ecosystem is also referred as an end-user. This should be separated from the term user, which refers to any ecosystem actor, who utilizes the network and its products and services. Contrary to users, developers are defined as parties taking part to the development activities in the ecosystem. Thus,

whereas customers or end-users are individuals utilizing the ecosystem through an interface, users and developers work in the system.

1.4 Structure of the study

After this introductory part, the thesis continues with the theoretical background. The main theories utilized in this study are presented in Chapter 2 about disruptive innovations, business and innovation ecosystems and value processes. Section 2.1 first defines disruptive innovations and presents their typical characteristics. Second, this section discusses the value related to these innovations and defines the reasons for failure and success of firms, when they face disruptive innovations. Finally, the section presents ways to recognize disruptive innovations and strategies for commercializing and responding to them.

Section 2.2 first discusses definitions, characteristics, actors and structures for business and innovations ecosystems. Next, the section illustrates, what benefits, problems and success factors are related to these ecosystems. Finally, the section discusses roles as strategies in ecosystems, and explains how to build and manage these ecosystems. The two theories of disruptive innovations and ecosystems are linked together in Section 2.3 by utilizing the theory of value. This section first defines value processes, which can be seen as a common denominator for disruptive innovations and ecosystems. Next, the section develops a framework, which allows studying value processes among different roles in ecosystems. Finally, the section presents, how this framework can be applied in order to study the effects of disruptive innovations in business ecosystems.

Chapter 3 discusses the use of methodology in this research. The chapter presents the research methods utilized in this study, demonstrates the research process, and presents the data collected for this study. Chapter 4 presents the results of this master's thesis. The theory framework is utilized in this chapter in order to find similarities and differences between different ecosystem roles. The chapter starts by defining the current situation and problems in the finance industry, which create the motivation for utilizing new technologies. Next, it presents what kinds of benefits, challenges and success factors organizations see for DLT ecosystems. Then, the interviewees' views regarding responsibilities, roles and relationships are discussed. Finally, the chapter concludes by presenting organizations' perceptions about the future of DLT ecosystems.

Chapter 5 combines the theory of this thesis to the empirical results presented in Chapter 4 by answering to the research questions. This chapter discusses the reasons behind the similarities and differences of different ecosystem roles. As a result, the chapter finds out the effects of disruptive innovations on value processes in ecosystems. Chapter 6 summarizes the master's thesis by discussing the main findings and assessing the research and its reliability and validity. Furthermore, managerial implications and future research directions are presented, too.

2. THEORETICAL BACKGROUND

This chapter presents the theoretical background for this master's thesis, and discusses themes related to disruptive innovations, business ecosystems and value processes. The structure of the chapters related to disruptive innovations and business ecosystems is similar: Chapters 2.1 and 2.2 define the topic, present the effects and outcomes, and discuss the managerial and strategic perspectives. Chapter 2.3 about value presents the different value processes and issues related to their management. This chapter combines the theories about disruptive innovations and business ecosystems to the theory of value processes, which leads to developing a framework for this thesis. The framework provides the premises to study the effects of disruptive innovations on value processes in ecosystems.

2.1 Disruptive innovations

The theory of disruptive technologies was first introduced and made popular by Bower and Christensen (1995). Later, the term was widened to innovations. Even if disruptive innovations have been well documented, scholars have faced difficulties in understanding theoretical reasons behind them (Adner, 2002), and in finding an unambiguous definition for them (Kostoff *et al.*, 2004; Markides, 2006). By studying diverse definitions starting from disruptive technologies and moving on towards related terms and characteristics of disruptive innovations, this chapter contributes to enhancing the understanding of the concept. This knowledge works as a premise to understand the effects and manage these innovations effectively. These topics of disruptive innovations are discussed later in this chapter.

2.1.1 Defining disruptive innovations

Definitions and related terms

Despite of the difficulties related to definitions, scholars share the opinion that disruption is a process, not an event (Bower and Christensen, 1995; Danneels, 2004). This process starts, when a new technology with significant differences to existing technologies comes to the market (Bower and Christensen, 1995). This technology introduces completely new performance attributes but does not succeed in attributes valued by mainstream markets. Thus, this technology does not attract the mainstream market. However, niche market finds it interesting. The technology is superior in new attributes and after a while, it reaches a sufficient level in old ones, too. At the same time, old technologies continue their development and begin to exceed the performance demanded by existing customers. Bergek et al. (2013) call this performance overshooting. Because of this, the mainstream market starts to adopt the disruptive technology, too. Thus, customer value emphasis

changes from old attributes to new ones. Eventually the new technology displaces the old ones (Adner, 2002) and hence, disrupts the market (Bower and Christensen, 1995). However, it is important to notice that this is the case only with successful disruptive technologies – sometimes they can fail, too (Danneels, 2004).

Bower and Christensen (1995) use hard-disk drives as an example of disruptive technologies. In this industry, disk drive capacity was the main attribute valued by existing customers. However, the industry faced disruption several times, when the diameter of the drives first dropped from 14 inches to 8 inches, then to 5.25 inches and finally to 3.5 inches. Thus, these smaller drives introduced size as a new attribute. However, since the new drives provided substantially less capacity than their precursors, established computer manufacturers and their disk drive suppliers rejected them first. For example, in case of 3.5-inch drives, personal computer industry was not interested in these new drives, unlike portable computer industry. As the capacity of 3.5-inch drives developed in the portable computer industry, it soon reached the demand of the mainstream market in the personal computer industry, too. As a result, customer value emphasis changed from capacity to size, and 3.5-inch drives disrupted the market for 5.25-inch drives in the personal computer industry.

Bower and Christensen (1995) demonstrate the process of disruption with performance trajectories. Trajectory charts include trajectories illustrating both the performance offered by new and established technologies and the performance demanded by customers in the market (Figure 2).

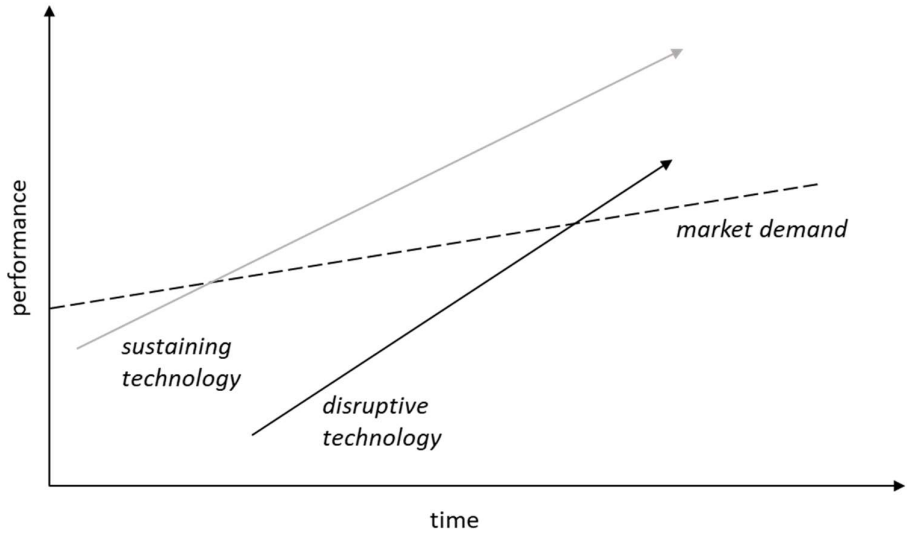

Figure 2. *Trajectory chart of a disruptive technology (modified from Keller and Hüsig 2009)*

Disruption can also be explained with trajectory charts: new technology disrupts the market, when the performance trajectory of that technology intersects the trajectory describing the performance demanded by the market. However, it is important to notice that the performance of disruptive technologies often never actually exceeds the performance of old technologies in the dimension initially valued by the mainstream market (Bower and Christensen, 1995). For example, 3.5-inch drives did not exceed the capacity of 5.25-inch drives – they only exceeded the demand for the capacity of the mainstream market. This is also visible in Figure 2. Even if Christensen's trajectories work well in case of disk drives, Danneels (2004) has criticized the concept. The trajectories suggest that only one or two attributes affect customers' choices. In many cases, the number of different attributes is much higher. Even if disk drives only had capacity and later size as key attributes, there are much more key attributes in a car, for example (Danneels, 2004). This makes the use of trajectories with more complex products and technologies difficult.

As previous examples show, Bower and Christensen's (1995) definition of disruptive technologies relies on supply perspective: oversupply in old attributes shifts the competition to new ones. Adner (2002) however highlights the demand-based view. He suggests that disruption occurs, because the new technology eventually better meets the demand of the mainstream market. Danneels (2004) argues that based on these definitions it is still hard to say, when a technology becomes disruptive, if it is inherently disruptive or if disruptiveness is related to the perspectives of different firms in the market. That is why Adner (2002) suggests the following definition: "A disruptive technology is a technology that changes the bases of competition by changing the performance metrics, along which firms compete."

As the popularity of disruptive technologies grew, the term was widened to innovations. In addition to disruptive technological innovations (or disruptive technologies), disruptive innovations include disruptive business model innovations (BMI) and disruptive or radical product innovations (RPI) (Markides, 2006). These types have been identified because they "-- arise in different ways, have different competitive effects and require different response strategies from incumbents" (Markides, 2006). Disruptive business model or strategic innovations introduce a significantly different business model compared to existing ones in the market. Thus, this type of disruptive innovations does not discover new products or services; it only redefines what the product is and how it is delivered to the market (Markides, 2006). Radical product innovations or new-to-the-world products represent often something completely new, which has not existed in the market before. That is why they are rarely driven by demand (Markides, 2006): customers could not had demanded something they did not know would even exist. Figure 3 illustrates the different types of disruptive innovations.

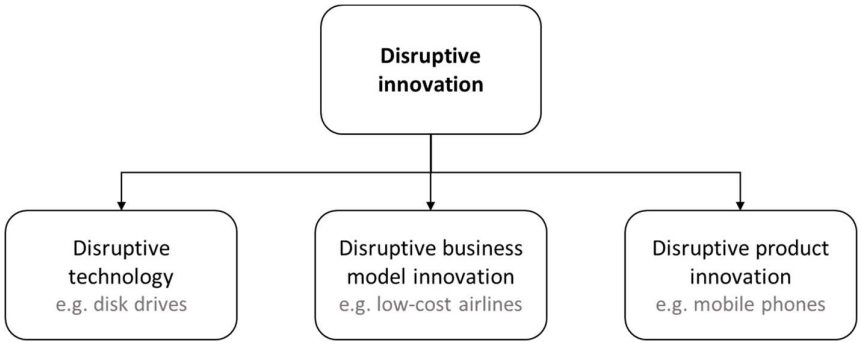

Figure 3. *Different types of disruptive innovations*

Low-cost airline companies (e.g. EasyJet, Ryanair) represent an example of disruptive business model innovations (Markides, 2006). Even if disruptive technologies often replace incumbents with entrants (Danneels, 2004), new business model innovations only capture a certain market share but never fully displace the old models (Markides, 2006). For example, British Airways is still competing in the market, even if EasyJet has taken some of its customers. In turn, innovations, such as car, TV, PC and mobile phone, represent radical product innovations (Markides, 2006). From now on, the term disruptive innovation is used in this study, if the use of disruptive technology is not exclusively needed.

An opposite for disruptive innovations are sustaining innovations, which improve the existing products, technologies or business models in the mainstream market (Kostoff *et al.*, 2004). Thus, sustaining technological innovations strengthen established performance trajectories. However, sustaining innovations (e.g. fuel injection of cars) have also driven companies out of business, so a firm's failure alone does not tell whether the change in the market was disruptive or not (Schmidt and Druehl, 2008).

It is important to notice that both disruptive and sustaining innovations can be either radical or incremental in nature (Kostoff *et al.*, 2004; Govindarajan and Kopalle, 2006b). However, being radical does not imply that the innovation is necessarily disruptive. Radicalness measures the extent an innovation is based on a considerably new technology in relation to existing ones (Chandy and Tellis, 1998; Colarelli O'Connor, 1998). Radical innovations can target either existing or niche markets, they perform well in existing attributes and incumbents usually survive them better than disruptive innovations (Govindarajan and Kopalle, 2006b; Govindarajan *et al.*, 2011). Thus, radicalness is a technology-based dimension, whereas disruptiveness is based on market factors. Cell phones represent radical and disk drives less radical disruptive innovations: they both disrupted their markets by introducing new performance attributes (portability and smaller size), but only cell phones were based on a new technology (Govindarajan and Kopalle, 2006b). On the other hand, digital versatile disks (DVD) represent a radical but sustaining innovation, because despite of the new technology, the innovation still targeted

the same market as video home system (VHS), i.e. an existing market (Govindarajan and Kopalle, 2006b).

Innovations can either enhance a firm's competence or destroy it (Bergek *et al.*, 2013). Again, this implies nothing about the disruptive nature of the innovation – even if incumbents tend to introduce competence enhancing and entrants competence destroying innovations (Gilbert, 2012). Competence enhancing innovations are based on existing competencies, knowledge and skills, whereas competence destroying innovations build on new competences, knowledge and skills (Tushman and Anderson, 1986). Therefore, competence destroying innovations make existing knowledge and skills obsolete (Anderson and Tushman, 1990), which often favors entrants (Tushman and Anderson, 1986). However, if competence destroying innovations still target the existing customers and their needs, incumbents have better chances to survive than in case of disruptive innovations (Danneels, 2004).

Characteristics

In the literature, certain characteristics are usually linked to disruptive technologies and innovations. They can be smaller, lighter and more flexible, reliable and convenient than existing technologies (Kostoff *et al.*, 2004). Disruptive innovations and technologies are often described as simple, too (Walsh *et al.*, 2002; Kostoff *et al.*, 2004; Schmidt and Druehl, 2008). This refers especially to the technological characteristics, which might not be so radically different or difficult (Bower and Christensen, 1995). As remarked by Walsh and Linton, disruptive technologies can indeed be a combination of existing technologies, too (Kostoff *et al.*, 2004). Despite of being technologically simpler, Kostoff et al. (2004) argue that disruptive technologies can still be more efficient, for example, in terms of higher unit performance (e.g. higher computing power).

One widely discussed characteristics of disruptive innovations and technologies is price. Many scholars have claimed that disruptive innovations and technologies are cheaper than established ones (Adner, 2002; Walsh *et al.*, 2002; Kostoff *et al.*, 2004). Indeed, this is true many situations: smaller disk drives (disruptive technology) were less expensive than their earlier versions and low-cost airline companies (disruptive business model innovation) offer cheaper flights than traditional airlines do (Bower and Christensen, 1995; Markides, 2006).

However, disruptive innovations can also be more expensive than established products and services in the market (Govindarajan and Kopalle, 2006b; Schmidt and Druehl, 2008). For example, cell phones were initially offered with a higher price, because they introduced attributes (e.g. portability and convenience), which attracted segments clearly detached from old ones. They were sold to corporate executives and doctors, who differ relatively much from the segments of landlines (homes and offices) (Schmidt and Druehl, 2008; Govindarajan *et al.*, 2011). Schmidt and Druehl (2008) argue that when a disruptive

innovation is adapted by customers whose needs are significantly different from the mainstream market, price can be higher. Price has also emerged discussion when it comes to trajectory charts. In his study, Adner (2002) justified that customers' willingness to pay for performance beyond their actual demand is decreasing. This means that price becomes more relevant, when performance exceeds the requirements. That is why he suggests that price trajectories should be included to trajectory charts, too.

Another important observation related to disruptive innovations is the effect of different perspectives. Some companies can find some innovations disruptive, while others see them as rather sustaining (Christensen, 2001). Moreover, time matters: initially a disruptive innovation may not be very disruptive to incumbents, but later it drives them out of business (Schmidt and Druehl, 2008). It is also important to notice that a disruptive innovation has nothing to do with that who introduces it – even if incumbents are often linked to sustaining innovations and entrants to disruptive ones. For example, Apple's iPod is a sustaining innovation introduced by an entrant, and Intel's Celeron processor represents a disruptive innovation introduced by an incumbent (Schmidt and Druehl, 2008). Thus, Danneels (2004) criticizes that the typical characteristics should not be an evaluation criteria for identifying a disruptive innovation. As discussed in this chapter, disruptive innovations are not always the same: there are many exceptions linked to them and they can be categorized in different ways. More important than finding an unambiguous definition for disruptive innovations is to understand their value, effects and consequences.

2.1.2 Effects of disruptive innovations

Value from disruptive innovations

Understanding the effects of disruptive innovations is the first step towards being able to manage and respond to them. As the multi-sided nature of disruptive innovations already implies, these innovations can have many diverse effects on companies interacting with them. The key is to understand how disruptive innovations change the value structure of the market. However, before focusing on consequences of the market changes and reasons that affect to the success and failure of firms, one should understand the value related to the disruptive innovations alone. Understanding this value motivates and encourages companies to work with these innovations, too.

Disruptive innovations provide many benefits for companies. These innovations can help firms to grow by providing opportunities for entering into new or existing markets (Walsh *et al.*, 2002; Govindarajan and Kopalle, 2006b, 2006a). They also contribute to organizational learning more than sustaining innovations do, because disruptive innovations challenge firms to change their way of thinking and working (Walsh *et al.*, 2002). Furthermore, disruptive innovations promote the emergence of strategic flexibility and development of dynamic capabilities (Walsh *et al.*, 2002). Strategic flexibility refers to the firm's ability to respond and adapt to dynamic and discontinuous changes in the environment,

i.e. change the strategy if needed (Brown and Eisenhardt, 1995). Dynamic capabilities provide a firm the actual resources and knowledge needed to survive disruptions and create market change in various situations (Teece *et al.*, 1997; Eisenhardt and Martin, 2000). Finally, disruptive technologies can expand the firm's technological competencies and create new ones, too. These effects can help the firm to survive the change in customers' value emphasis. Thus, disruptive innovations also contribute to sustainable competitive advantage and help to gain a stable position in an instable market (Walsh *et al.*, 2002).

However, there are many challenges to overcome if companies want to gain the value related to disruptive innovations. That is why many firms rather ignore them, if possible. Generally, disruptive innovations include a high risk of failure because of customer resistance (Walsh *et al.*, 2002). This means that customers' value emphasis is not easy to change. Thus, there are many examples of firms, who have failed to develop and commercialize disruptive innovations or to survive disruptive change (Bower and Christensen, 1995; Danneels, 2004). However, often companies cannot simply ignore the disruption, and they are forced to respond at least somehow. That is why it is important to understand, which reasons and conditions contribute to both failure and success of firms, when they confront disruptive innovations. Thus, the following sections discuss these topics in detail from both incumbents' and entrants' perspectives.

Failure and success of incumbents

Especially the reasons behind incumbents' failure are widely discussed in the literature (e.g. Bower and Christensen, 1995; Adner, 2002; Walsh *et al.*, 2002; Danneels, 2004; Govindarajan and Kopalle, 2006b; Schmidt and Druehl, 2008). In this paper, the exact reasons leading to incumbents' failure have been divided into seven different categories: difficulties in recognizing disruptive innovations, difficulties in recognizing the threat, resource allocation problems, compatibility problems, customer- and market-related problems, technology-related problems and management-related problems.

First, disruptive innovations are hard to identify in the first place (Schmidt and Druehl, 2008), and some scholars argue that they cannot even be identified ex ante, i.e. before the disruption has occurred (Bower and Christensen, 1995; Danneels, 2004). Kirchhoff and Walsh stated in their book that many successful organizations have also failed, because they could not differ sustaining innovations from disruptive ones (Kostoff *et al.*, 2004). Because incumbents often tend to concentrate on their existing customers, they might become blind to notice new technologies in emerging markets (Bower and Christensen, 1995). Danneels (2004) argues that it is important to understand that incumbents' customers include both the existing and the potential ones.

Second, even if incumbents could recognize disruptive innovations, they often ignore the threat related to them. Because disruptive innovations do not always succeed, incumbents can be skeptical about the whole concept of disruptiveness (Danneels, 2004). According to Schmidt and Druehl (2008), disruptive innovations may initially have no effect on the

incumbent's sales, if they start to diffuse from detached markets. Even if some sales were impacted, this would be the low-end market with low margins. Because incumbents are often only interested in defending the sales of their high-end and more profitable customers (Schmidt and Druehl, 2008), they fail to recognize the threat.

Third, Christensen and Raynor (2003) highlight the problems related to resource allocation as one of the biggest reasons leading to failure of incumbents. Problems related to resource allocation are often due to ignoring the threat of disruptive innovations. Furthermore, development of these innovations often looks unattractive to incumbents, especially in financial terms (Bower and Christensen, 1995; Walsh *et al.*, 2002; Govindarajan and Kopalle, 2006b). Since there is a lot of technological uncertainty, the market does not exist or seems insignificant and revenues appear small, it is hard to justify the allocation of resources to the development of disruptive innovations (Bower and Christensen, 1995; Walsh *et al.*, 2002).

Hence, the rational decision is often to allocate resources to the development of sustaining innovations, which target the profitable markets. Listening too much to current customers and their needs, and holding to existing cost structures, steer resources towards the development of sustaining innovations (Bower and Christensen, 1995). It has been proven that emerging customer orientation has a positive, whereas mainstream customer orientation has a negative effect on the development of disruptive innovations (Govindarajan and Kopalle, 2006a). Nevertheless, it is important to understand that it takes time – many years compared to sustaining innovations – before disruptive innovations can yield to high profits (Walsh *et al.*, 2002).

Fourth, Christensen and Raynor (2003) argue that disruptive innovations might not fit to the existing values, processes and resources of firms. Bergek et al. (2013) see these compatibility problems the same: "incumbents are unwilling or unable to respond due to organizational, technological or strategic inertia and therefore allocate insufficient resources to response to the threat." Furthermore, disruptive innovations can cause internal conflicts between technologists and sales people because of contradictory views (Bower and Christensen, 1995). Technologists can be enthusiastic about these innovations, while marketing managers resist or refuse to sell and promote the products because of low margins (Walsh *et al.*, 2002). Fifth, one reason for incumbents' failure are problems linked to market and customer. Incumbents try to market the innovation for mainstream market (lack of marketing competence), or do not know, how to serve the new market segment (lack of customer competence) (Danneels, 2004). Furthermore, customer resistance in the market causes a high risk of failure, as marked before (Walsh *et al.*, 2002).

Sixth, firms confront challenges when building necessary resources (Danneels, 2006) and applying required technological competences (Bergek *et al.*, 2013). Often the challenge for incumbents is to simultaneously maintain and develop their knowledge regarding existing technologies, acquire new knowledge and integrate new technologies into complex

settings with existing technologies. For example, electric car manufacturers have confronted these problems (Bergek *et al.*, 2013). Finally, management-related problems might cause incumbents to fail, too. Managers are stuck to their habits (Bower and Christensen, 1995) and they favor low-risk options with short term payoffs in order to meet the profitability targets and to assure their own position (Kostoff *et al.*, 2004). Bureaucracy, arrogance, tired executive blood, poor planning and short-term investment horizons can lead to failures, too (Bower and Christensen, 1995).

Even if many incumbents fail due to various reasons, there are still some stories of successful incumbents. For example, Charles Schwab in online brokerage and Fuji in photography represent incumbents that survived disruption (Danneels, 2004). In order to succeed, knowledge of own organization, capabilities and resources is important. According to Helfat and Lieberman (2002), resource profile and gaps define, how successfully firms will enter a new market. If the incumbent knows in detail what resources it lacks, it can fill those gaps by licensing or by participating in joint ventures and alliances (Danneels, 2004). It often has resources to acquire innovative start-ups, too (Walsh *et al.*, 2002). Furthermore, incumbents' existing capabilities often enable them to develop solutions faster and more efficiently than entrants. For example, this has helped incumbents to survive in the electric car industry (Bergek *et al.*, 2013).

Internal factors can contribute to incumbents' success, too. Danneels (2004) suggests that managers' capabilities might help incumbents to survive. If the incumbent makes long-term oriented incentive plans and its organizational culture values entrepreneurship, risk taking, flexibility and creativity, it is in a better position to develop disruptive innovations. The incumbent's willingness to cannibalize some of its existing product sales also contributes to the development of disruptive innovations (Govindarajan *et al.*, 2011). Furthermore, if the incumbent is good at sensing, understanding and integrating technologies, it has good opportunities to develop disruptive innovations (Govindarajan and Kopalle, 2006b). Previous experience of disruptive innovations might also help to develop these capabilities and in general, increase the rate of survival. However, one should notice that only internal experience can contribute to survival: for example, when it comes to disk drives, many incumbents failed, even if they had external experience, i.e. they had seen their precursors failing (Bower and Christensen, 1995).

Moreover, external and national factors can help incumbents to succeed. Afuah (2000) highlights the importance of value networks and ecosystems: a strong network of cooperating suppliers, complementors and customers might help a company facing disruption to survive. National factors, such as mobility of qualified and experienced employees, venture capital actions, exclusivity of relationships (moral or contractual) and the region's government industry policy, can contribute to success, too (Danneels, 2004). For example, Japanese disk drive manufacturers most likely survived the disruption that caused incumbents to fail in USA because of more favorable regional environment (Chesbrough, 1999).

In order to conclude this topic, it is important to discuss the changes in incumbents' value structure due to disruptive innovations. The change in customer value emphasis from old to new attributes requires the incumbent to reposition itself in the market: it has to redefine its objectives, think new ways to approach the industry and execute internal changes. Recognizing and understanding the matters discussed above help the incumbent to implement these changes successfully. These reasons related to failure and success also help the incumbent to adjust its operations and be better prepared facing disruptive innovations – even if there were no immediate threat of disruption in the market. Furthermore, it is important to understand the effects of the external environment on developing and surviving disruptive innovations. If the incumbent notices that its external environment does not protect it against disruptive changes, it can strengthen its internal capabilities and vice versa.

Failure and success of entrants

In the literature, the failure of entrants have been studied much less than the failure of incumbents. However, three reasons can be identified, and they are strongly linked to the external environment of the entrant. First, if an innovation simply fails to satisfy the performance demands of the mainstream market, the innovation will remain in the niche market. For example, despite of some superior attributes, electric cars are still too inferior to disrupt the market of personal vehicles (Bergek *et al.*, 2013). They lack too much behind in range and flexibility, which are the attributes currently valued by the mainstream market (Bergek *et al.*, 2013).

Second, if the existing innovations are not overshooting in performance, existing customers do not see the need to change their preferences to new attributes (Bergek *et al.*, 2013). As Danneels (2004) argues, car performance is evaluated against several attributes. Thus, entrants should be able to be superior in a couple of new attributes but still provide satisfactory performance in all other attributes, which is a big challenge at least for smaller firms (Bergek *et al.*, 2013). Thus, this makes it hard for entrants to enter the mainstream market. Third, established infrastructures and institutional frameworks can even be a bigger challenge for entrants than the change of performance attributes (Bergek *et al.*, 2013). Whereas in Japan the national and external factors helped established disk drive manufacturers to survive (Chesbrough, 1999), electric cars have faced difficulties because of the lack of charging stations, regulatory issues and customers' resistance to change their driving patterns (Bergek *et al.*, 2013).

However, success stories of entrants imply that they have some advantages in commercializing disruptive innovations compared to incumbents. First, they have faster time to market, and they can focus on one technology or product at a time while having relatively low operating costs (Walsh *et al.*, 2002). Walsh et al. (2002) argue that the time to market for entrants is four times faster than for incumbents. Second, flexibility in strategies gives an advantage for entrants (Walsh *et al.*, 2002) – it is often hard for incumbents to change

strategies (Rosenbloom and Christensen, 1994). Furthermore, entrants do not have strong core competences or an established customer base (Bower and Christensen, 1995; Walsh *et al.*, 2002). Thus, they are free to select technologies and markets, spot wider opportunities and detect broader threats (Walsh *et al.*, 2002; Govindarajan *et al.*, 2011).

Finally, entrants' nature and position might make them successful, too. Entrants have nothing to lose and they can put all their efforts to the innovations they are developing (Danneels, 2004). Even if disruptive innovations can cause internal conflicts, it is suggested that entrants can handle these better than incumbents (Almus and Nerlinger, 1999). Generally, entrants are usually better in commercializing disruptive innovations than incumbents (Bower and Christensen, 1995; Walsh *et al.*, 2002).

In order to summarize this topic, one should also discuss the changes in entrants' value structure due to disruptive innovations. Disruptive innovations provide a true possibility for entrants to grow and become a successful individual company in the market. At first, entrants are strongly dependent on other actors, when developing new innovations. Thus, they need long-term financing in order to be able to commercialize these innovations. They also need time to develop capabilities and acquire resources before they are internally strong enough to present innovations to the market or to present themselves as noteworthy companies to be acquired or merged. Furthermore, entrants should observe their external environment in order to spot the favorable conditions for commercializing disruptive innovations. However, it is not enough to understand the effects of disruptive innovations. One needs to be able to manage their value in order to truly benefit from them.

2.1.3 Managing value of disruptive innovations

Recognizing disruptive innovations

The first step on the way to manage disruptive innovations is the ability to recognize them. Because of the lack of an unambiguous definition, numerous but sometimes contradictory characteristics (e.g. price) and the dynamic nature of disruptive innovations, it is not easy to recognize and differ them from other inferior innovations. Even if many scholars have claimed that disruptive innovations can only be recognized ex post, i.e. after the disruption has happened (Bower and Christensen, 1995; Walsh *et al.*, 2002; Danneels, 2004), there are frameworks, which can help to recognize disruptive innovations ex ante, too.

Schmidt and Druehl (2008) introduce a three-step-framework for identifying possible disruptive innovations, which is based on the exact assessment of markets and products. The first step is to identify current and possible new market segments and primary attributes of the existing product. One should order current market segments from high to low-end and think of new primary attributes, which might displace the old ones. The second step

is to assess current and new market segments' willingness to pay for both the current and new key attributes. Finally, one should sketch all possible products with a different combination of attributes and assess, which segments will buy a given product over time. In addition to helping in recognition, this framework gives information about the nature of possible disruptive innovations and their markets. Bower and Christensen (1995) emphasize the importance of this information before responding to disruptive innovations, too.

Furthermore, Keller and Hüsig (2009) suggest a combination of trajectory charts and criteria sheets to identify especially disruptive technologies. They add price trajectories to the chart of performance trajectories and use criteria sheets to evaluate, for example, entrants' and incumbents' resources and networks. Thus, in addition to technology and demand, they take into consideration internal and external factors. This might yield to better outcomes, since internal conflicts between technologists and marketing managers can reveal disruptive technologies, too (Bower and Christensen, 1995). Furthermore, Danneels (2004) suggests that technology forecast methods could be tailored to recognize especially disruptive technologies. Using lead users (Danneels, 2004) or combining literature analysis to workshops and to technology roadmap techniques (Kostoff *et al.*, 2004) might yield to positive outcomes.

Sometimes one does not even have to recognize disruptive innovations, but identifying suitable market conditions for them is enough. Adner (2002) highlights the importance of price in identifying market conditions for disruption. If customers' requirements have been exceeded, they are more willing to accept an offering with a worse performance, if its price is sufficiently low. In addition to this situation, a disruption is more likely to happen, if there are high preference overlap and asymmetric segment preferences. Preference overlap measures, how desirable another segment finds an offering, which is highly valued in its original segment. Preference symmetry measures, how symmetrically these preferences have been divided in different segments. (Adner, 2002) Thus, if firm A has a lot of potential customers in segment B, but firm B rarely has customers in segment A (high and asymmetric preference overlap), firm A has a better opportunity to disrupt market segment B. Hence, firm B should be aware of innovations coming from firm A.

Strategies for disruptive innovations

Without being able to recognize disruptive innovations and to understand the factors contributing to firms' success and failure, neither incumbents nor entrants have a possibility to succeed. Succeeding requires that a firm has selected the right strategy to the right situation and exploits this strategy efficiently. This section introduces strategies that entrants and incumbents can utilize when commercializing and responding to disruptive innovations (Figure 4). Because response strategies vary between different types of disruptive innovations, these types have been taken into consideration in this section.

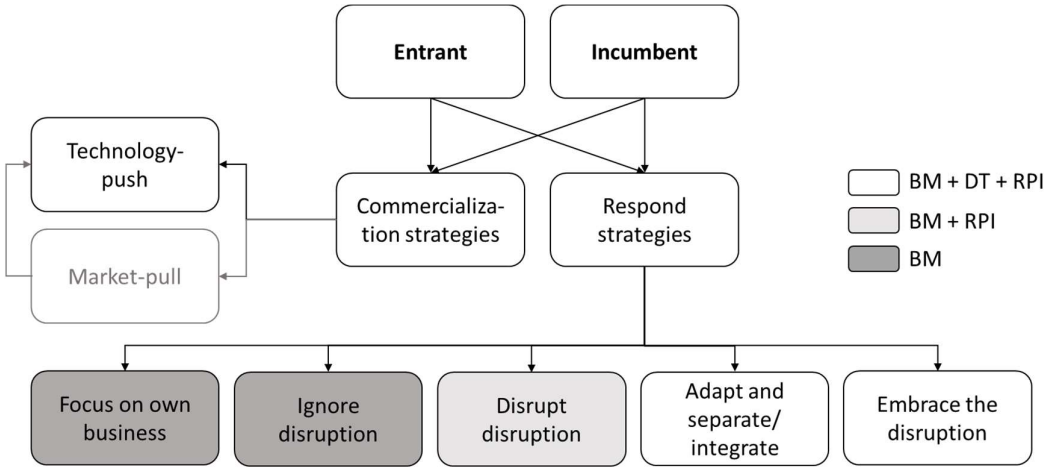

Figure 4. *Commercialization and respond strategies for disruptive innovations*

The two strategies entrants and incumbents can choose for commercializing disruptive innovations are technology-push and market-pull. Technology-push strategy means that a company introduces a product, because the company itself is convinced of its technology. Market-pull strategy means that a company introduces a product, because its customers have demanded it. Because technology-push strategy is often linked to disruptive innovations, market-pull strategy is not highlighted in Figure 4. However, firms can utilize this strategy, too. For entrants, technology-push strategy is argued to be risky and expensive with high rates of failure (Carroad and Carroad, 1982). Because incumbents have more resources at their disposal, they might be better at commercializing technology-push. For entrants, a market-pull strategy, where they target incumbents' customer base, is a low-risk and low-cost possibility to get customers and revenue to launch a full technology-push strategy later (Walsh *et al.*, 2002). In case of incumbents, a pure market-pull strategy often leads to sustaining innovations (Walsh *et al.*, 2002).

When it comes to respond strategies, there are more options for incumbents and entrants. Charitou and Markides (2003) suggest five different strategies to respond for disruptive business model innovations. Because these innovations usually do not fully displace the old ways of doing business (Markides, 2006), the first strategy is to focus on the traditional business and to make it more attractive (Charitou and Markides, 2003). For example, Gillette did this successfully. The second strategy is simply to ignore the new innovation (Charitou and Markides, 2003). However, this can only be successful, if the disruption is happening in a totally different industry. Otherwise, this strategy easily leads to failure, as suggested by Schmidt and Druehl (2008). When it comes to disruptive technologies and radical product innovations, neither of these strategies would be suitable, because disruptive technologies and products can often totally displace the old ones (Adner, 2002).

The incumbent can also try to disrupt the disruption as a third strategy (Charitou and Markides, 2003). Charitou and Markides (2003) present an example about the watchmaker Swiss, which highlighted the quality of movement and accuracy in its products. Seiko tried to disrupt the market with a product emphasizing price and performance, but Swiss responded by introducing Swatch, which highlighted style. Swatch disrupted the disruption and later became one of Swiss' most successful products. This strategy might also work in case of radical product innovations: when the dominant design has not yet emerged, there is usually many companies in the market and firms have an opportunity to counterattack, too (Markides, 2006). However, when it comes to disruptive technologies, it might be too hard to first recognize the threat and then be able to develop another disruptive technology in a very short time.

On the other hand, if the incumbent decides to adopt the disruptive business model innovation, it can do it by playing both games at once (Charitou and Markides, 2003), i.e. by emphasizing ambidexterity. Popular way of utilizing this fourth strategy is a separate unit. Also, an integrated approach works, if the existing and new market share some similarities (Markides and Charitou, 2004). The separate unit is the most successful, if it has its own decision-making autonomy and budget, investment policies, procedures, culture and values (Markides and Charitou, 2004).

In case of disruptive technologies, Bower and Christensen (1995) recommend to build a separate and independent unit, too. However, Danneels (2004) argues that resource complementarities between incumbent and the spin-off favor an integrated approach. Christensen (2000) has later specified that a spin-off is only required, if it needs a different cost structure and cannot meet the growth targets of the main organization. Furthermore, Bower and Christensen (1995) argue that one separated, the spin-off should be kept independent or it fails. They say integration would rise problems regarding resource allocation and cannibalization. Even if this can happen, Danneels (2004) argues that an integration back to the main organization can be successful, too. Thus, both separation and integration are noteworthy strategies, and should also be considered in case of radical product innovations, because these innovations have many similarities to disruptive technologies.

The last strategy is to embrace the innovation completely, scale it up and abandon the existing way of doing business, as Charles Schwab did successfully in online brokerage (Charitou and Markides, 2003). However, not the same company has to be both the innovator and the one who scales up the business. Especially in case of radical product innovations, Markides (2006) suggests that acquiring an innovative start-up might be a successful strategy. In case of disruptive technologies, incumbents are often forced to abandon their existing technologies, too. Often they just realize this too late and fail (Bower and Christensen, 1995).

In order to select the most suitable strategy, a company has to consider its motivation and ability to respond. Motivation to respond depends on how important the company finds

the new business, whereas ability to respond refers to the company's competences and ability to counterattack (Charitou and Markides, 2003). Chapter 2.1.2 defined the value of disruptive innovations and the reasons, why firms fail or success, when confronting these innovations. The Chapter also mentioned factors for motivation and ability to respond. The following figure places the strategies into a matrix, which helps to select the most suitable strategy for a specific firm.

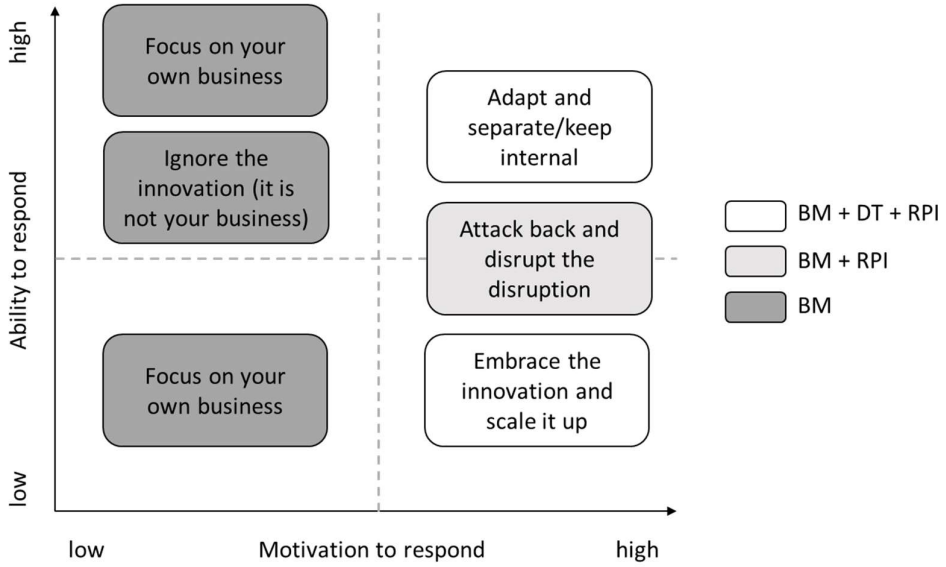

Figure 5. *Respond strategies for disruptive innovations (modified from Charitou and Markides 2003)*

A company should recognize the type of the disruptive innovation and carefully assess its potential and effects before selecting a strategy. If its motivation towards the innovation still stays low after the assessment, the company can ignore the innovation and focus on its own business, no matter what its ability to respond is. However, if the motivation to respond is higher, i.e. the company recognizes and appraises the threat, it has to respond somehow. If the ability to respond is high, the company can adapt the innovation and keep it internal or external depending on the similarities in the needed resources. If the ability to respond is low, the company is suggested to fully embrace the innovation, since it does not have capabilities to integrate the new innovation into the existing business. If the ability to respond is moderate, the company can also try to attack back and disrupt the disruption.

2.2 Business and innovation ecosystems

This chapter introduces the topic of business and innovation ecosystems. First, it defines the concept and discusses its actors and structures. Second, the chapter discusses the purpose of ecosystems by presenting the benefits, challenges and success factors linked to

these networks. Finally, the chapter concludes by discussing the management side of ecosystems: it describes the ecosystem roles as strategies, presents the lifecycle of these networks and combines this to the discussion about building and managing these systems. Furthermore, especially the aspect of value is considered, when it comes to the management of these systems.

2.2.1 Defining ecosystems

Definitions and characteristics

As the business perspective expanded from firm centric to a wider environment of relationships, the term ecosystem gained more attention. The concept of ecosystem comes from ecology (Moore, 1993; Iansiti and Levien, 2004), and can be defined as loose networks of co-evolving independent and interconnected actors, which work cooperatively and competitively to create value (Moore, 1993; Eisenhardt and Galunic, 2000; Iansiti and Levien, 2004; Adner and Kapoor, 2010). In addition to the focal firm itself, these socio-economical systems consist e.g. of customers, suppliers, distributors, universities, regulatory authorities and financial institutes (Moore, 1993; Iansiti and Levien, 2004; Dedehayir *et al.*, 2016). For example, Apple's and IMB's ecosystems are formed around these focal firms, but Silicon Valley and a specific healthcare sector form their own ecosystems, too (Adner, 2017).

As Moore (1993) first introduced the term ecosystem, he spoke about business ecosystems. Later, the term innovation ecosystem has also gained a lot of attention (Ritala *et al.*, 2013). It is hard to tell the exact difference between these terms, but the definitions of innovation ecosystems highlight value creation especially through technology development and innovation activities (Ritala *et al.*, 2013; Oh *et al.*, 2016). However, value creation, which is a common goal for all ecosystems, stems from innovation activities (Adner and Kapoor, 2010). Wright (2014) explains that business ecosystems highlight customer side, which innovation ecosystems also recognize but do not emphasize. Indeed, innovation ecosystems often emphasize the role of research economy together with the commercial economy (Oh *et al.*, 2016), whereas definitions of business ecosystems tend to focus on the commercial purposes. This study focuses especially on business ecosystems, because the customer perspective is an essential part of the empirical study.

Adner (2017) suggests the following: "The ecosystem is defined by the alignment structure of the multilateral set of partners that need to interact in order for a focal value proposition to materialize." This definition includes many of the typical characteristics related to ecosystems. First, alignment structure means that members of the ecosystem have certain roles (e.g. leader and follower), which are mutually agreed (Adner, 2017). However, it is important to notice that even if ecosystems are designed and engineered systems, they adapt and evolve over time (Iansiti and Levien, 2004; Weber and Hine, 2015; Oh *et al.*, 2016; Pellikka and Ali-Vehmas, 2016). Thus, the roles of different actors can change

(Dedehayir *et al.*, 2016). Furthermore, the percentage of different roles occupied varies over the ecosystem's lifecycle (Markham *et al.*, 2010).

Second, multilateral in the definition refers both to the multiplicity of partners and to the relationships, which are not decomposable into multiple bilateral relationships (Adner, 2017). Thus, ecosystems are more than the sum of their parts (Weber and Hine, 2015). This differs ecosystems from groups of connected firms and more traditional value chains. Because of this structure, value creation in an ecosystem is not a linear process (Iansiti and Levien, 2004): members of the ecosystem create value in a network of many horizontal relationships, which can be situated in many different layers, too (Ritala and Almpanopoulou, 2017). Thus, the ecosystem creates and delivers value to customers rather as an interrelated entity of independent companies than as individual companies (Clarysse *et al.*, 2014).

Third, the set of partners highlights that the membership is defined in a way that value propositions depends on the actor's participation, whether the actor have direct links to the focal firm or not (Adner, 2017). According Adner (2017), even if different actors have value creation as a common goal, they might have different end states and firm-specific goals in mind, and different plans for the composition of the ecosystem. Furthermore, he argues that same sets of actors structured in different configurations around different value propositions constitute two different ecosystems. Moreover, two ecosystems consisting of similar firms producing the same product with same processes are neither the same (Weber and Hine, 2015). Weber and Hine (2015) and Dedehayir et al. (2016) also highlight that firms can exist in many different ecosystems at the same time: for example, Adobe has a central role in its own ecosystem but a smaller one in Microsoft's ecosystem.

Fourth, for a focal value proposition to materialize means that the key task in the ecosystem is to contribute to the value proposition and deliver all the needed activities in order for the proposition to materialize (Adner, 2017). It is important to notice that eventually, each member of the ecosystem shares the fate of the network regardless of the member's internal capabilities and strengths (Iansiti and Levien, 2004). However, as the definition and characteristics of ecosystems imply, there is no consensus on the definition, scope, boundaries and theoretical background of business and innovation ecosystems (Li, 2009; Satsangi, 2012; Oh *et al.*, 2016; Ritala and Almpanopoulou, 2017). Because of this, a more detailed information about actors and structures can enhance the understanding of ecosystems.

Actors and structures

Ecosystem actors have different roles, which are defined by their behaviors and activities. Because ecosystems usually lack formal organizational structures, these roles emerge rather naturally than through contracts (Dedehayir *et al.*, 2016). The key roles include leaders, followers and supporting actors. Ecosystems are usually dominated by one or more leaders, also referred as keystones (Iansiti and Levien, 2004) and focal firms (Adner and

Kapoor, 2010). These actors ensure the health of the ecosystem by designing and guiding it towards common objectives, providing resources and infrastructures, connecting actors, and ensuring value creation (Moore, 1993; Iansiti and Levien, 2004; Clarysse *et al.*, 2014; Dedehayir *et al.*, 2016; Adner, 2017). Thus, without the leader the ecosystem will collapse (Moore, 1993; Iansiti and Levien, 2004).

Successful leadership can only be achieved though willingness to follow (Adner, 2017). Followers, also referred as niches, are highly differentiated players with specialized capabilities (Iansiti and Levien, 2004). They deliver, assemble and use components, complementaries, products and services (Dedehayir *et al.*, 2016), but often depend on other members in the ecosystem (Iansiti and Levien, 2004). An ecosystem can also include dominators (Iansiti and Levien, 2004). Their actions are guided more by self-interest than common goals: either they try to control the whole system or gain all value without contributing to its creation. Thus, they damage the ecosystem health.

Lastly, ecosystems also include a wide array of different supporting actors. Even if they do not directly participate in producing an offering, they have an important role in supporting activities (Dedehayir *et al.*, 2016). For example, research institutes, system integrators, advertisers, financers, regulatory authorities, policy makers (Moore, 1993; Iansiti and Levien, 2004; Dedehayir *et al.*, 2016), and non-profit-organizations (e.g. Mozilla) (Hurley, 2009) represent these supporting actors. Figure 6 illustrates one possible configuration of an ecosystem.

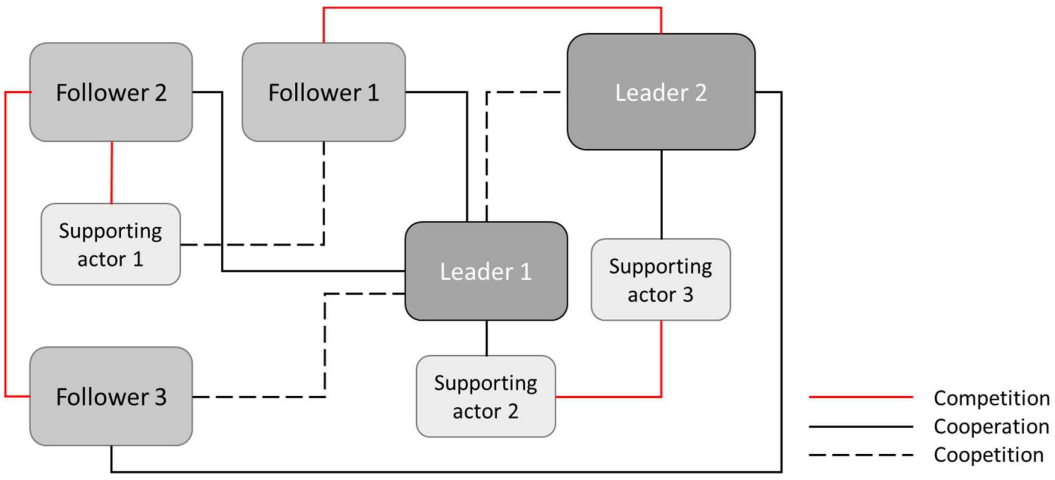

Figure 6. *Ecosystem's actors and relationships*

Furthermore, ecosystems members can also be categorized into developers and users regarding whether they are responsible for and contribute to the development of products and services, or the ones only using them. Users often define the problem or need, which developers try to fix or fulfill (Dedehayir *et al.*, 2016). Thus, both leaders, followers and

supporting actors can either be developers or users and vice versa. This section only provided a short description of different roles in ecosystems, but their effects on value related activities are further discussed in Chapters 2.2.3, 2.3.2 and 2.3.3.

When it comes to ecosystems, one should consider platforms (Cusumano and Gawer, 2002), even if not every ecosystem has one (Dedehayir *et al.*, 2016). Platforms are technical premises that connect providers of products and services together with users of these products and services (Autio and Thomas, 2014; Gawer and Cusumano, 2014). Furthermore, they provide a foundation upon which ecosystems can function and develop new innovations (Gawer and Cusumano, 2014; Dedehayir *et al.*, 2016). For example, Apple's platform connects individual consumers to value creating organizations, whereas Airbnb's platform connects individuals to one another, since they share the roles of providers and consumers (Dedehayir *et al.*, 2016).

After identifying the parts constituting ecosystems, it is important to focus on their interactions. The relationships between ecosystem members can either be cooperative, competitive or coopetitive (Moore, 1993; Afuah, 2000; Smith, 2013), as described in Figure 6. Coopetition refers to the simultaneous competition and cooperation strongly present in ecosystem structures (Gnyawali and Park, 2011). These relationships are either direct or indirect linkages between the actors (Adner and Kapoor, 2010) but they are not always governed with contracts (Poppo and Zenger, 2002; Dedehayir *et al.*, 2016). According to Adner (2017), ecosystem relationships should be studied from two different perspectives: within the ecosystem and across ecosystems. He says that even if these levels are distinct, they interact, too.

However, even if actors and their relationships are known, it is difficult and sometimes even impossible to define the boundaries of ecosystems (Iansiti and Levien, 2004). According to Broechler and de Voigt, these systems are often global (Oh *et al.*, 2016), and their boundaries transcend a single industry (Mäkinen and Dedehayir, 2012). Examples of these kinds of ecosystems are the mobile phone ecosystem (Basole, 2009), the internet ecosystem (Zacharakis *et al.*, 2003; Nehf, 2007), Amazon's web service ecosystem (Isckia, 2009) and Google's ecosystem (Iyer and Davenport, 2008). For example, mobile phone ecosystem has spanned into industries like internet, gaming, media, photography and fitness (Weber and Hine, 2015). Thus, both Adner (2017) and Dedehayir et al. (2016) argue that ecosystem boundaries have nothing to do with firm levels, sectors or regions. They suggest that all the parties that contribute to materializing value proposition should be included in an ecosystem. Even if the ecosystem formed around Apple is called Apple's ecosystem, that does not mean that it is only limited to that one key company, and its direct suppliers and customers.

2.2.2 Purpose of ecosystems

Benefits of ecosystems

The popularity of the ecosystem concept implies that there are benefits in doing business in this kind of a formation. First, ecosystems enable the sharing of skills, resources and information easily (Harper and Georghiou, 2005; Zahra and Nambisan, 2012). Thus, members of the ecosystem can access resources and technologies that would not otherwise have been available for them (Chiaroni *et al.*, 2008). They can also access these resources faster than developing them in-house (Harper and Georghiou, 2005). Furthermore, getting the resources does not require big investments. Hence, this makes members of the ecosystem more flexible, because they are not tied to certain resources that might quickly become obsolete in a rapidly changing environment (Zahra and Nambisan, 2012; Pellikka and Ali-Vehmas, 2016). This can result in a shorter time to market.

Second, ecosystems can enhance and provide many opportunities for learning (Lawton-Smith, 2004). In addition to new resources, technologies, skills and information, cooperation and competition contribute to learning and help firms to expand their competences (Allocca and Kessler, 2006). Third, both resources and learning lead to improved capabilities for creating and developing new innovations (Chiaroni *et al.*, 2008; Pellikka and Ali-Vehmas, 2016). Innovations are again an important factor in facilitating the growth of the company (Christensen *et al.*, 2002). Fourth, ecosystems enable and improve risk sharing, too. Close cooperation in an ecosystem and information about other members secures compatibility of different products and reduces market uncertainties (Pellikka and Ali-Vehmas, 2016). Furthermore, cooperation can also improve the predictability of the market and provide early signals of significant technological or business model changes (Pellikka and Ali-Vehmas, 2016). Lastly, being part of an ecosystem can provide access to new markets, too (Chiaroni *et al.*, 2008; Pellikka and Ali-Vehmas, 2016). This can happen through new collaboration partners or licensing (Chiaroni *et al.*, 2008).

All in all, every benefit of ecosystems mentioned above contributes to competitive advantage for companies. According to Iansiti and Levien (2004), this advantage is especially visible in comparison to isolated companies. Furthermore, Adner (2006) argues that ecosystems enable firms to create value that no single firm could have created alone. However, he highlights that this is only possible, if ecosystems work. Thus, there are some challenges and risks related to these systems as well.

Challenges of ecosystems

According to Adner (2006), it is easy to overestimate the benefits of ecosystems, because many different players are combining capabilities. At the same time, it is easy to underestimate the problems, because they often seem to be someone else's responsibility (Adner, 2006). Thus, he suggests that business ecosystems include three different types

of risks: initiative, interdependence and integration risks. This section utilizes these categories to illustrate different risks of ecosystems identified in the literature.

First, initiative risks refer to the uncertainties related to the success of the offering, customer satisfaction, appropriate partners and the quality of the project team (Adner, 2006). Sometimes technical difficulties related to innovations and products might cause ecosystems to fail (Adner, 2006; Ritala *et al.*, 2013). Management related challenges can be included to initiative risks, too. Companies might fail, if they try to plan out the whole ecosystem, select their position and stick to it no matter what (Adner, 2006). Because ecosystems evolve, actors should be able to react to these changes in a flexible manner. Managers tend to focus on internal issues at the expense of external ones, too (Adner and Kapoor, 2010). This causes problems, because companies operating in an ecosystem are required to perceive the whole network. Furthermore, if no one in the ecosystem is ready to take the lead and the system is left without a leader, ecosystems often fail, too (Iansiti and Levien, 2004; Adner, 2017). The actor in the ecosystem can manage these initiative risks internally or give them to external partners. However, it depends on the situation, which is the best way to act (Adner, 2006).

The second category entails interdependence risks, i.e. uncertainties of coordinating with other innovators (Adner, 2006, 2017). Failure is often linked to delays, which again impede value creation, delivery and capture. Adner (2006) suggests an example: Four parties are participating in delivering a product and every of them has a 90 % chance to stay in schedule. Thus, the probability for the end product to be delivered on time is only $0{,}9^4 \approx$ 66 %. Furthermore, if the performance of one of the parties suddenly drops to 20 %, the overall probability drops to 15 % ($0{,}9^3$*0,2 ≈ 15 %). This illustrates the importance of individual ecosystem members and their health. Behavior-related challenges are included to interdependence risks, too. Actors in the ecosystem can have different expectations about roles and structures, and they can have contradictory goals (Ritala *et al.*, 2013; Adner, 2017). Sometimes actors might even be more interested in their own success than the survival of the ecosystem. Hence, the threat of dominators is always present (Iansiti and Levien, 2004). Moreover, since some actors can operate in two different ecosystems, the challenges related to this system of systems have to be managed, too (Pellikka and Ali-Vehmas, 2016).

Adner and Kapoor (2010) argue that innovation challenges do not only depend on their magnitude but location, too. They represent two kinds of external challenges, both included to interdependence risks. Supplier-related challenges affect the components (e.g. processors for computers) that are part of the complete product (Adner and Kapoor, 2010). If there are problems with components, the delivery of the product for customers will be delayed. Complementor-related challenges create a situation, where a firm can offer a complete product to its customers but they cannot utilize it, because the environment is incomplete (Adner, 2006; Adner and Kapoor, 2010). For example, the lack of charging stations makes it difficult to use electric cars outside of cities.

Lastly, integration risks refer to the uncertainties linked to the adoption process among the members of the ecosystem (Adner, 2006, 2017). When the number of intermediaries increases, the uncertainty related to market success increases, too. Adner (2006) argues that if the intermediaries do not find that the benefits of the product exceed its costs, they will not promote the product further. For example, in order for the new Michelin tires to reach the customers, garages need to buy new equipment and dealers have to attend trainings. If garages do not want to do this, it is difficult for customers to utilize the innovation. Thus, the ecosystem has the power to impede the innovation, too. Sometimes ecosystem partners can also face difficulties, when coordinating innovations across the system (Adner, 2006). This might cause delays in commercializing and adopting. Furthermore, cultural and geographical distances can make the integration difficult (Ritala *et al.*, 2013).

Success factors of ecosystems

The next step is to ensure that the benefits of ecosystems will be realized and the risks avoided. Therefore, this section lists different success factors related to ecosystems. First, many of the success factors are linked to the actors of the ecosystem. According to Adner (2017), it is important that all actors are satisfied with their positions within the ecosystem. This does not mean that the positions could not change over time, but in general, satisfaction contributes to successful ecosystem and motivated actors. Pellikka and Ali-Vehmas (2016) also highlight the satisfaction of actors, when it comes to resource allocation and shared capabilities. Especially, it is important that there are shared vision and common goals in the ecosystem and they are known by the actors (Pellikka and Ali-Vehmas, 2016). This leads to alignment in goal setting and contributes to innovation. However, it is also important that this shared vision is in the right balance with self-interests of actors (Adner, 2006).

Creating the shared vision is often on the leader's responsibility (Ritala *et al.*, 2013), but this actor overall has a crucial role for the success of ecosystems (Moore, 1993; Iansiti and Levien, 2004; Clarysse *et al.*, 2014). In addition to leader's vital resources and activities (Moore, 1993; Pellinen *et al.*, 2012; Ritala *et al.*, 2012), it is also important that the leader can create and provide a platform, which makes it possible for other actors to enhance their performance (Iansiti and Levien, 2004; Weber and Hine, 2015). The role of other actors has been highlighted in the literature, too. Researches, entrepreneurs, supportive financial network and regulatory environment, and innovative start-ups are crucial for the success (Clarysse *et al.*, 2014; Oh *et al.*, 2016). However, the ecosystem has to monitor that none of these actors develops into dominators, which are harmful for the ecosystem's health (Iansiti and Levien, 2004; Clarysse *et al.*, 2014). Furthermore, the diversity and the sufficient number of actors are key factors for success, too (Pellinen *et al.*, 2012; Clarysse *et al.*, 2014). However, in order for the ecosystem to be healthy, every actor in it has to be healthy, too (Iansiti and Levien, 2004).

Second, relationships between these actors are also key issues in ensuring the success of the ecosystem. Trust is seen as an important, or even as the most important factor for ecosystem health (Blomqvist and Levy, 2006; Ritala *et al.*, 2013). Since some relationships in ecosystems are not governed with contracts (Poppo and Zenger, 2002), trust can be seen as a complementary governance mechanism (Zaheer and Venkatraman, 1995; Blomqvist *et al.*, 2005). Long-term relationships, which provide benefits for all actors, contribute to the success, too (Fransman, 2007; Ritala *et al.*, 2013). These relationships should also be buffered against external changes (Iansiti and Levien, 2004). Furthermore, external competition can make the ecosystem internally more coherent and motivate actors to invest in the system (Pellikka and Ali-Vehmas, 2016). This contributes to innovations, capabilities and the ecosystem's health.

Third, the knowledge and understanding about the ecosystem and its monitoring are widely recognized to be one of the most important success factors (Adner, 2006; Möller and Rajala, 2007; Basole, 2009). Firms in the ecosystems should be able to recognize other actors, especially the ones, with which they interact, the nature of relationships and their own position in the network (Möller and Rajala, 2007; Basole, 2009). Thus, firms should monitor the ecosystem, its actors and their capabilities in order to detect threats and opportunities, and ensure the health of the network (Weber and Hine, 2015). For example, if there are a lot of delays, a firm can find new partners in the ecosystem or design a product with flexible interface (Adner, 2006). Iansiti and Levien (2004) suggest that the health can be measured with productivity (ecosystem's ability to product innovations), robustness (ecosystem's ability to survive disruptions) and niche creation (ecosystem's ability to increase diversity and create new niches).

Fourth, management capabilities and strategy are also vital for ecosystems to succeed (Adner, 2006; Pellikka and Ali-Vehmas, 2016). If managers can assess ecosystem risks and benefits systematically and continuously, they can create more reliable predictions and select the most suitable strategies (Adner, 2006). Strategy is the key for realizing benefits and avoiding threats, and it ensures that the other success factors are present in the ecosystem construction. That is why the next Chapter 2.2.3 takes a closer look to different strategies in ecosystems.

2.2.3 Managing value in ecosystems

Roles as strategies in ecosystems

According to Adner (2017), ecosystem strategy considers ecosystem structure, roles and risks. As traditional strategy responds to competition between firms and aims for competitive advantage, ecosystem strategy responds to competition between ecosystems and aims for partner alignment, i.e. having the right partners in the right positions. Partners can either have consistent or contradictory ecosystem strategies, i.e. they have different

views of structures and roles (Adner, 2017). Creating a strategy in an ecosystem is iterative because of interconnected players and complexity of the network (Adner, 2006). Furthermore, the strategy has to be flexible, because ecosystems evolve and change over time (Iansiti and Levien, 2004). In their study, Iansiti and Levien (2004) present that ecosystem strategies can be categorized according to actors' roles, which can be central or peripheral. However, Burt emphasizes that it the role itself does not lead to benefits, but it is crucial how the firm exploits it (Dhanaraj and Parkhe, 2006). These roles were introduced already in Chapter 2.2.1, but here they are discussed considering the strategy and value perspectives.

First, the firm can select to apply the role of a leader. Leaders have four important responsibilities in ecosystems regarding governance, partnerships, platforms and value (Dedehayir *et al.*, 2016). Governance includes designing the ecosystem, coordinating the relationships between actors, sharing resources and orchestrating resource flows between actors. Leaders manage partnerships by attracting actors to join, bringing them together, keeping them satisfied, and creating a common objective for the ecosystem. Leaders also provide a platform, and manage the compatibility of this platform and other technologies in the ecosystem (Iansiti and Levien, 2004; Dedehayir *et al.*, 2016). However, the most important task for the leaders is value management: they contribute to value creation and ensure value delivery across the ecosystem (Iansiti and Levien, 2004; Clarysse *et al.*, 2014; Dedehayir *et al.*, 2016). When it comes to value, the key is to find a balance between sharing value to others and keeping something for itself (Dedehayir *et al.*, 2016). If this fails, other actors will not stay satisfied and loyal, and will eventually abandon the ecosystem.

Leader's position allows the firm to possibly capture a higher share of the value in the ecosystem (Moore, 1993; Adner, 2017), because of its many contributions. Leaders also have the possibility to guide the ecosystem and tailor its development to their own strengths (Adner, 2006; Pellikka and Ali-Vehmas, 2016). On the other hand, the role requires big investments over a long period of time, and the leaders face many uncertainties regarding the success of the ecosystem (Adner, 2006). It is also challenging to communicate the common vision among the actors and keep them satisfied and truly collaborative (Dedehayir *et al.*, 2016). Thus, actors might want to compete on roles and conquer the leader's position. However, there are ways to defend. The leader's investments and contributions to the ecosystem, as well as high switching costs for followers and their unwillingness to work with new leaders help the actor to ensure its position (Moore, 1993; Iansiti and Levien, 2004).

Second, members acting as followers often directly contribute to value creation in the ecosystem. This role includes suppliers, assemblers, complementors and users (Adner and Kapoor, 2010; Dedehayir *et al.*, 2016). Suppliers deliver key components (e.g. processors for computers), technologies and services, and assemblers are responsible for integrating

them into offerings and delivering them further on. In turn, complementors provide complementary products (e.g. software for hardware), services and external environments that either extend or enable the functioning of the core offerings. Users have an important role in defining the problem and bringing innovative ideas into the ecosystem. Thus, followers are especially important when it comes to creating value in the ecosystem (Dedehayir *et al.*, 2016). Followers do not have to make big investments, coordinate or manage the ecosystem, so risks related to this role are lower than in case of ecosystem leaders. However, followers need to make decisions, which leader candidates to follow and how aggressively they want to commit themselves (Adner, 2006). Furthermore, they are dependent on other players, and they have to be well aware of the ecosystem to maintain their positions (Iansiti and Levien, 2004). Followers' highly specialized capabilities can be helpful, when they try to defend their positions (Iansiti and Levien, 2004).

Third, ecosystems include different kinds of supporting actors, too. Their role is important but the most peripheral of all ecosystem actors. For example, supporting actors are research institutes and universities, integrators, financers, start-up firms and regulatory authorities (Moore, 1993; Iansiti and Levien, 2004; Dedehayir *et al.*, 2016). They support and enable value creation and delivery without actively participating in these activities (Dedehayir *et al.*, 2016). However, supporting actors may want to capture some of the ecosystem's value, even if they would not have similar targets for value capture than other ecosystem actors. A viable commercial ecosystem can strengthen the positions of these supporting actors in their respective fields. For example, universities can get research opportunities and financing from the ecosystem and start-up firms resources to scale up their production.

Furthermore, supporting actors contribute to the entrepreneurial development of the ecosystem (Dedehayir *et al.*, 2016). For example, research institutes and universities present new insights, technologies and consultation, and integrators build connections between different actors. Different sponsors give financial support (e.g. venture capitalists), provide business education or connect start-ups with other actors (Moore, 1993; Iansiti and Levien, 2004; Maia and Claro, 2013). Regulators work in order to formulate favorable economic, political and regulatory conditions for ecosystems (Dedehayir *et al.*, 2016).

Fourth, firms can also apply dominator strategies in ecosystems (Iansiti and Levien, 2004). Physical dominator tries to control the whole ecosystem including its value creation and capture. This is only beneficial for one actor (dominator) making the existence of the ecosystem irrelevant. For example, Cisco's merges and acquisitions imply that it operates as a physical dominator in its ecosystem (Li, 2009). Value dominator in turn tries to contribute to value creation in the ecosystem as less as possible, but still capture most of the value (Iansiti and Levien, 2004). This leads short-term benefits for the dominator but eventually the ecosystem collapses and everyone suffers. Thus, especially value dominators damage the ecosystem health and their presence is not desirable in successful ecosystems.

All roles mentioned above include different benefits and risks. In order to select the most suitable roles for themselves, firms need to reflect these benefits and risks to their capabilities, goals and external environments. The following figure helps to select the suitable strategy in relation with complexity of relationships and level of turbulence and innovation. Supporting actors are not included to the figure because they do not directly contribute to value related activities in ecosystems.

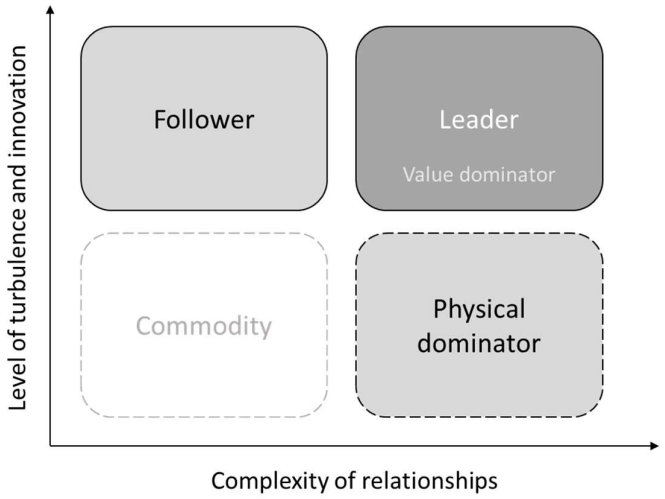

Figure 7. *Framework for selecting the most suitable ecosystem strategy (modified from Iansiti and Levien, 2004)*

If the business environment is changing rapidly and constantly (a lot of turbulence) but the firm is able to concentrate on a narrow and clear business segment (little complexity of relationships), the follower strategy might be a good option. This allows the firm to focus on one specific capability, which helps it to secure its position in a turbulent market. However, if the firm works in a turbulent environment with many complex interconnected actors, leader's role might be the best option: by managing the market, the firm develops itself towards the position of an irreplaceable actor. Because the environment is relatively instable, value dominators might appear in the ecosystem, too. In the figure, this strategy is not highlighted, since it benefits no one long-term. On the other hand, physical dominator strategy might be a good option for firms, which operate in a relatively stable environment. These firms can manage the complexity of relationships with acquisitions, for example (Iansiti and Levien, 2004). However, physical dominator eventually absorbs the ecosystem, which makes the ecosystem strategy irrelevant over long-term. That is why the role is marked with a dashed line. In a stable environment with low complexity (commodity), actors might rather stay independent, and ecosystem strategy is irrelevant, too.

After recognizing and selecting the roles for operating in ecosystems, the next step is to build and manage this network of actors. Leaders often have an essential role in building and managing the ecosystem, but other actors are needed as well. As mentioned before,

successful ecosystems create value, deliver this value throughout the ecosystem and ensure that this value can be captured to such an extent that satisfies the actors. According to Ritala et al. (2013), the mechanisms in ecosystems that affect value creation and capture are different in building and managing phases. That is why the next two sections discuss, how actors should build and manage the ecosystem in order to ensure effective and successful value processes.

Building ecosystems

Building and managing ecosystems are strongly based on the ability to understand the lifecycle of ecosystems. In his study, Moore (1993) identified different evolutionary stages for ecosystems: birth, expansion, leadership and self-renewal or death. Birth and expansion are linked to building an ecosystem, whereas leadership and self-renewal refer to the management phase. Understanding the stages helps to recognize right technologies to invest in, signing on suppliers, developing crucial elements of value and integrating new innovations (Moore, 1993). That is why it is important to discuss these stages before taking a closer look how to ensure value creation, delivery and capture in ecosystems. The evolutionary stages are illustrated in the figure below.

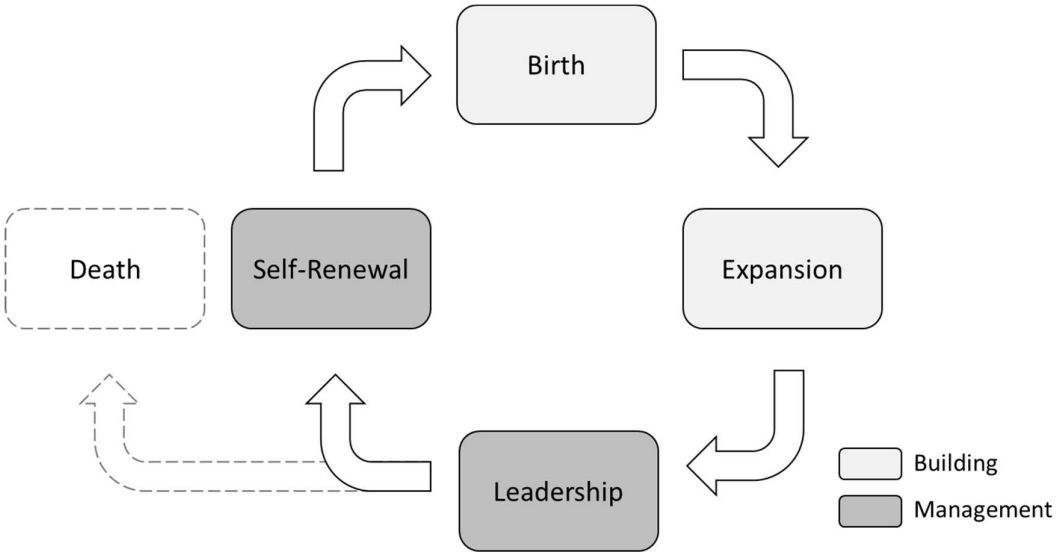

Figure 8. *Evolutionary stages of ecosystem lifecycle*

In the birth stage, the leader should work closely with other actors and customers to define a value proposition around a new innovation (Moore, 1993). Dedehayir and Seppänen (2015) propose that this phase starts by discovering, testing and demonstrating new innovations, and goes on towards first commercial applications. Thus, it is important to first construct premises, shape conditions, define objectives and ensure common understanding before moving on to value creation (Moore, 1993). Often the ecosystem's birth is more chaotic and iterative than later stages in the lifecycle (Dedehayir *et al.*, 2016). In order for the ecosystem to achieve the expansion stage, customers have to value the business concept and the leader has to be capable of scaling up the innovation (Moore, 1993).

Thus, it is vital to maintain strong cooperative relationships with other actors and customers in the ecosystem (Moore, 1993). Leadership and self-renewal stages are discussed in the next section about managing ecosystems.

According to Ritala et al. (2013), the ecosystem building phase includes the early phases of ecosystem, where the preliminary group of participants starts to shape. In this phase, the leader has to make decisions about the size, diversity, density and autonomy of the network and about the roles of actors (Dhanaraj and Parkhe, 2006). In the building phase, the premises of value creation and capture are formed, too (Ritala *et al.*, 2013). Ritala et al. (2013) divide the all mechanisms for value creation and capture for tangible (i.e. concrete) and intangible (i.e. relational) ones. When it comes to facilitating the premises of value creation, tangible methods refer to structures that connect and attract actors together, such as forums, associations and get-togethers (Pellinen *et al.*, 2012; Ritala *et al.*, 2012). Intangible mechanisms include gathering and attracting ecosystem actors (Dhanaraj and Parkhe, 2006), initiatives taken by leaders (Pellinen *et al.*, 2012), clear communication of common vision and building trust among ecosystem actors (Ritala *et al.*, 2009).

When it comes to defining the premises for value capture, tangible methods refer to setting up contractual structures and initial plans that ensure the value capture for each actor (Dhanaraj and Parkhe, 2006). For example, actors can define, who owns which intellectual rights and who is justified to utilize the upcoming results (Ritala *et al.*, 2013). Intangible mechanisms involve considering the motivation of different actors and creating a vision for these actors' business goals (Ritala *et al.*, 2012). This helps to solve conflicts in the future (Ritala *et al.*, 2013). However, managing both value creation and capture simultaneously when building an ecosystem is not easy. For example, different actors have different planning horizons: large companies make plans for 5 to 10 years, while smaller ones often create plans only for the next two years (Ritala *et al.*, 2013). However, value creation has to be stable in addition to tempting growth and profitability in order for the ecosystem to move from expansion to the leadership stage (Moore, 1993).

Managing ecosystems

In the leadership stage, a compelling vision of the future is important in enhancing cooperation between ecosystem actors and encouraging them to improve the offering (Moore, 1993). Ecosystems and their processes are beginning to stabilize, but constant innovations, contracts and patents become even more important for an ecosystem to stay healthy. When the threat of new innovations and ecosystems is raising, or there is a sudden change in environmental conditions, the ecosystem moves towards self-renewal (Moore, 1993). In this phase, leaders should either slow down the development of new ecosystems, or create new innovations in order to renew their mature ecosystems. This can be done by

maintaining high barriers to entry (preventing innovators from building alternative ecosystems) and high customer switching costs (buying time to implement new innovations) (Moore, 1993). If the ecosystem fails to renew, it inevitably faces its death.

In order to prevent the ecosystem from dying, Ritala et al. (2013) suggest that it is crucial to maintain value creation and realize value capture when managing ecosystems. In this phase, the ecosystem is already established and the actors are known, which makes the value creation and capture mechanisms more concrete than in the building phase (Ritala *et al.*, 2013). When it comes to maintaining value creation, tangible mechanisms are similar to the ones in building phase, but often more detailed (Ritala *et al.*, 2013). They include for example contracts, plans, platforms and forums (Fjeldstad *et al.*, 2012; Ritala *et al.*, 2012), which are highlighted in the leadership stage by Moore (1993), too. These structures help the leader to ensure and manage knowledge mobility in the network – a capability highly emphasized by Dhanaraj and Parkhe (2006). Intangible mechanisms emphasize trust, since it contributes to knowledge sharing and network stability but reduces opportunism and conflicts (Dhanaraj and Parkhe, 2006; Ritala *et al.*, 2013). Open communication and maintaining a common vision of the ecosystem are considered important mechanisms, too (Doz, 1996; Ritala *et al.*, 2009).

When it comes to realizing value capture, tangible mechanisms are highly contract-based, such as guidelines, contracts and intellectual property rights (IPR) (Dhanaraj and Parkhe, 2006; Ritala *et al.*, 2009). These should ensure innovation appropriability, i.e. actors of the ecosystem perceive that the value created is also shared equitably (Dhanaraj and Parkhe, 2006). Finally, intangible mechanisms aim to ensure understanding and communication of the business goals and needs of different ecosystem participants (Ritala *et al.*, 2012). Figure 9 below summarizes the value mechanisms in ecosystems' building and management phases.

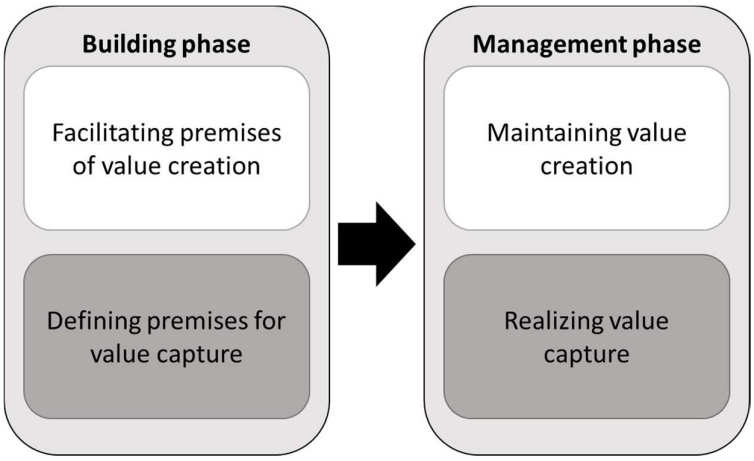

Figure 9. *Building and managing value in ecosystems (modified from Ritala et al. 2013)*

Even though here the development of ecosystems was categorized into different phases, one should understand that the boundaries between different lifecycle stages and between building and management phases are often blurring (Moore, 1993; Ritala *et al.*, 2013). However, it is important to recognize the different phases in order not to think of ecosystems as static entities. This section focused on roles and mechanisms to build and manage successful ecosystems in general. In order to enhance the understanding of ecosystems further, one need to consider how different actors actually perceive value in these kind of constellations. This in studied more closely in the next chapter by combining the value processes into the discussion about ecosystems.

2.3 Value processes in ecosystems

This chapter concludes the theoretical background of this thesis by discussing the topic of value processes. First, along with the definition, the chapter presents the effects of value processes to the relationships between actors and illustrates ways to manage them. Second, the chapter discusses the value processes for different ecosystem actors and develops a framework for studying these processes in the concept of ecosystems. Finally, the chapter describes the activities and responsibilities for these roles in detail and illustrates how disruptive innovations affect the roles. This chapter defines the premises for this thesis to approach the research questions.

2.3.1 Defining value and value processes

Value is a key concept in business management and considered as a top priority by managers in industrial companies (Corsaro, 2014). When defining value, one always have to consider the context. From economical point of view, value is added during the production process, it is embedded in products and services and its objective measure is the price paid for these products and services (Corsaro, 2014). Value also has a relational perspective, which sees value in actors' roles and relationships (Corsaro, 2014). Psychological and sociological perspectives refer to actors' subjective interpretations, i.e. what one considers valuable, might not provide much value to another. Furthermore, cultural aspects impact value (Corsaro, 2014). Thus, many scholars argue that value should be defined as a combination of different perspectives (Chandler and Vargo, 2011; Edvardsson *et al.*, 2011; Corsaro, 2014), because it is never purely an objective concept. Companies consider value through value processes, i.e. value creation, delivery and capture, which are illustrated in the figure below.

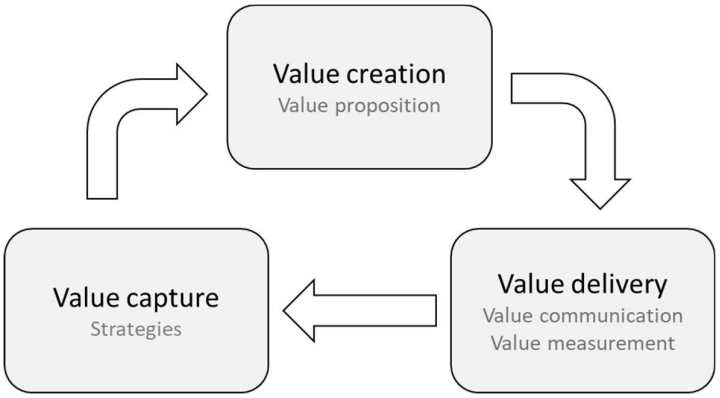

Figure 10. *Value processes and their interconnectedness*

Value creation refers to the offering and activities that create benefits for customers in the market (Bowman and Ambrosini, 2000; Priem, 2007). On the other hand, value creation also illustrates the firm's ability to understand and interpret customer needs in its offerings and activities (Harmsen and Jensen, 2004). Value creation is closely related to successful innovation activities (Adner and Kapoor, 2010), and the firm's ability to create more value than its rivals is considered as a source of competitive advantage (Porter, 1985, p. 3; Brandenburger and Stuart, 1996). However, before value can be created, there is only value potential and the firm can only make a value proposition (Vargo and Lusch, 2004). According to Kotler and Keller (2012, p. 149): "Value proposition consists of the whole cluster of benefits the company promises to deliver; it is more than the core positioning of the offering." Thus, in order to benefit from the value created, the firm has to success in delivering it to the customers, too.

Value delivery includes processes of value communication and value measurement. Perceptions of value emerge through communication (Corsaro, 2014) and value measurement helps in making these perceptions more concrete and reliable (Wagner *et al.*, 2010). Communication can happen, for example, through sales material, presentations, brands or interpersonal dialog. On the other hand, value is not easy to measure, because it has both an objective and subjective nature, and tangible and intangible components (Gadde and Snehota, 2000). According to Anderson et al., many firms lack the necessary skills and knowledge to measure value (Corsaro, 2014). However, Keränen and Jalkala (2013) suggest five processes, which can be helpful in assessing value: identification of value potential, verification of the customer base, evaluation of the performance, establishment of long-term value and systematic management of information. These procedures highlight that especially reference values and long-term data are needed in order to measure value.

If a firm can measure value, it can also better manage the process of value capture (Wagner *et al.*, 2010). If the firm knows the total amount of value in the market, it can better evaluate the amount of value that it expects to capture. Thus, when value creation refers to creating more value (expanding the pie), value capture refers to extracting some

of this value (gaining a larger slice of the pie) (Dhanaraj and Parkhe, 2006). Hence, value capture can be seen as an individual firm-related activity (Ritala and Hurmelinna-Laukkanen, 2009; Ritala *et al.*, 2013), whereas value creation and delivery often concern other parties, too. For example, patents, contracts, barriers to entry and high switching costs help to realize value capture (Mizik and Jacobson, 2003; Lepak *et al.*, 2007). As discussed in Chapter 2.2.3, similar mechanisms help to realize value capture in business ecosystems, too.

After identifying the value processes, one should understand their effects on the relationships between actors. Understanding the effects is the only way to know, how to manage them. During the process of value creation, the challenges are related to creating a common understanding of the value and predicting the value potential of future. When it comes to value delivery, challenges are related to communication issues and difficulties to measure the intangible concept. During value capture, experienced inequity, opportunism and conflicting views cause challenges. The following table lists the effects of each value process and presents practical methods that can be applied in managing these effects.

Table 1. *Effects and management of value processes (modified from Corsaro 2014)*

	Effects in relationships	**Management**
Value creation	• actors' different ideas of value • difficulties in predicting value potential • difficulties in imagining future value • frequently changing ideas about value	• use drawings to represent future value • confront actors' ideas of value • constantly monitor actors' value representations
Value delivery	• different contexts affect ideas of value • complicated communication due to complex networks • heterogeneity in cultures, languages and technologies • difficulties in measuring value • knowing the real value only after using the solution	• ideas of value translatable into different contexts • coordinate ideas and ensure common understanding • right interlocutor, direct interactions • train sales people • context specific measurements • connect actors together to find a common base for comparison • highlight non-economic measures of value
Value capture	• inequities due to asymmetric value capture • opportunistic behavior • impossibility to fully regulate through contracts • different views of actors entitled to capture the value	• flexible contracts regulating network level value capture • known levels of inequity acceptance of each actor • pictures supporting the understanding of the network

Since value is strongly linked to the context and relationships, actors' roles in the value chain affect their value processes, too. Because business is moving away from traditional value chains towards complex ecosystems (Moore, 1993; Iansiti and Levien, 2004), it makes sense to study especially the value processes of different ecosystem actors. The next chapter represents a categorization for different ecosystem actors and discusses each value process for each actor separately.

2.3.2 Value processes for different ecosystem actors

As discussed in Chapter 2.2, ecosystems consist of different actors with different roles due to different activities, characteristics, goals and motivations. Because of these differences, value processes related to leaders, followers and supporting actors are significantly different. Leaders contribute to value creation themselves, but a more important task for them is to establish the premises for value creation and maintain them throughout the ecosystem lifecycle. When it comes to value delivery, leaders are in the key role. They contribute actively to value delivery, create the conditions for it and ensure its efficiency. In case of value capture, leaders are in the key position to ensure that all ecosystem actors find that the value created is shared equitably between them. Furthermore, leaders have to be able to capture some of this value themselves, too. This is crucial for the health of the whole ecosystem, because without motivated and satisfied leaders, the whole ecosystem can easily collapse (Moore, 1993).

On the other hand, followers are the ones, who usually create most of the value in ecosystems (Dedehayir *et al.*, 2016). They do not manage value delivery but some of them might still contribute to it by delivering different products, services and information among the ecosystem actors. Since followers depend on other actors in the ecosystem (Iansiti and Levien, 2004), they have to be able to defend their positions and objectives in order to capture the amount of value they can be satisfied with. When it comes to supporting actors, they are not responsible for creating the value themselves. However, they have an important role in supporting value creation and providing necessary resources and conditions in order for other ecosystem actors being able to create value. Similarly, they support value delivery. In order for the supporting actors to capture value, they have to be able to defend their positions and justify their right for capturing value. If other actors do not see them entitled to this, it might be difficult for them to gain any value.

However, the classification of ecosystem roles into leaders, followers and supporting actors is not enough to study the value processes related to different roles explicitly. Thus, one needs to take into consideration the dimension related to development activities, too. As mentioned in Chapter 2.2.1, ecosystem roles can be divided into developers and users. Developers actively take part in the development of new products and services, whereas users settle for using these products and services. Similarly, there are differences between

these roles regarding the value processes, too. Developers take actively part in value creation when they innovate, develop and test the offering. They are also responsible for its commercialization. When it comes to value delivery, developers take care that the value created reaches the users. As a result, they often expect to capture a high share of value, since they have significantly contributed to its creation.

On the other hand, users contribute to value creation, too, even if they do not exactly participate in development activities. They have an important role in defining a problem or need, which works as a spark for developers to start innovating a solution and building an ecosystem in the first place (Dedehayir *et al.*, 2016). Users also give feedback to developers, which helps them to improve the offering. Users contribute to value delivery by spreading the word about new products, services and technologies. In case of users, value capture often corresponds to the use of the offering. Thus, when it comes to value processes, developers and users have relatively clear responsibilities that do not intersect much.

Finally, one should also recognize the differences between the roles related to leading (leader, follower, supporting actor) and the roles related to development (developer, user). As mentioned before, developers and users have relatively clear responsibilities. The following example validates this: A user would like to buy clothes directly from home. He communicates this need to a developer, who builds an online store. The user benefits from the new service and the developer gets a financial compensation for creating the service through increased total sales due to a new channel. Thus, this simplified example implies that there are no big conflicts between users and developers. However, when it comes to leaders, followers and supporting actors, even a simple example exposes conflicts in value processes. In case of online stores, leaders coordinate and contribute to the development, followers build and deliver components and complements, and supporting actors finance the plan. The question remains, how value is shared equitably between the actors.

Because the categorization between users and developers is clearer, it can be used to clarify the value processes related to leaders, followers and supporting actors. Thus, the example above shows that these two different dimensions are needed in order to classify the roles in ecosystems and to study the value processes explicitly. That is why it is justified to integrate the dimension of leaders, followers and supporting actors to the dimension of developers and users. This leads to the framework illustrated in Table 2.

Table 2. *Framework for studying different value processes in ecosystems*

	Leader	**Follower**	**Supporting actor**
Developer	Firm 1a	Firm 2a	Firm 3a
User	Firm 1b	Firm 2b	Firm 3b

However, constructing only different value processes for different roles is neither theoretically nor practically very relevant. That is why this framework can be used to study the changes in value processes of different roles, when their ecosystem is facing changes. There are many new innovations (e.g. blockchain, distributed ledger technology) in the market at the moment, which have a high potential to disrupt numerous industries in the near future. Thus, there is a need to study what kind of effects these disruptive innovations can have on value processes. Thus, the framework is used to study, how the value processes of different roles in ecosystems change in case of disruptive innovations.

2.3.3 Effects of disruptive innovations on value processes

When the concept of disruptive innovations is studied in the context of ecosystems, one first have to accurately define the structure of this new concept. First, there can be an ecosystem, which produces disruptive innovations, which affect value processes. Second, the ecosystem can be build based on disruptive innovations (e.g. the platform of this ecosystem is based on a distributed ledger technology), which changes the value processes. Third, the value in this ecosystem can be disruptive in nature. This study is based on the first combination, because it gives the best opportunities to study the changes in value processes. The second combination is complex because it would not allow generalizing the effects of disruptive innovations, since it is tied to platforms. However, this combination is also considered in this study, when answering to the fourth research question. The third combination is difficult, because it is hard to define, measure and conceptualize disruptive value.

As the framework built in Chapter 2.3.2 (Table 2) shows, there are six possible roles for ecosystem actors: developer-leader (firm 1a), user-leader (firm 1b), developer-follower (firm 2a), user-follower (firm 2b), developer-supporting actor (firm 3a) and user-supporting actor (firm 3b). Next, the effects of disruptive innovations on value processes of each role are discussed separately. The activities for different roles are divided into coordination (management), contribution (active participation) and support related activities (passive participation). Table 3 illustrates these activities regarding each role. A cross in Table 3 refers to main activities, a cross in brackets to assumed secondary activities.

Table 3. *Activities related to value processes for different ecosystem roles*

Role		Coordinates	Contributes	Supports
Firm 1a:	**Developer-leader**	X	(X)	
Firm 1b:	**User-leader**	X	(X)	
Firm 2a:	**Developer-follower**	(X)	X	
Firm 2b:	**User-follower**		X	
Firm 3a:	**Developer-supporting actor**		(X)	X
Firm 3b:	**User-supporting actor**			X

Furthermore, similarities and differences between different roles are studied in this chapter, and the author makes suggestions about the expectations of value capture for each role regarding their centricity in the ecosystem.

Firm 1a: Developer-leader

Leaders are in the key role in coordinating the disruptive change, but they contribute to value processes, too. However, it is crucial that the actors in this role understand the new situation and the change in customer value emphasis. This is the prerequisite to lead the ecosystem to the right direction. Thus, leaders communicate the changed value and the new situation to other members in the ecosystem. It is important that there is a common understanding of the new direction among the ecosystem members in order to efficiently create, deliver and capture value despite of the disruptive change.

When it comes to value creation, a developer-leader should allocate a sufficient amount of resources to the development of disruptive innovations. This actor should also have a comprehensive understanding of the ecosystem as a whole and be able to identify the members, who have hard time facing the change. It is on the developer-leader's responsibility to help these actors, and ensure that there is a right mix of roles in the ecosystem. Even if coordination is a primary concern for this role, it can contribute to the value creation, too. When it comes to value delivery, this role coordinates and contributes to it by communicating the new value attributes and measuring the total value. If the ones delivering the value understand the new attributes, and the ones receiving the value are able to identify them, value delivery will remain effective among the ecosystem actors. A developer-leader is in the key role to ensure this.

When it comes to value capture, developer-leader coordinates this process and makes sure everyone in the ecosystem gets something. If other members in the ecosystem understand the new value, the situation can be avoided, where these members capture value but fail to identify it, and become dissatisfied. If the members clearly understand the new situation, they can even satisfy with less value than before, because they understand the challenges related to the disruptive change. The developer-leader should also ensure that trust remains in the ecosystem, because the turbulent environment might lead to fear and opportunistic behavior among the actors. Because this role is challenging and it requires a lot of effort, developer-leader expects the highest share of the value in the ecosystem. In case of a disruptive change, this actor can even justify a bigger share of value than before, because it has an important role in implementing changes and pushing the ecosystem to the new direction. Since this actor is an active participant and often has many nodes in the ecosystem, the developer-leader is a central role, too.

Firm 1b: User-leader

User-leader's role is in many ways similar to the one of developer-leader, since user-leaders coordinate the value processes, too. This role communicates the changes in value

and in the environment, and helps other members in the ecosystem to find the right direction. However, this role is also significantly different from a developer-leader. As a user, the user-leader often understands the changed value and the needed measures to respond to the disruptive change better than the developer-leader. Thus, the user-leader takes care of setting the initial direction for the change, whereas the developer-leader actively takes care of pushing the ecosystem to this direction. For example, in case of value creation, the user-leader contributes by communicating the first need. The developer-leader takes the charge, when the direction and the needed changes are starting to take shape.

When it comes to value capture, the user-leader expects a high share but satisfies with less value than the developer-leader. The user-leader's role is challenging but it does not require so much effort than the developer-leader's role: the user-leader is often less active than the developer-leader and does not contribute the same way to different value processes. In case of disruptive change, the user-leader might even expect more value than before, because it has such an important role in setting the right direction. Because this role is less active than the developer-leader, it does not probably have so many nodes in the ecosystem than the developer-leader has. Thus, the user-leader's role is not so central than the one of the developer-leader.

Firm 2a: Developer-follower

When it comes to followers, it is important to understand that they are the ones who actually create the value. After leaders have communicated the new direction and changes in the value attributes, these actors with specialized capabilities start working to create value in the ecosystem. Thus, it is crucially important that leaders succeed in communicating the changes to followers. However, because followers have highly specialized capabilities, they might be in danger when facing a disruptive change. If followers' capabilities are significantly different from the ones that the new value attributes need, certain followers might end up being replaced in the ecosystem.

Even if creating value is the main activity for a developer-follower, this actor also participates in innovating and setting the new direction for the ecosystem. Being proactive, open for change and able to innovate might help the developer-follower to respond to the disruption and maintain its position in the ecosystem. In case of value delivery, this role is an active participant and contributes to communication process and measurement activities, too. When it comes to value capture, the developer-follower expects a high share: it has created most of the value and participated in innovation and development activities. However, because this role is not in the center of coordinating the ecosystem, it might find it hard to satisfy with less value than before the disruptive change. That is why it is important that leaders communicate the amount of value available for each role in the ecosystem. If the new value attributes correspond well to the capabilities of the develop-follower, this role might indeed be able to capture a big share of value. However, this share is often less than what the developer-leader get.

Firm 2b: User-follower

When it comes to a user-follower, this role contributes to value processes but a little less actively than the developer-follower does. Just like the user-leader, the user-follower has an important role in communicating the need and changed value attributes to other members in the ecosystem. Because this role is a user, it works closer to end customers and easily gets inputs from them regarding their value emphasis. Whereas the user-leader should understand the big picture of disruption, the user-follower can significantly contribute to this understanding in a detailed level.

Because user-followers' role is a bit less active than the one of a developer-user, this role satisfies with a medium share of value. Often it is enough for the user-follower to be able to be part of the ecosystem and use its offerings. However, if the user-follower's own capabilities are significantly different than the ones needed in disruptive change, this actor might be in big trouble. Due to its nature, the user-follower is less flexible and familiar with change than the developer-follower. That is why this role might have to satisfy with less value than before the disruptive change. If the user-follower is able to defend its position in the ecosystem, it might get more value again when the business environment has settled down.

Firm 3a: Developer-supporting actor

Supporting actors' key focus is to support the ecosystem and maintain its functions. Their role might even become more important in case of disruptive change. Because these actors do not have a specialized role in the ecosystem, their capabilities will usually remain relevant. For example, universities make valuable research, financing institutions provide funds and regulatory authorities ensure fair competition within the industry – even if the industry would change dramatically. These capabilities and resources can help the ecosystem and its members to survive the disruptive change.

When it comes to a developer-supporting actor, this role can even contribute to value creation and delivery. For example, universities have first-hand knowledge about new technologies. This knowledge can be useful, when an ecosystem is setting its new direction and wants to create value efficiently. Furthermore, universities can contribute by communicating the anticipated effects of disruptive change. Because the developer-supporting actor supports the ecosystem and even makes small contributions, it expects a medium share of value. However, this actor has to justify why it is entitled to capture value. Other ecosystem members might not be keen to give value for someone, who is not eventually dependent on the value it gets from the ecosystem.

Firm 3b: User-supporting actor

The role of a user-supporting actor is in many ways similar to the role of the developer-supporting actor. This role supports the ecosystem in general but in the contrary to the developer-supporting actor, this role does not contribute much to value processes. For

example, regulatory authorities prescribe laws in a way that they correspond to the current environment. This helps ecosystems to design their actions according to the disruptive change. Because this role is quite peripheral in the ecosystem, it does not expect to capture much value. However, if disruption makes this role more important, the actor might get some value, too. If this actor is careless and supports an ecosystem, which does not survive the disruption, the user-supporting actor can even lose some value. The discussion about the activities and responsibilities of different ecosystem roles is summarized in Table 4. This table illustrates the most important activities for each roles regarding both value creation, delivery and capture.

Table 4. *Summary of the activities of different ecosystem roles*

	Value creation	**Value delivery**	**Value capture**
Developer-leader	• leading the direction • helping others • sharing resources	• communicating the big picture • measuring the total value	• coordinating the process • ensuring trust and satisfaction • capturing own share of value
User-leader	• setting the direction • helping others • communicating needs	• communicating the big picture • measuring the total value	• coordinating the process • ensuring trust and satisfaction • capturing own share of value
Developer-follower	• building the offering • innovating and developing	• communicating details	• capturing own share of value
User-follower	• building the offering • communicating needs	• communicating details	• using the offering • capturing own share of value
Developer-supporting actor	• providing resources and competences • innovating and developing	• -	• using the offering • capturing own share of value
User-supporting actor	• providing resources and competences • communicating needs	• -	• using the offering

As a summary, one cannot make any suggestions regarding the importance of different roles – each of them has a specific place in the ecosystem. Leaders coordinate and manage the ecosystem and its value processes, lead the system towards a new direction and ensure its right composition. This is especially important in case of disruptive change. Followers are the ones who actually create the value in the ecosystem. Without them, there is no one to do the actual work. However, if followers are not capable for doing their tasks, they can be replaced rather easily. Supporting actors support the ecosystem and ensure its

functioning. Again, their role is important in disruptive change: when customer value emphasis changes, the ecosystem is often more depended on resources and information provided by these actors.

Furthermore, one can summarize that developers are usually more capable in responding to change. They have strategic flexibility and dynamic capabilities, because they are familiar with innovating and uncertainty. Users are steadier and used to use products rather than developing them. They are in the key role when communicating the changed need of customers. After that, developers take charge and implement the changes. When the new direction is set, users are again needed. On the other hand, developers ensure that the ecosystem remains innovative and is able to renew itself.

This chapter also discussed, what kinds of expectations each role has about value capture. Figure 11 summarizes this discussion about value expectations of each role as a function of centricity in the ecosystem.

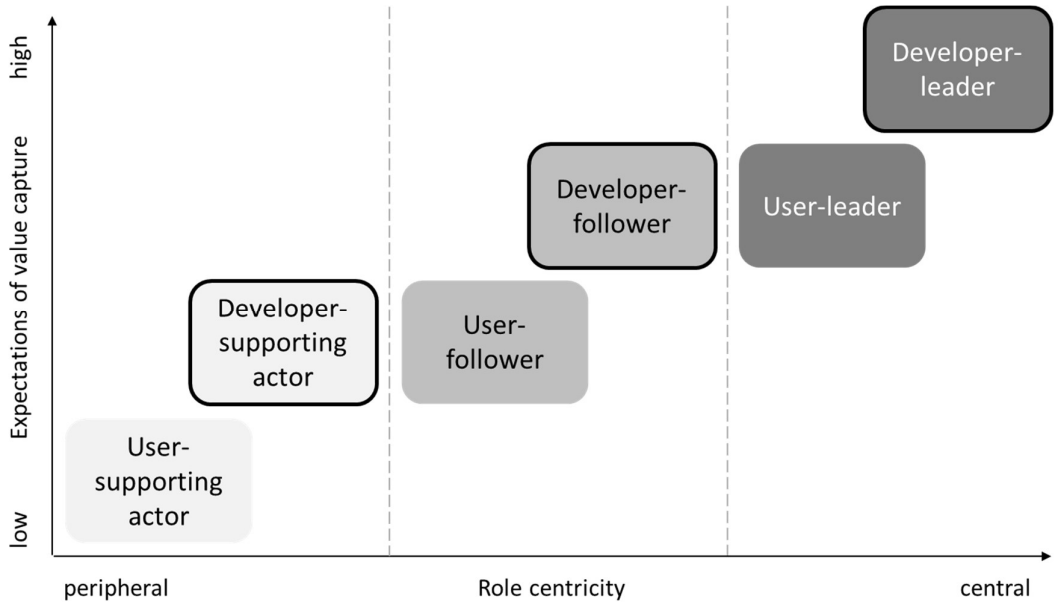

Figure 11. *Value expectations for each role as a function of centricity in the ecosystem*

The figure is a simplification and only identifies clear differences between roles regarding value expectations. It does not represent explicitly proven theories but it is rather based on subjective assumptions made by the author. For example, the developer-leader usually expects more value than the developer-follower does. These suggestions will be later reflected in the discussion part. One should also consider that the value expected does not necessarily correspond to the value captured. Expectations depend on the ecosystem and might change in different times.

3. METHODOLOGY AND DATA

This chapter discusses the methodology of this research. First, the chapter presents the research methods selected for this study and justifies their use in this master's thesis. Second, the chapter demonstrates the timeline of this study and describes the research process in detail. Third, this chapter discusses, how the interviewed organizations and the interviewees were selected and what guidelines this selection process followed. Furthermore, this chapter presents both the main and the secondary data utilized in this research.

3.1 Research methods

In order to perform a reliable and valid research, one should carefully consider the research methods. There are different methods for different research constructs. In order to select the right methods, one has to consider the research questions, assumptions and limitations related to the research (Saunders *et al.*, 2012, p. 129). Right methods ensure that the study truly answers to the specific research questions. However, often the right set of methods can be selected in multiple ways. One way to illustrate the methods behind the research is the so-called research onion (Figure 12). The outermost layers, philosophy and approach, define the premises for the research. The inner layers, methodological choices, strategies and time horizon focus on the research design: how to turn research questions into a research project. Finally, the innermost layer defines the practicalities of the research: what are the practical measures to collect and analyze data.

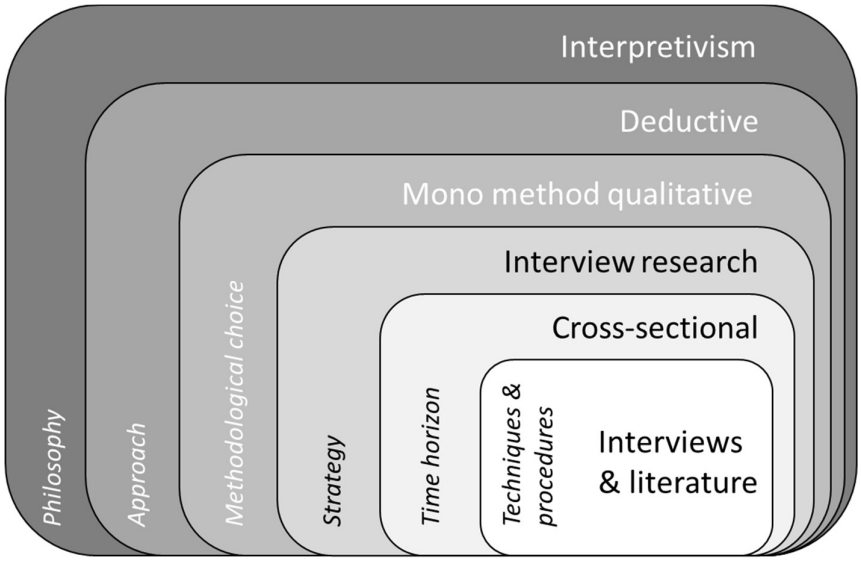

Figure 12. *Research methods selected for this study (modified from Saunders et al. 2012, p.128)*

Research philosophies refer to the development and nature of knowledge (Saunders *et al.*, 2012, p. 127). Understanding these philosophies makes the researcher able to identify taken-for-granted assumptions about the world, critically examine them and evaluate their appropriateness (Saunders *et al.*, 2012, p. 129). It is important to identify these assumptions, since they shape the understanding of the research questions and eventually the interpretation of results (Crotty, 1998). Indeed, Johnson and Clark argue that the philosophy has a great impact on how the researcher understands what he is studying (Saunders *et al.*, 2012, p. 128). In this study, the chosen research philosophy is interpretivism. Interpretivism assumes that the world of business and management cannot be justified with definite theoretical laws without considering the differences between humans and their roles as social actors (Saunders *et al.*, 2012, p. 137). From ontological perspective, the reality is socially constructed and subjective, it may change or there may be multiple truths. From epistemological perspective, acceptable knowledge is included to subjective meanings and focuses on details of situations and the reality behind these details (Saunders *et al.*, 2012, p. 140).

Since there are no existing DLT ecosystems, there is no information about the real functions and relationships in these ecosystems. That is why the results of this study are based on subjective evaluations and opinions of people from different organizations and positions. The researcher sees these positions and organizations as social constructions, and contradictory views from different people can be equally true. Furthermore, Saunders et al. (2012, p. 137) argue that interpretivism is suited especially to study organizational behavior. When studying ecosystems, one should especially focus on the actions and behaviors of different firms and the relationships between them. Thus, the interpretive philosophy is a highly appropriate premise for this study.

The next layer of the onion, research approach, tells to what extent the researcher can utilize existing theories in the beginning of the research (Saunders *et al.*, 2012, p. 143). This premise defines whether the research approach is deductive, inductive or abductive. According to Saunders et al. (2012, pp. 143–147), deductive research first forms theories based on existing literature. Then the premises of these theories are empirically tested. Finally, conclusions are made based on whether the premises are true or not. Inductive research first collects data and then forms new theories based on this data. Abductive research goes back and forth: first, it collects data, then it forms a theory and finally, it tests this theory by conducting empirical research. In this study, the research approach is deductive. First, a new theory is build based on existing theories about ecosystems, disruptive innovations and value processes. Then, empirical research is conducted to gain data to analyze this theory. Finally, the premises of this theory are tested and conclusions made. This is a way to study whether the developed framework is true and to what extent, and to adjust this framework according to the results.

The selected research philosophies and approaches affect the methodological choices, too. The researcher has to decide whether to conduct a research based on a single qualitative or quantitative method or multiple methods. This study represents a mono method qualitative research. Because there is no existing data about disruptive innovations in ecosystems, the only way to study this phenomenon is to conduct a qualitative research. According to Denzin and Lincoln (2005), qualitative research is often especially linked to interpretive philosophy. Even if qualitative research is often inductive, Yin (2009) argues that deductive approach can also easily be used, as in this study. Due to the emergent nature of the topic, this research represents an exploratory study. An exploratory study aims to understand a new phenomenon and gain valuable insights (Saunders *et al.*, 2012, p. 171). The exploratory nature of this research also justifies the choice of a single method: one method is enough, because the idea is more to explore ecosystems than to find causal relationships between different value processes in ecosystems, for example.

The next layer in the research onion represents research strategies. According to Saunders et al. (2012, p. 173), a research strategy works as a plan, which tells how the researcher is going to answer to his research questions. Denzin and Lincoln (2005) define it as a methodological link between philosophy and methods for collecting and analyzing data. Common strategies for qualitative research are, for example, case study, ethnography and action research, but this study does not fit to any of them. Considering time and scope of the master's thesis and the newness of the topic, the strategy of this study is an interview research. As a strategy, interviews consider not only how to collect data, but also when to conduct the research, what kinds of results can be expected and how to ensure coherence between outer and inner layers of the research onion.

The last choice regarding the research design refers to time horizon. Due to the limited timeframe for the master's thesis project, this study represents a cross-sectional study. It focuses on a particular phenomenon at a particular time (Saunders *et al.*, 2012, p. 190) – in this case, on the effects of disruptive innovations on value processes in ecosystems at the time of the interviews. Even if the cross-sectional study cannot tell much about the development of the phenomenon over time, it can enlighten its current state in detail. That is why the cross-sectional aspect is valuable and thus, appropriate for this study. Furthermore, the review of the existing literature and the suggestions that this study can reveal for future research make sure that there is a longitudinal aspect in this study, too. All in all, understanding the nature of the research design (choices, strategies and time horizons) helps the researcher to adjust her expectations regarding the results.

Finally, the innermost layer of the research onion stands for practical techniques and procedures to conduct the research. The main technique to collect data in this research are semi-structured interviews. Interviews are strongly linked to a qualitative study: they suit to new topics and help to collect rich empirical data (Saunders *et al.*, 2012, pp. 378–380). Furthermore, semi-structured interviews are well-suited to exploratory research (Cooper

and Schindler, 2003; Saunders *et al.*, 2012, p. 171). This justifies the use of semi-structured interviews in this study. The researcher conducted 10 interviews face-to-face and on a one-to-one basis during this study. In order to select the interviewees, purposive sampling with a heterogeneous aim was used. According to this method, interviews were conducted in three different organizations and on both operative and management level. The actual interviewees were selected based on suggestions: the ones, who worked with or were familiar with the topic, were contacted first. Furthermore, existing literature was used to gain understanding of the topic, to build the framework, and to discuss and justify the empirical findings.

3.2 Research process

This master's thesis project was conducted for the SBU of a global IT-service and consulting company. The researcher worked for the company as a trainee and was located in Helsinki, Finland. She had already worked for the IT-service provider as a trainee in 2017, so she was relatively familiar with the organization in general. Figure 13 represents the timeline of this research process from May 2018 to January 2019.

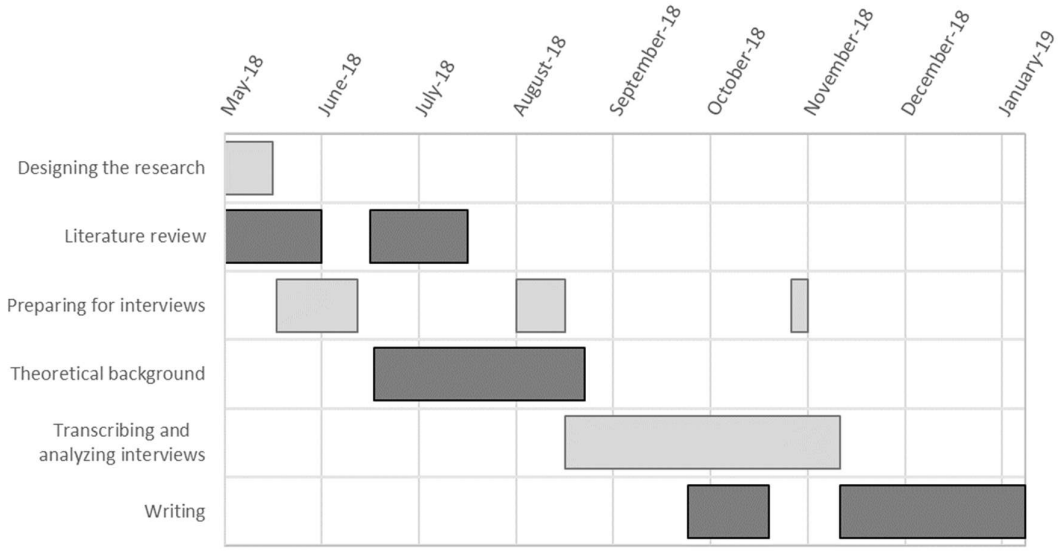

Figure 13. *Timeline for the research process*

The project started already in August 2018 by choosing the topic but because the researcher had other duties in the company, the thesis project started properly in May 2018. The author was interested about new technologies, such as blockchain and distributed ledger technology, and their utilization in industry context. The IT-service provider had built a concept around these technologies with the aim to pursue their possibilities in an ecosystem. This ecosystem had been developed strongly from the technological perspective. Thus, the idea was that this thesis could enlighten the theory about disruptive technologies, ecosystems and their value processes. This kind of information would be highly

valuable for the IT-service provider, since the company was aiming for a central role in building and managing these new ecosystems.

The research project started by getting familiar with the topic and the company's concept. The researcher had discussions with different people working with the concept, she attended concept meetings and studied documents and other material regarding the concept. A meeting with the university professor, the company supervisor and the researcher was held 9.4.2018 in order to discuss the topic and the objectives of the research, and to find a balance between practical and theoretical perspectives. Furthermore, defining the research questions, designing the empirical study and scheduling a timeline for the project were among the first tasks conducted. The original idea was to conduct a case study concentrating on this concept, but since there was no existing ecosystem, it was decided to focus on DLT ecosystems in general. However, the concept worked as a sparkle, pushed the study on the right track but eventually remained in the background as an example. Due to this, the research objectives and questions slightly altered in the beginning of the research.

A preliminary literature review was also conducted in May to get familiar with the existing research in the field. The researcher searched for articles about business and innovation ecosystems, disruptive technologies and innovations and value creation, delivery and capture. This literature review helped the researcher to sketch the preliminary table of contents and to design questions for the upcoming interviews. The structure of the interviews is explained in detail in Chapter 3.3. Before the first interviews, the questions were tested both with a family member, who had no knowledge about the topic, and with colleagues familiar with the concept. Their feedback helped to ensure that there were no leading questions, the questions were relevant, in a logical order and they covered all important aspects.

First three interviews for the master's thesis were conducted in June 2018. The interviewees were first contacted by the thesis supervisor to gain access, since he had been working with the interviewees before. Later, the researcher agreed on the specific time and date by email. The topic of the interview was shortly explained in the emails, and the questions were send to the interviewees a few days before the actual interview. This helped the interviewees to prepare for the interview and to get familiar with the themes to be discussed. Before the interviews, the interviewer studied some basic information regarding participants and their organizations, too. This helped the interviewer to prepare herself for the interview, and to adjust her behavior and questions. In the beginning of every interview, the interviewer explained the use of the data and highlighted that the interview and the interviewees' identity were confidential. This helped the interviewer to gain credibility and interviewees' confidence, which are important prerequisites for a successful interview (Saunders *et al.*, 2012, p. 389). Furthermore, the objectives for the thesis were briefly explained once more at the beginning of every interview. After the agreement of the interviewees, all interviews were recorded, too.

During July and August 2018, the researcher conducted a comprehensive literature review, wrote the theoretical background and built the framework for the thesis. This literature review increased the amount of articles collected during the preliminary review. The peer-reviewed articles were searched in scientific databases, such as Web of Science and Scopus. The researcher used search words, like "disruptive technolog*", "disruptive innovation*", "technology disruption*", "business ecosystem*", "innovation ecosystem*", "value creation", "value delivery", "value capture" and "value appropriation", and combined them with Boolean operators. The results were arranged by times cited from highest to lowest in order to find the most relevant articles. Furthermore, the latest issues of acknowledged journals, like Technovation, Strategic Management Journal and Journal of Product Innovation, were checked in order to complete the review with the latest scientific discoveries. The university professor provided some interesting articles for the researcher, too. The articles found were given a priority from 1 to 3 based on their relevance regarding the topic of the thesis. The articles with the highest priority were read carefully, and other articles were read through more superficially. After covering the theory for disruptive innovations, ecosystems and value processes, the researcher synthetized these topics in the framework.

During August 2018, the researcher started to transcribe the recorded interviews and reviewed the research questions before the next five interviews. They were held in the end of August and in the beginning of September. Other tasks conducted in September included transcribing and analyzing interviews and writing the methodology section for the thesis. The last interviews were scheduled at the beginning of November 2018. According to the original schedule, all interviews should have been conducted in June. However, the researcher's other duties at the IT-service company, the busy schedule of interviewees and the summer holiday season extended the empirical study. Because most of the interviews were conducted at other companies than where the researcher worked, she had to be flexible regarding the schedule. During October and November 2018, the interviews were analyzed and the results were documented. In December 2018, the results of the master's thesis were discussed and conclusions drawn. The first draft of the thesis was handed in to the university professor on 6.1.2019. After the comments of the professor, the master's thesis was finalized and the final version was handed in on 14.1.2019.

3.3 Research data

Interviews were the main data gathering method used in this study. The aim was to collect data regarding different organizations' perceptions about disruptive technologies and innovations, their effects on business ecosystems and on value processes. Identifying the right interviewees was a critical part in designing the research. As mentioned in Chapter 3.1, purposive sampling was used to selected interviewees in this study. The researcher aimed to collect a heterogeneous sample, which could maximize the variation in the data (Saunders *et al.*, 2012, p. 287). Organizations for interviews were targeted keeping in

mind that they should be able to form an ecosystem together. However, there was no need for this ecosystem to exist in real life. The target organizations should represent different roles in the ecosystem, which were defined in the framework. At least one leader, one follower and one supporting actor should be in the sample. Moreover, the sample should include both developers and users in order to answer the research questions. Table 5 illustrates how the target organizations are placed in the framework.

Table 5. *Supposed roles for target organizations in the framework*

	Leader	**Follower**	**Supporting actor**
Developer	IT-service provider	Bank	-
User	-	-	Tax office

In order to meet the criteria regarding ecosystem roles, the IT-service provider's concept was used as a basis for selecting the target organizations. At first, the idea was to target all six organizations included to the concept (retail, bank, insurance, repair and maintenance, transportation and taxation). However, this idea had to be rejected because it was highly uncertain, if the researcher would have been able to gain access to all these firms within the timeframe of this study. That is why convenience sampling was used to select the organizations that met the criteria: because the IT-service provider, the bank and the tax office were relatively easily accessible, these organizations were selected. In the optimal situation, all six different ecosystem roles would have been covered in the interviews, but this was not possible considering the time and scope of the master's thesis project. However, ecosystem roles are usually not fixed, and they might especially vary in the building phase of the ecosystem. Finding one leader, one follower and one supporting actor for the interviews can reveal something from both developer's and user's perspectives.

In order to extend the heterogeneity of the sample, the criteria was set to conduct interviews both on operative and management levels. This made the data more representative and revealed a more comprehensive picture regarding the organizations' attitudes towards ecosystems. When it comes to a relatively small sample, as in this study, Patton (2002) argues that the purposive, heterogeneous sampling helps to improve the versatility of the data. Thus, two interviews were conducted both on operative and management level in organizations representing a leader and a follower. However, because of the more peripheral nature of the supporting actor's role, there was no need to conduct two interviews on both levels. That is why only two interviews were made at the supporting actor.

After the organizations and the criteria for the interviewees were identified, the researcher designed the interview questions. The outline of the interview included a couple warm-up questions, around 15 main questions about the topic and some closing questions. In

the warm-up section, the interviewees were shortly asked about their current job description, their education and past experiences. The idea with these questions was to gain some background information about the interviewee and to start the questioning with simple questions before more challenging topics. The main questions were categorized into three main themes in order to make the structure of the interview more logical. The first section included questions about benefits, problems and success factors of DLT ecosystems. In the second section, the interviewee was asked about building and management of such ecosystems. This included questions regarding the roles of different actors, for example. In the last section, the future of such ecosystems was discussed. The closing questions gave the interviewee the possibility to bring up perspectives not yet discussed, complete some answers or summarize the most important aspects. Appendix A presents the final version of the interview questions.

During the interview process, the questions were slightly altered and adjusted from one interview to another. This is very typical for a qualitative interview, where data collection is often non-standardized (Saunders *et al.*, 2012, p. 163). Depending on the interview and the answers, the exact questions and their amount varied, too. Even if the questions were tested before the actual interviews, the first interviews revealed that some questions needed clarification and some were asking the same thing with different words. Thus, these questions were either reformed or deleted. Furthermore, the answers often led the interviewer to ask extra questions and clarifications. However, the basic structure of the interview and the themes were not changed.

Altogether, 10 interviews were conducted between June and November 2018. The interviews were conducted one-to-one and face-to-face at the premises, where the interviewee was working. All interviews were held in Finnish, which was the mother tongue for both the interviewer and the interviewees. This possibly improved the quality of the interviews, since the risk of misunderstandings was smaller than when conducting interviews with a foreign language. The duration of the interviews varied between 30 minutes and one-and-a-half hours, the average being 53 minutes and 47 seconds. On average, the interviewees had been working in their companies for more than five years, but they had about 16 years of experience from the finance and IT-industry. The following table illustrates the data collected during the empirical research.

Table 6. *Data regarding interviews*

Number	Date	Role	Level	Company	Duration
1	7.6.2018	Architect (1)	Operative	Bank	01.05.13
2	11.6.2018	Product manager	Management	Bank	01.24.54
3	12.6.2018	Architect (2)	Operative	Bank	00.58.24
4	24.8.2018	Architect	Operative	IT-service provider	00.25.11
5	28.8.2018	Director (1)	Management	IT-service provider	00.46.21
6	29.8.2018	Director (2)	Management	IT-service provider	00.49.19
7	31.8.2018	Head of architecture	Operative	IT-service provider	00.31.11
8	4.9.2018	Head of R&D	Management	Bank	00.52.15
9	5.11.2018	Advisor	Management	Tax office	01.11.44
10	5.11.2018	Analyst	Operative	Tax office	00.53.13

As mentioned in Chapter 3.2, all interviews were recorded and the recordings were later transcribed. According to Koskinen et al. (2005), there are four levels for transcribing interviews, level one being the roughest and level four the most detailed analysis. In this study, the interviews were transcribed word-to-word, which corresponds to the standards of level three. The researcher decided to conduct such a detailed transcription, because the empirical research in this study was mainly based on one method. Thus, it is important that the interviews are analyzed in detail to understand not only what is said, but also to identify non-verbal communication and contextual settings (Saunders *et al.*, 2012, p. 550). Without the context, the interview data would inevitably become poorer.

After the transcription, the interviews were coded and organized to 16 different categories in Excel, which were identified while reading the interview transcriptions. For example, the categories included current problems in the finance industry, technology, benefits, challenges, success factors, ecosystem structure, roles and future. According to Saunders et al. (2012, pp. 546–548), this helps to identify the important themes and make sense of the data. The author also utilized colors when coding the interviews, because this helped her to separate different organizations and different interviewees from one another. Then the author grouped these categories into a logical order, which she found helpful in answering to the research questions, which is also encouraged by Saunders et al. (2012, pp. 546–548). She also merged some of the categories together in order to create a logical story. Furthermore, the framework built in Chapters 2.3.2 and 2.3.3 was utilized, when

presenting the results. This framework helped to find differences and similarities between different ecosystem roles, and between management and operative level interviewees. Yin (2009) also suggests that this benefits the data analysis.

Even if the interview data represents the preliminary data in this research, other data sources were utilized, too. Meetings and presentations about the ecosystem concept, and white papers about the distributed ledger technology used in building the ecosystem (Corda) provided important background information for the researcher. Furthermore, the researcher got material regarding other similar ecosystem projects that the IT-service provider and the bank had been conducted earlier. Tax office provided some basic material about DLT ecosystems, too. This secondary material is illustrated in Table 7.

Table 7. *Data regarding secondary data sources*

Number	Data content	Data type	Source
1	Ecosystem concept	Presentations, meeting notes, demo presentations	IT-service provider
2	White papers	Technical documents about DLT (Corda by R3)	IT-service provider
3	Similar ecosystem projects	Presentations, videos	Bank, IT-service provider, tax office

This secondary data helped the researcher to understand the notions and answers of interviewees better. The material was also used to reflect the results and validate the discussion. Saunders et al. (2012, p. 554) recommend to utilize different documents as a means of triangulating other empirical data, too. This is especially important in this study, because interviews were the main data collection method. Furthermore, the white papers helped the researcher to gain a deeper understanding of the distributed ledger technology (Corda) itself.

4. EMPIRICAL RESULTS

This Chapter presents the empirical interview results with the help of the framework developed in Chapters 2.3.2 and 2.3.3. The framework is used to identify similarities and differences between different ecosystem roles. It is also discussed, what kinds of differences and similarities were identified between operative and management level interviewees. The results are divided into six different categories in order to create a logical story of the themes discussed during the interviews. First, the current situation and motivation within the finance industry are presented. This section identifies the problems and reasons, which create demand for distributed solutions. Furthermore, the current status of organizations regarding distributed technologies is reviewed. Next, the author explains, what kind of benefits, challenges and success factors of DLT ecosystems were identified during the interviews. Then, the roles and structures of these kinds of disruptive ecosystems are discussed. Finally, the results regarding the future and potential of DLT ecosystems are presented.

4.1 Current situation and motivation in the finance sector

Before implementing a new technology to an industry, it is important to understand the current situation in this specific field. According to all interviewees, the finance industry suffers from inefficiency. Behind this inefficiency, there are many different problems, which are partly due to governance, partly due to technological difficulties. The regulatory environment in the finance sector is known to be very strict and this was also highlighted by interviewees from the bank. The technological situation was summarized by one operative level interviewee in the following way:

"The old model of doing things starts to reach its end technologically; systems are complicated, old, expensive and difficult to maintain." (Architect 1, bank)

All three different organizations interviewed agreed on the biggest issue in the industry: sharing and transferring data between organizations is very slow and difficult. Strong regulation affects this but when it comes to technology, all organizations explained the issue from their own points of views. The interviewees from the IT-service provider told that when sharing data to a new party, one has to build a new integration between these companies every single time. This takes time and burdens the management. On the other hand, the interviewees from the bank and the tax office highlighted that the whole industry and its systems are divided into silos. Thus, the data in the silo is only available for someone, who works in that silo. This means that both different companies and even different teams within one company work with same problems and solutions without knowing from another. This is very inefficient.

Both the bank and the IT-service provider explained that the current processes are expensive, slow and disposable. The interviewees from the tax office added that current processes lack credibility, too. There are still a lot of manual processes and paper in the industry. For example, digital signatures are not widely used yet, as the product manager from the bank noted. This requires a lot of labor, increases the management costs, and exposes to human errors. One architect gave a good example of general inefficiency:

"For example, companies know your customer (KYC) processes are extremely expensive and disposable. If the company has five banks as customers, it has to conduct the KYC-process for each bank separately." (Architect 1, bank)

The KYC-process refers to a process, where the bank validates the identity and credibility of its customers. Currently, the bank has to conduct this process for every new customer. Thus, there might be a situation where multiple banks conduct the same validation for the same customer, without knowing from another. It would be much more efficient, if banks could better share information between each other and only one bank had to conduct this process. Furthermore, another example of inefficiency is related to contracts:

"If there has originally been a contract between three parties and then one party is replaced with another party and again with another party, it is really difficult to manage contracts." (Product manager, bank)

Both the bank and the IT-service provider especially liked to find examples from trade finance, when it came to current problems in the finance industry. There is still a lot of physical paper in this sector and many manual processes have not yet been digitalized. The IT-service provider mentioned the problems in the transportation industry, while the tax office did not highlight any specific field. Finally, all these problems have made it hard for smaller actors to join the market. Thus, the current systems lack scalability. The director (2) from the IT-service provider illustrated the situation:

"It is becoming more expensive to maintain the integration network between companies all the time, and this network cannot be scaled because it takes so much time to build it in the first place. Thus, there is a clear need to manage the transactions and processes in the network by using distributed technologies." (Director 2, IT-service provider)

These problems in the industry have increased the demand to find new solutions. Especially distributed technologies (ledgers and blockchains) have gained a lot of interest in recent years. Using distributed technologies, APIs (application programming interfaces) and nodes it is possible to connect different actors to the same network, even if they would not be using same platforms. Adding a node to the existing network is much easier and faster than building a new end-to-end integration. In addition to the scalability, this construct also provides an easy way to share and transfer data between the network parties. Because every transaction is traceable, the actors would be able to control better, who can

view certain information. Thus, distributed technologies create a premise for ecosystems, which all interviewees see as a way to do business in the future.

Currently, the situation between bank, IT-service provider and tax office differs a little, when it comes to ecosystems and distributed technologies. Bank and tax office have actual projects around actual ecosystems, which are built on a distributed ledger technology (Corda). IT-company only has a concept without an existing ecosystem, but this concept utilizes Corda, too. However, this company has several ecosystem projects, which are not based on distributed technologies. None of the DLT projects is yet in production but the bank is aiming to start the production in early 2019. Bank and tax office have at least some full time resources assigned to work with these themes. In the bank, employees mainly focus on these new technologies, while the tax office even has employees focusing especially to ecosystems. On the other hand, the IT-service provider only assigns part time resources to work with distributed technologies and ecosystems. The following figure summarizes this situation.

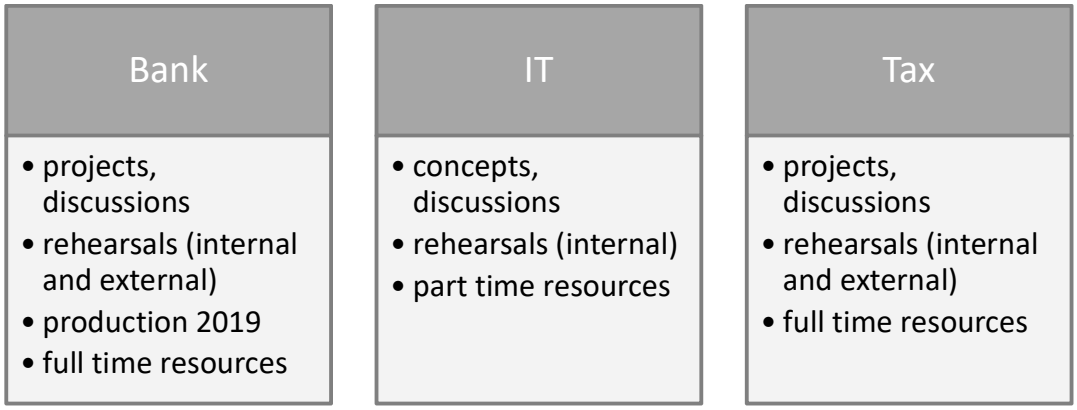

Figure 14. *Current situation in organizations regarding ecosystems based on distributed technologies*

All interviewees agreed that distributed ledgers are excellent technologies, but they had different views regarding the readiness of the technology in the ecosystem concept. The interviewees based their answers on the technology they use (Corda), but highlighted that not every DLT and blockhain is as developed as Corda. Almost all interviewees were relatively positive about the technology: they believed Corda is soon ready for production and already suits well to be used in smaller ecosystems of six to ten actors. Even if there are still some problems, IT-service provider and tax office illustrated that the technology is near to its take off point in the technology S-curve. However, the bank's head of Research and Development (R&D) was very skeptical and argued that the technology will need more time to develop than the industry believes. He explained that the technology does not fit well to the current environment, where regulation and data security restrict the industry.

Considering the challenging situation in the industry and the activities the organizations have made, it is clear that the motivation to participate to ecosystems and their development is great. There are also other reasons that force companies towards new models. For example, according to the law, real estate business has to be digital in Finland from January 2019 onwards. Especially the interviewees from the bank highlighted that the technology is interesting just because it is something completely new and poses fascinating technological challenges. Both the IT-service provider and the bank mentioned that the fear-of-missing-out keeps them active and interested, too. However, the biggest motivation for organizations are perhaps the benefits, which distributed technologies provide in ecosystem context. These are discussed in the next chapter.

4.2 Benefits of distributed technologies in ecosystems

Organizations believe that there are various benefits that distributed technologies bring to ecosystems. The interviewees mentioned words like fluency, speed, quality, reliability, transparency and easiness. The 10 main benefits mentioned in the interviews are represented in the table below. The table specifies which organization mentions which benefits, and whether these benefits are mentioned by operative level interviewees (O) or by management level interviewees (M). Controversial opinions are marked with red.

Table 8. *Benefits of DLT ecosystems for different organizations (O = operative, M = management)*

	Inter-organizational efficiency	Data sharing and transferring	Cost savings	Security & criminality	New business possibilities	New innovations	Competitive advantage	Scalability	Practical Benefits	Benefits for end-users
Bank	OM	OM	OM	M	OM	-	OM	OM	OM	OM
IT	M	OM	OM	OM	OM	M	M	OM	-	OM
Tax	OM	OM	O	OM	M	-	M	OM	O	OM
TOTAL	5	6	5	4(-1)	5	1	4	6	3	6

Since inefficiency is perhaps the biggest issue currently in the finance industry, efficiency, especially in inter-organizational processes, is one of the biggest benefits of distributed technologies in ecosystems. This benefit was mentioned by all organizations. Interviewees from bank and tax office highlighted that the new model would break the silos and open up the industry. The architect from the bank clarified this idea:

"Fundamentally, this technology (DLT and blockchain) is all about making inter-organizational processes more efficient and all business is about inter-organizational processes. No organization is living for itself." (Architect 1, bank)

When inter-organizational processes are more efficient, sharing and transferring data becomes easier, too. This was also mentioned by all organizations, and they highlighted the visibility rights: one can define the visibility rights for certain information for certain actors and they can access this information, whenever they need it. This removes the obligation to declare and thus, decreases the dependency between actors in the ecosystem:

"-- we do not need to get all information from the ecosystem to our hands but we could have the contractual right to check the information we need -- this is how we see the world of future instead of companies reporting to us at regular intervals. The data would always be real-time, accessible and correct." (Advisor, tax office)

The interviewees argued that visibility rights would speed up the process, provide high-quality data and make this data more reliable, transparent and easier to access. Furthermore, this would remove the need for reporting same data in a different form to a different organization, said the advisor from the tax office. It would be enough to upload the data once in one format to one system. This and other benefits mentioned would naturally lead to significant cost savings, too. According to the architect from the bank, the costs could be decreased to 10 % of the original ones. He also said that smaller fixed costs mean that there would be more value in the ecosystem to be shared between the different ecosystem parties.

When it comes to data sharing and transferring, questions about security and criminality raise. IT-service provider and tax office found it certain that distributed technologies could increase the security in general. The IT-service provider justified this from the technological perspective. One architect explained that DLT makes every transaction traceable and ensures identity, i.e. everyone in the ecosystem always knows who does and what. Tax office added that the ecosystem would make criminal activities more complicated. This can also be explained from a technological perspective: if the data is distributed to several locations, criminals should break in to all these systems to get the complete data. Hence, the architecture increases safety. Furthermore, the advisor said that the possibility not to declare taxes would be eliminated, because authorities would get the information automatically or they would have the right to view it. The analyst explained that it would not be possible to apply compensations for one incident from many insurance companies at the same time anymore. The IT-service provider admitted though that new systems always intrigue criminals and they certainly try to find ways to utilize distributed technologies to commit crimes.

However, the head of R&D from the bank had a completely controversial opinion, when it comes to security. He explained that the technology is so complicated that even if it

would provide ways to increase security, especially end-customers do not know how to protect data. He argued that until now, data has been protected, because sharing it was so difficult. Since data sharing would now be much easier and faster, data cannot be secured the same way anymore. The product manager from the bank added that actors lose the control of products through distributed technologies – ecosystems connect multiple parties and the financier might not always know where the money ends up. The system ensures that the transaction is unique but it does not ensure its authenticity. Thus, the other party can even be a criminal:

"How will you ensure that you are not the number one sponsor of terrorists? -- The threat is close all the time." (Product manager, bank)

Despite of the controversial views regarding security, all organizations identified that using distributed technologies in ecosystems would bring many new business opportunities. Both bank and IT-service provider explained that the ecosystem would provide them a bigger market and an access to new customers. The bank presented that the DLT ecosystem would even provide them an opportunity to go global:

"When it comes to the international context, we have to rely on the cooperative network anyway. The more efficient this network is, the more it benefits us. We can utilize this flexibility." (Product manager, bank)

The director (1) from the IT-service provider illustrated that the new business possibilities are a big motivation for the organization to participate in the first place. He tied these new possibilities to new ideas, innovations and perspectives: the ecosystem combines different parties with different backgrounds from different industries, and this cross-industry environment leads to completely new business ideas. This director was the only interviewee, who especially highlighted the benefits for innovation activities.

The director (1) from IT-service provider also gave an example regarding the cross-industry benefits. He had been working with an innovation ecosystem, where the idea was to provide better service for elderly people. A company providing devices for measuring the quality of electricity had contacted them and suggested cooperation. At first, the development team from the IT-service provider did not see any use for this kind of an actor in the ecosystem. However, the company explained that their measurement devices could tell what kinds of devices, when and how long elderly people use in their house – for example, do they cook, watch television or use a microwave oven. This would allow service providers to focus their services better to actually potential customers. For example, food service companies would not offer their services to people, who are still able to cook themselves.

All organizations and especially the management level interviewees mentioned that DLT ecosystems are crucial for competitive advantage, too. The organizations have noticed

that they cannot make their services any better alone and in order to compete in the industry, they need ecosystems:

"The information about a person that a single service provider has is no longer enough to make individual services better for this person -- sharing data is something that benefits everyone." (Director 2, IT-service provider)

"We as a bank cannot do all these things that others (fintechs, blockchain start-ups, Amazon, WeChat) do, but we have to create some kind of a shared ecosystem, where there are many other banks and companies. Then, we can provide our services in this ecosystem." (Architect 2, bank)

"Instead of utilizing one kind of data to provide services for customers, companies and states, we can combine the data from various sources. This can yield lead to many new business opportunities." (Advisor, tax office)

Furthermore, every organization mentioned scalability as one of the benefits of DLT ecosystems. The operative level interviewees from bank, IT-service provider and tax office explained that this scalability is due to technology: one can build a new node and add it easily to the ecosystem without the need for a point-to-point integration. Furthermore, product manager from the bank said that the ecosystem would allow every party to use their own platforms, since they can communicate in the ecosystem through APIs. All organizations have also noticed that these things especially benefit smaller actors. Since transaction costs are significantly lower, smaller actors have possibility to join to the ecosystems and at the same time, they can access all the customers that bigger companies have brought to the network. On the other hand, management level interviewees from the bank and IT-service provider added that smaller actors are important to bigger actors, too, since they bring their special competences to the ecosystem and conduct tasks that others cannot do.

DLT ecosystems bring operative level benefits, too. All organizations mentioned that the system would fully digitalize the finance industry – this would be a significant improvement for sectors, where there is still a lot of paper and manual work. This again would release employees away from manual processes to more productive tasks, as the product manager from the bank added. Especially interviewees from the bank and the IT-service provider highlighted the benefits that the ecosystem would bring to trade finance. Furthermore, bank's management mentioned that ecosystems would make monitoring from the technological perspective significantly easier. When it comes to tax office, the need for monitoring would exit completely:

"We find it beneficial, if we can trust that taxes regarding a transaction on this platform have either been paid or declared – we do not need to specifically monitor this transaction." (Analyst, tax office)

For bank and IT-service provider, all benefits mentioned above are more or less accurate. Bank highlighted efficiency in processes, improvement in data sharing and practical benefits. IT-service provider, for its part, found new business possibilities and innovations important. However, the main benefits of the tax office are even clearer. Both interviewees from the tax office explained that their aim is to ensure that authorities' rules and regulations are built into the system. First, they are satisfied, if they get the information regarding taxable transactions (invoicing, VAT etc.) automatically or they have the right to view this information. Second, they want the data to be real-time, accurate and reliable, so that the need for monitoring is eliminated. This is summarized in Figure 15 below.

Figure 15. *Main benefits of DLT ecosystems for different organizations*

In addition to all these benefits the DLT ecosystem would bring to the ecosystem members, the new model would also help end-users. All organizations explained that the user experience would become better: the end-user can do business with all parties in the ecosystem at once and in the same place. Following example illustrates a possible scenario:

"It does not have to be more than two minutes, than the end-user gets three offers from different actors and there is a possibility to sign the contract immediately with fingerprint identification. The insurance was invited to bid and sold in two minutes, this is the goal." (Architect 1, bank)

When it comes to taxes, the end-user would have to do nothing, since the process would be automated. The director from the IT-service provider brought up an example from health care industry. He referred to a situation when an end-customer suffering from diabetes goes to see a doctor. If the doctor had real-time information from the different devices the patient uses (data about blood pressure and sugar levels etc.), he or she would likely be able to serve the patient better. In this case, the patient would not have to memorize this information, which poses a threat to mistakes or false interpretation. These examples illustrate the optimal situation, which organizations truly believe to be achievable. However, there are still many challenges on the way towards functioning ecosystems. These challenges are presented in the next chapter.

4.3 Challenges of distributed technologies in ecosystems

Organizations mentioned diverse challenges of DLT ecosystems during the interviews. However, all interviewees shared the same common opinion that the biggest challenges are not related to technology itself but to the things around it. These challenges are grouped in 10 different categories, which are presented in the table below. The table specifies which organization mentions which challenges, and whether these challenges are mentioned by operative level interviewees (O) or by management level interviewees (M). Since the IT-service provider and tax office said that DLT ecosystems increase security and prevent criminality, their opinions are marked with green.

Table 9. *Challenges of DLT ecosystem for different organizations (O = operative, M = management)*

	Book of rules	Regulation & law	Confusion & newness	Lack of resources & finance	Challenges related to actors	Cooperation & competition	Change resistance	Security & criminality	Technology & development	Challenges for end-user
Bank	M	OM	OM	O	OM	OM	OM	M	O	M
IT	M	OM	OM	OM	OM	M	-	OM	O	-
Tax	M	OM	OM	-	-	O	-	OM	OM	-
TOTAL	3	6	6	3	5	5	2	1(+4)	4	1

The biggest challenge according to all organizations is the book of rules in the ecosystem, and how organizations develop and agree about these rules. Even though only management level interviewees mentioned this challenge, it is often the reason behind many other challenges mentioned by operative level interviewees, too. For the bank's head of R&D, this was the biggest reason, why he was very skeptical about the DLT ecosystems:

"We have still not sorted out these problems related to cooperation between organizations in a unique way. The technology does not eliminate the need to agree about these things." (Head of R&D, bank)

Both the tax office and IT-service provider explained, why the common rules are so difficult in the ecosystem context. Director (1) from the IT-service provider gave an example about innovations and asked: Who owns a new innovation developed in the ecosystem? Do all participants own it? If not, how can the ownership be defined? He highlighted that

this problem is crucially linked to the fact, who is allowed to capture the value, which is created through this innovation. The advisor in the tax office added that in an international context, agreeing about the rules is even more complicated. Different states have different laws and regulations, and it is very difficult to align them. Furthermore, he explained that it takes minimum five years to develop common standards, which are crucial for a functioning ecosystem. Likewise, the managers from the bank were concerned that these problems might lead back to centralized systems and new silos only with different technological configurations.

Another big issue mentioned by all interviewees were regulations and laws. Currently, data sharing is still difficult due to strict regulations in the finance industry. Director (2) from the IT-service provider explained that global corporations might have rules, which forbid data sharing in some countries. Analyst from the tax office said that tax authorities have strict rules what information they are allowed to view, too. Thus, not all possibilities that the technology provides can be utilized currently. It is also difficult to match the old regulation to a new technology. This was mentioned by the interviewees from the bank and IT-service provider:

"A great deal of regulation is built for a world, where these things are not possible. -- With these technologies, we could fulfill the requirements of the regulations significantly better, but in order to do so, we need to change the current regulation, which forces us to do things in a certain way. This will be a very big challenge." (Architect 2, bank)

"Since there are no laws regarding blockchains and etc. yet, the old regulations are applied and how this will be done, no one knows." (Head of architecture, IT-service provider)

Tax office emphasized that it is highly important to develop regulations and laws to the right direction – both the advisor and the analyst underlined the need for "an enabling legislation", which would allow utilizing the full potential of the technology. However, the analyst noted that at the moment, the development is going to the wrong direction in Finland: the draft of the new information management legislation of Ministry of Finance demands that the communication between authorities has to be messaging-based (Valtiovarainministeriö, 2017, p. 94). This requirement means that whenever data is changed in a database, a message will be sent to the authority, whom this information concerns. Since blockchain and DLT are not messaging-based, they would be prohibited according to this alignment. Tax office has left a statement, which notes this issue and suggests excluding the notion for a messaging-based architecture. According to the advisor of the tax office, it takes minimum three years to prescribe laws – thus, there is still time to adjust the alignment.

Because of the uncertainties in rules and legislation, there is a significant confusion around the ecosystems and DLTs in the finance industry. For example, the interviewees

from the bank noted that business models and the way revenue is created are going to change inevitably. According to all organizations, uncertainties related to the management of the ecosystems are also a big problem. There are many open questions considering the responsibilities, costs and operations of the ecosystems: for example, who will take the responsibility, if the ecosystem is not working as it should. The director (1) from the IT-service provider emphasized that it is difficult to know how to lead ecosystems. This is partly related to the newness of these networks and technologies, which was noted by both operative and management level interviewees from the bank and IT-service provider. One architect noted:

"The technology is completely different what we have used so far -- The technologies that we use are not truly eligible for production until the end of this year (2018)." (Architect 1, bank)

Especially, operative level interviewees highlighted that working with DLT solutions and estimating their effects is difficult, because there is no functioning production environment to test the technologies. However, this should soon change, since the bank is going to start the production in 2019.

The next topic mentioned in the interviews was related to the lack of resources and finance. Among all organizations, especially the director (2) from the IT-service provider saw this as a big problem:

"We need to utilize people when they have time, which makes building this kind of a concept really fractured, and risky -- we have mechanisms to get finance for products based on these new technologies, but these do not allow us to participate to ecosystems in order to simply learn." (Director 2, IT-service provider)

The architect from the bank did not mention difficulties when it comes to human resources, but he emphasized that sometimes it is hard to get financing for these kinds of new projects. He said that it is hard to give plausible estimates whether the project will be profitable and how long it takes to get returns. He described the situation in a following way:

"The more disruptive the projects and technologies are the more one needs to use other methods than the traditional ones for justifying the investment. When it comes to excel practices, we always lose." (Architect 1, bank)

With this notion, the architect referred to the fact that traditional ways of justifying investment decisions, such as calculating the payback period for the investment and estimating its returns, do not suit to technologies with a disruptive nature. Furthermore, he added that internally, it has sometimes been hard to find an owner for blockchain and DLT projects, because the projects are multidisciplinary and do not necessarily fit to the

existing division of departments and teams. Tax office did not mention any problems regarding resources and finance.

Since actors are in a central role in ecosystems, there are also problems related to them. Bank and IT-service provider emphasized that it is difficult to gather all the right actors "around the same table". Architects from the bank noted that the ecosystem have to achieve the critical mass, i.e. enough participants, to be able to maintain itself. However, the bank said that it is not enough to involve the actors, but they need to be engaged for a longer period, too:

"There is a big risk that an actor wants to exit the ecosystem and then its role and responsibilities will burden other actors. In the worst case, the whole project will fall flat." (Architect 2, bank)

Bank and IT-service provider shared the concern related to finding the right actors. However, the bank was mainly interested in engaging enough participants, while the IT-service provider was more concerned about being able to manage the system. Both directors from the IT-service provider highlighted that especially in the beginning, the amount of actors should be moderate in order to launch the system and to be able to manage it.

Furthermore, one should consider the relationships between actors, too. In the ecosystems, one should often be able to both cooperate and compete with same actors at the same time, which is referred as coopetition. In the bank, operative level interviewees were more suspicious, how this will work, while the management saw this more as an opportunity. Both bank's and IT-service provider's management mentioned that it is challenging to trust and share own knowledge to ecosystem participants. This is also related to criminality and security. Since this topic was discussed in Chapter 4.2, it will be skipped here. When it comes to pure competition, both bank and tax office agreed that it will be more fierce in ecosystems than with current business models.

Even if all organizations have mainly identified similar challenges, change resistance was only noted by the bank, especially by the management. In general, there is always change resistance when it comes to new technologies and solutions. One architect from the bank noted that finance industry is known to be very conservative and unwilling to change. According to the managers, it is very hard to replace existing systems and disrupt the industry, if there is a common belief that the old way of doing things is still good enough. Head of R&D justified his thoughts in a following way:

"Unfortunately, existing technologies are good enough and replacing them is too expensive and requires too much work, i.e. this makes the potential, limited cost savings marginal. If the ecosystem increases efficiency, bigger actors might lose some value, which decreases their motivation for development activities in their core business areas. That is why existing systems are a problem difficult to overcome." (Head of R&D, bank)

Mainly operative level interviewees mentioned some issues related to technology and its development, too. Architects from the IT-service provider and tax office explained that the distributed network is much harder to maintain than a centralized one. Thus, there are still technical difficulties when data needs to be modified, because updates should be done for several parties. Architect (2) from the bank added that compatibility of different systems can also cause problems. All organizations noted that it is hard to find the right direction for the development. Especially, the bank highlighted that end-users should be the main focus in development activities – solving problems only from a technological perspective does not lead to good results and end-users cannot be forced to use new solutions. Since it is also expensive to build the ecosystem, it should be done correctly at once.

As the discussion above implies, there are some differences, how each organization defines its biggest challenges in DLT ecosystems. For the bank, setting the common rules and overcoming change resistance and the issues related to existing systems seemed to be the biggest issues. The IT-service provider saw it as a challenge to break its traditional reputation as a company providing application maintenance services. It aims to be in the front line of development of distributed solutions. However, resources, financing and difficulties in trusting other ecosystem participants might be on its way, when trying to achieve this goal. The analyst from the tax office described that being a member in many ecosystems might be challenging. Tax office cannot built a node to all networks but it has to manage its activities through an interface strategy. Regulation and laws can complicate the involvement of this actor, too.

Figure 16. *Main challenges of DLT ecosystems for different organizations*

When it comes to the end-user, only the bank's head of R&D mentioned some challenges. He said that one needs to be "a certain type of a person in order to understand the technology". Even if he agreed with other organizations that theoretically, the end-user would not have to understand what happens under the user interface, one question remains. According to the head of R&D, the end-user should be concerned, whose rules she or he will be committed, when making a transaction. However, there are ways to overcome the challenges and prevent the problems – the next chapter discusses the success factors of DLT ecosystems.

4.4 Success factors of distributed technologies in ecosystems

The table below presents the main success factors for DLT ecosystems and how these systems should be built in order to be successful. The table separates the opinions of different organizations and presents the differences between management and operative level interviewees. The success factors are grouped in 10 different categories.

Table 10. *Success factors of DLT ecosystems for different organizations (O = operative, M = management)*

	Shared benefits & problems	Credible ecosystem	Book of rules	Permissioned & transparent	Building & structure	Enough right actors	Need for a neutral leader	Resources & investments	Enabling environment	Acceptance of end-users
Bank	OM	OM	OM	OM	OM	OM	OM	-	M	OM
IT	OM	OM	OM	OM	OM	OM	M	OM	OM	OM
Tax	M	-	M	OM	OM	-	M	OM	M	M
TOTAL	5	4	5	6	6	4	4	4	4	5

All organizations considered shared benefits and problems between participants an important success factor for DLT ecosystems. Interviewees from the bank explained that there has to be demand for a new solution, and everyone in the company but also in the industry should agree that things need to change. The director (2) from the IT-service provider explained that shared benefits and problems among the actors lead the ecosystem to the right direction. Bank and IT-service provider counted credible ecosystems among the success factors, too. Interviewees from these organizations highlighted that the participants have to trust that the ecosystem and its technology will succeed. According to the director (2) from the IT-service provider, this trust is easier to gain, if the ecosystem can find proper business possibilities for the technology.

The previous chapter listed the book of rules as one of the biggest challenges for DLT ecosystems, but it is obvious that a successful ecosystem needs rules. The management of the IT-service provider highlighted the need for trust among parties, while the bank saw equal chances for all an important factor. Both of these companies also emphasized that actors should remain satisfied with the ecosystem and they should get benefits out of it. However, all organizations demanded clear responsibilities and roles, and highlighted the need for shared understanding:

"The book of rules helps the whole ecosystem -- it should be open for all, so that every organization knows their own role in relation to the ecosystem." (Advisor, tax office)

"Creating a successful ecosystem requires that different parties understand the vision from their own perspectives and see the big picture." (Director 2, IT-service provider)

"Everyone in the ecosystem should know what the ecosystem does." (Architect 2, bank)

Furthermore, all interviewees emphasized a similar structure for the ecosystem: it should be permission-based but as transparent as possible. A permissioned system is limited only for selected participants (DLT ecosystems), while permissionless systems are available for everyone (bitcoin and many cryptocurrencies). Accenture's representatives Fielder and Light (2015) compare permissioned systems with intranet and permissionless with internet. Architects from the bank explained:

"We cannot make a completely open system, where whoever could do whatever, like in these public blockchains. We have quite a strict regulation and we want to do business in a certain way, serve our customers in a certain way." (Architect 2, bank)

"If the ecosystem does not work properly and someone ends up losing money -- there has to be someone, from whom you can ask for compensations." (Architect 1, bank)

The management from the bank and the tax office added that the common rules should include a notion, what the requirements for new ecosystem participants are. The bank's product manager said that this is about ensuring the identity and the nature of the new actor. Furthermore, all interviewees emphasized openness and transparency in the ecosystem. This transparency has two different meanings. First, all organizations highlighted that it should be easy for new actors to join to the ecosystem. Second, especially the management demanded open communication, information sharing and cooperation among the participants. IT-service provider explained that organizations should be able to open their own activities and share information to the ecosystem in order to get something back. This was something the company also saw as a challenge for itself.

When it comes to building the ecosystem, the bank and the IT-service provider shared views. When launching an ecosystem, it is important not to have too many participants, so that the system is still manageable. The director (2) from the IT-service provider explained that one should first create a minimum viable product (MVP) or in this case, a minimum viable ecosystem (MVE):

"First, we focus on retail and insurance, and build the interaction between them -- when there is trust that the interaction works, we can add new features to this interaction, and suddenly, we notice that we have an inter-organizational process in operation. Then, we can scale again and start seeking new actors, new retail companies etc. to join." (Director 2, IT-service provider)

However, after the ecosystem works properly, both bank and tax office emphasized that the goal should be to expand the system to international environments. The analyst from the tax office said that the system should cover at least whole Finland in the beginning, and later expand to Europe and to the world. The bank and tax office also highlighted that it is crucial to build the ecosystem correctly at the first time, because it is difficult to modify the system afterwards. That is why the product manager from the bank added that control mechanisms already have to be build-in in the beginning. This is also the reason, why tax office is interested in these ecosystems before they have even been built: their aim is to ensure that the ecosystem is built according to their rules and regulations.

Moreover, the advisor from the tax office explained that the ecosystem should be sensitive and able to react to changes. However, the director (1) from the IT-service provider noted that the more actors the ecosystem includes, the stiffer it probably is. The head of architecture from the IT-service provider added that the ecosystem should be easy to use, while the product manager from the bank demanded that its operations should be transaction-based. This means that for example, service fees should not be fixed but based on transactions. This ensures that the ecosystem is fair to smaller actors, too. However, tax office and bank mentioned something that the IT-service provider did not say. They emphasized that the ecosystem could have a juridical entity of its own, which could take care of administrative tasks. The head of R&D noted that if there was a joint venture (JV), it would be easier to define the ownership of the ecosystem's innovations, for example. The analyst from the tax office added:

"The joint venture will decide about the book of rules -- The private companies establish the joint venture, public administration (tax office etc.) cannot be included to it." (Analyst, tax office)

There are several success factors related to the ecosystem actors, too. However, only bank and IT-service provider clearly considered these factors. First, these companies highlighted that the ecosystem requires enough actors in order to utilize the benefits of the distributed technology properly. The management of these companies emphasized the importance of right people, actors and structures, and the diversity of the ecosystem. The participants should fit in the context of the system, too. Managers mentioned following things:

"It is good that there are governmental agencies in the ecosystems, too – this creates different kind of depth, credibility and substance. I would seek for diversity -- if we work around digitalizing paper, then the parties, who use paper, should be included." (Head of R&D, bank)

"The innovativeness and vitality of the ecosystem are created by the companies themselves." (Director 2, IT-service provider)

The product manager from the bank added that the participants should also be mature enough – for example, if some actors do not have required competences or their industries cannot implement distributed solutions, they delay the overall development of the ecosystem. The advisor from the tax office also mentioned this, even if he did not comment the topic any other way. Bank and IT-service provider noted that competitors and other highly valued companies attract organizations to join ecosystems, too. The head of R&D argued:

"Would we have joined to the R3 consortium, if it had not included 16 significant banks, and we think these banks might understand something that we do not? Probably not. It is a big reserve in the beginning, when there is no evidence that the fear-of-missing-out is created and people think they will miss something, if they are not involved." (Head of R&D, bank)

Finally, the management of the interviewed organizations mentioned that the ecosystem inevitably needs a leader. All organizations also added that this leader should definitely be a neutral one:

"It would always be easier, if there were a neutral orchestrator, who collects and shares information to all members." (Head of R&D, bank)

"It would be easier for competitors to trust, if there were a neutral party that the ecosystem operates for common good." (Director 2, IT-service provider)

All in all, tax office and IT-service provider emphasized the need for sufficient resources and investments. While the IT-service provider mentioned that management support is crucial, tax office argued that test labs, where you can experiment the technologies, would be beneficial. The bank did not mention these factors at all. However, external factors can also influence the success of the ecosystem. Tax office demanded for enabling legislation, while IT-service provider and bank argued that if the new system is better than the existing one, the possibilities for success increase.

As the last success factor for the ecosystem, the organizations mentioned the acceptance of end-users. These users should be the main focus when building the system, and the system should meet their needs and requirements. The head of architecture from the IT-service provider demanded user-friendliness, but at the same time, he and the architect (1) from the bank said that the end-user should not even see the ecosystem under the user interface. Even if some factors related to ecosystem actors were briefly discussed in this chapter, the actors need a more detailed analysis. When actors join the ecosystem, they assume certain responsibilities, which define their role, position and actions in the ecosystem. Both the responsibilities, roles and relationships between ecosystem actors are discussed in the next chapter.

4.5 Responsibilities, roles and relationships in ecosystems

According to the bank's head of R&D, the book of rules defines the roles and responsibilities for the ecosystem participants. Since there are no existing ecosystems based on distributed technologies yet, it is difficult to define exact roles for the participants. Furthermore, all interviewed organizations admitted that an ecosystem is a constantly changing entity, and its roles and responsibilities change over time. That is why this chapter first defines the responsibilities that are needed in the ecosystem. After these responsibilities have been identified, they can be combined in different ways, which leads to finding specific roles. Roles and responsibilities have been considered keeping in mind the lifecycle of an ecosystem and its development phases. However, especially the bank noted that organizations can have different roles, i.e. combinations of responsibilities, in different ecosystems, too. Figure 17 below identifies the different categories for ecosystem responsibilities.

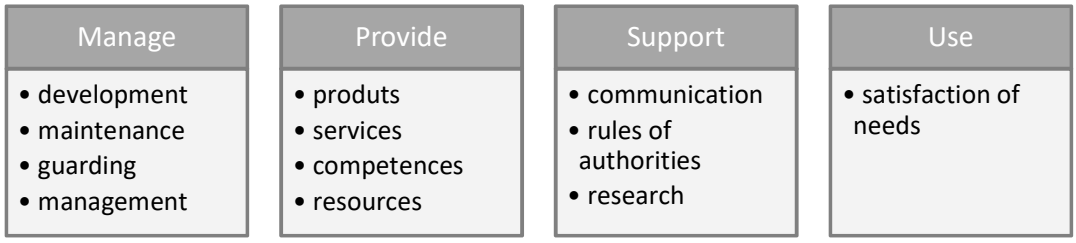

Figure 17. *Categories for different responsibilities in ecosystems*

As it was already mentioned in the previous chapter, all organizations emphasized the need for a neutral leader. These organizations also added that the one responsible for management related tasks should not otherwise participate in acting in the ecosystem. The architect (1) from the bank explained that this actor should be accepted by all members in the ecosystem and they should agree paying for it. After analyzing the interviews, four different management related tasks emerged: development, maintenance, guarding and management. All organizations and both management and operative level interviewees identified the same main responsibilities.

Development and maintenance are closely related to another and they represent the technological part of management related tasks. In early phases, bank and IT-service provider highlighted that someone needs to take responsibility regarding the development of technology and solutions. Bank emphasized coding, IT-service provider combining:

"The network operator creates the code, for example Corda, which establishes the processes, which are running in the network." (Architect 1, bank)

"We can think the integrator as a technical role, which integrates a) systems together or b) information flows between organizations." (Director 2, IT-service provider)

As these citations illustrate, interviewees used several names for an actor taking care of these responsibilities. In addition to network operator and integrator, bank mentioned technology partner and IT-service provider application developer. When the ecosystem and its processes are up and running, there is a need for someone to maintain the system, too. Bank and IT-service provider explained that maintenance includes fixing bugs in the system, participating in minor development and managing the nodes of the whole network. However, this task does not include steering the ecosystem participants. Furthermore, tax office mentioned that public agencies have been presented as one possible party to take care of the maintenance:

"In some occasions, government has been suggested to maintain certain platforms, which could give everyone open possibilities to do business." (Advisor, tax office)

Even if development and maintenance both are related to the technology, they are clearly different tasks and their importance varies in different phases of the ecosystem lifecycle. Organizations did not mention whether these tasks should be conducted by the same party or whether they should be separated. However, head of architecture from the IT-service provider mentioned that when the company has delivered a solution, they have often taken care of the maintenance, too.

However, IT-service provider and tax office added one more responsibility, when it comes to technology management related tasks. They said that the ecosystem should have a gatekeeper, who takes care of adding new parties to the network. The director (2) from the IT-service provider said that the ecosystem as an entity would decide who can join, but this role should take care of adding the party from the technological point of view. He and the analyst from the tax office said that this responsibility should be separated from maintenance related tasks. The analyst illustrated this from the technological perspective:

"We could have one extra node, which could take care of external interfaces, and which could be used to add new services into this network." (Analyst, tax office)

Since ecosystem includes several actors, someone needs to take care of organizing everything. The architect (2) from the bank called this actor a facilitator, who gathers the participants, promotes the conversation between them and manages the ecosystem overall. Both bank and tax office emphasized that taking the initiative and conducting these duties is especially important in the beginning. However, when the ecosystem matures and stabilizes, these responsibilities alter as well. It is not required for the managing party to be as active as in the beginning. Bank said that managing an ecosystem includes actively gathering and sharing information, while IT-service provider and tax office suggested that this role should be kept quite small:

"This role should be quite small, it should be more like an enabler than a guard -- then the ecosystem can develop to its natural direction." (Head of architecture, IT-service provider)

With this quote, the head of architecture meant that the managing party should not watch over the ecosystems members too much but rather guarantee a convenient environment for them to do business. Furthermore, both tax office and bank suggested that some kind of a joint venture could take care of these responsibilities, which was not mentioned by the IT-service provider. These companies also mentioned that in a project, where they both were included, a tech start-up was taking care of these activities and technological responsibilities, too. This setup turned out to be successful. The analyst from the tax office stated:

"If all banks and insurance companies in Finland established a common start-up, it would be a good, neutral actor." (Analyst, tax office)

However, the head of R&D from the bank said that the actor taking care of these management and technology related responsibilities should not be too innovative. He justified this by saying that being too innovative, the actor can easily overengineer the system. Then the network exceeds the needs of the end-users, i.e. additional features do not create any additional value, and this burdens the overall development. Director (2) from the IT-service provider added that this actor should neither try to control the whole ecosystem, since otherwise the motivation for other organizations to participate will decrease. When it comes to sharing these responsibilities, the organizations interviewed were not completely on the same page. The product manager from the bank noted that different entities should take care of management related and technology related tasks:

"When it comes to technology and management, I think it would be good to share the responsibilities. Since there are so big actors involved already in the beginning – authorities, logistics, companies – it is very unlike that anyone could, just on its own, run the whole thing." (Product manager, bank)

Architect (2) from the bank was not so radical with his statements. He said that facilitating and technology development can either be taken care of one or two separate parties, and the same applies to facilitating and managing. Even if the director (1) from the IT-service provider agreed that facilitator and technology developer are possible to separate, he was strongly suspicious regarding this set-up. The other director (2) from IT-service provider stated that as long as the ecosystem is thriving, there is no need to change the leader or separate its tasks.

However, there are also other important responsibilities in the ecosystem. IT-service provider and bank listed that the ecosystem needs actors to provide products, services, resources and competences. The bank highlighted especially that competitors have to be part of the ecosystem:

"The network should include all the competing services, because it is not a reliable ecosystem, if you can only ask from one company, how much does the insurance cost. You should be able to invite all to tender." (Architect 1, bank)

Furthermore, the system needs an advisor, who could communicate the needs from customers to the ecosystem participants, and a research institute, which would keep the ecosystem up to date regarding the newest scientific discoveries. All organizations also highlighted the role of authorities. Bank emphasized that it is important to find fitting roles to the authorities, and the tax office expressed its interest to be involved. Finally, the end-users are also needed, because otherwise, there would be no one to utilize the system. When it comes to the organizations itself, bank, IT-service provider and tax office had their own aspirations regarding the roles in the ecosystem. Their opinions are listed in Figure 18 below. The responsibilities that were listed by several organizations are highlighted with red. Research was the only responsibility that none of the organizations wanted to have.

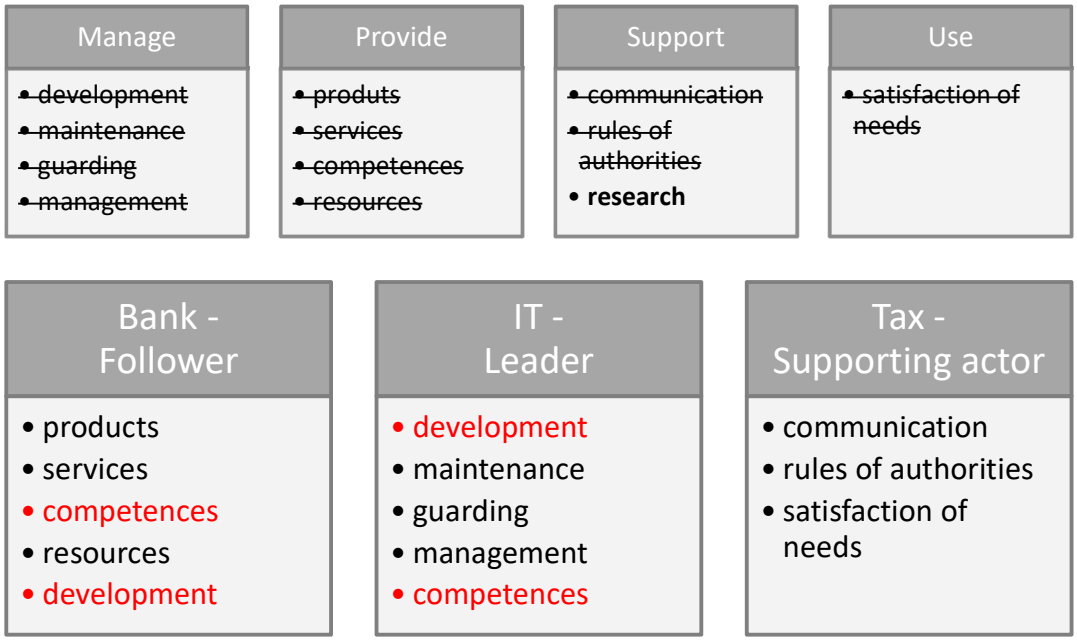

Figure 18. *Organizations' aspirations for responsibilities and roles*

According to the organizations' aspirations, the assumptions made in Table 5 in Chapter 3.3 about the roles for IT-service provider, bank and tax office was correct. The bank saw itself as a provider of products and services in an ecosystem located in the finance sector. This is a natural role for the bank considering its position in the current finance market. Because the company has strong competencies regarding distributed technologies, it would like to join the development, too. Thus, its role would be the developer-follower. The head of R&D illustrated:

"We can show initiative in the ecosystem and we are happy to follow interesting development projects, but leading is a difficult word for us." (Head of R&D, bank)

He shared this opinion about leadership with IT-service provider and tax office. They also stated that the provider of products and services cannot be the leader in the ecosystem,

because this would put other competitors, i.e. providers of similar products and services, into an unequal position. Furthermore, the product manager from the bank said that it is highly important for them to participate actively in ecosystems in Finland, but they have to accept that when it comes to international environments, their role will be smaller.

When it comes to the IT-service provider, this company wanted to be in charge of all responsibilities related to management. The architects highlighted that this company can both build the technology and maintain it, too. The directors emphasized that the company should take a more active role than before, when it comes to the development activities in the ecosystem and in customer organizations. Thus, the company wants to be a developer-leader and bring its own competences to the ecosystem, too. Directors stated:

"We want to be a leader in the ecosystem, we want to develop the system to our direction in order to develop our business." (Director 1, IT-service provider)

"These new distributed technologies make it possible for us to participate in ecosystems with a new role; we would be more like a leader, an integrator. I see that this helps us to benefit even more, when we can take a bigger role, when it comes to organizations' IT-development." (Director 2, IT-service provider)

When it comes to the tax office, it had a clear picture regarding its own role. This organization wants to be an advisor and make sure that its rules regarding taxes are implemented into the ecosystem. The advisor said that those ecosystems that are close to their own strategic focus areas (salary payment, invoicing, VAT etc.) are important for them. However, both interviewees emphasized that when it comes to commercial activities in the ecosystems, tax office has no aspire to participate. The advisor also added that the business knows, what needs to be developed and they do not have to care about that. However, the analyst argued that if the development activities concern their interests, they could possibly help and guide the development. The analyst summarized the role in a way that tells that the organization can also satisfy its needs by only using the ecosystem. Thus, the tax office wants to be a user-supporting actor:

"We want to have a role that we do not have to do anything but we get money. Automatic taxation and interface strategy so that we do not need to maintain a node." (Analyst, tax office)

In addition to roles, the relationships in the ecosystem were discussed in the interviews, too. The relationships can be divided into three different categories: cooperation, competition and coopetition, which refers to simultaneous cooperation and competition (e.g. Gnyawali and Park, 2011). When it comes to the development and building of the ecosystem, the bank agreed that this is where cooperation is especially important. Both bank and IT-service provider saw that actors should be open-minded: they emphasized open communication, and especially bank highlighted commitment and close cooperation between technology provider and other ecosystem actors. Companies from totally different

industries can cooperate in the ecosystem, but both bank and IT-service provider admitted that not all actors are interacting with one another. One interviewee from the bank explained the border between cooperation and competition:

"Together, we need to make sure that the network works -- but when the network works, we are competing on this platform as fiercely as before." (Architect 1, bank)

As this citation illustrates, ecosystem actors compete, when it comes to their core products and services. In many cases, the competition occurs between same companies, who were cooperating when building the system. This is referred as coopetition. The bank agreed that coopetition is relatively common in the finance industry. The interviewees justified this by mentioning R3 consortium and Finanssiala ry (common organization for companies in the Finnish finance industry), where different banks work together. However, the bank's management was more willing to cooperate with competitors than the more reserved operative level. The management of the IT-service provider identified the urgent need for coopetition, but the directors admitted that it will not be easy for them. The tax office only referred to coopetition by saying that the internal tensions in the ecosystem do not affect this authority.

Furthermore, external competition should be discussed, too. According to the architect (2) from the bank and the head of architecture from the IT-service provider, fin-tech start-ups were considered as the main threat for both of these companies in the finance industry 5 to 10 years ago. Nowadays, start-ups developing blockchain-based solutions are tough competitors. However, the bank saw big organizations (e.g. Apple pay, WeChat, Amazon, Google Play Store, Facebook) posing the biggest threat for them. The product manager also mentioned companies providing financing for invoices, like Klarna. IT-service provider added competing ecosystems and tax office international environments to the list of factors increasing competition. However, the architect (2) from the bank saw competition as a good thing, too:

"It would be desirable that there would be a long period of competition, where we would try different networks and update the technology, so that there would not be one technology, which captures the sector and remains as a standard the next 40 years." (Architect 2, bank)

When the organizations were asked about equity in the ecosystem, all of them saw this in the same way: other actors in the ecosystem will benefit more than others. Bank and IT-service provider argued that smaller actors probably get more benefits than the bigger ones do, because they will suddenly have access to wider markets through ecosystems. However, the head of R&D from the bank emphasized that everyone needs to be satisfied at some level – otherwise, there will be no ecosystem. Thus, the next chapter illustrates what kind of scenarios and aspirations these different organizations have for the future of DLT ecosystems.

4.6 Future and potential of ecosystems

When it comes to the future and potential of DLT ecosystems, all organizations admitted that forecasting is really difficult. However, all organizations were relatively sure that DLT based ecosystems will become more common but it is hard to say when. The operative level of bank was slightly more exited and confident about the ecosystems than the management side:

"I believe that in the future, these ecosystems can build a totally new kind of economy, where you can build new services." (Architect 2, bank)

"When this (ecosystem) changes the world, it necessarily never happens. It has the potential, but I think it would be too bold. From my point of view, it is much more likely that autonomous cars will come and change the world." (Head of R&D, bank)

The head of R&D emphasized that ecosystems will become common in some areas, but he is afraid that the ecosystems will only be applied in these limited areas. He also added that it will take longer to utilize the systems than what people think now. However, the architects from the bank highlighted that when the ecosystem business becomes serious, i.e. there are significant participants and the network works, development will be fast and there will be more resources available. Then, remarkable results can be achieved and the ecosystems can expand a lot even in a couple of years. The director (2) from the IT-service provider confirmed this, too. He said that due to scalability, growth can be fast.

The management of the IT-service provider was quite convinced about DLT ecosystems. The directors said that those systems will inevitably become more common, and they are remarkable considering the national economy, too. In contrary to the bank, one of the architects (1) from the IT-service provider was a bit more hesitant about the success of these ecosystems. However, the other architect (2) compared the DLT ecosystems to internet, and so did the tax office, too:

"Probably, this will not be as big as internet back in the days, but this can be one of the big disruptions inside of the internet." (Architect 2, IT-service provider)

"Many have referred to this as another internet, some even as a bigger thing than internet." (Advisor, tax office)

In general, tax office based its opinion on banks. They said that if the banks trust the technology and see its potential, there are no reasons for the tax office to doubt that. All interviewees were also asked, how the ecosystems would look like in five years. Their opinions are listed in the table below. The table separates the opinions of different organizations as well as the opinions of operative and management level interviewees.

Table 11. *Organizations opinions regarding ecosystems after five years (year 2023)*

Organization	Management	Operative
Bank	• 4 years in production, some benefits realized (Product manager) • First real applications in 3-5 years, some working solutions (Head of R&D)	• Way of working completely different (Architect 1) • Many different ecosystems, some of them interrelated, no global platform yet (Architect 2)
IT-service provider	• Some ecosystems up and running (Director 1) • 2 years of increasing the hype, development accelerates in 3-5 years, small ecosystems working with minimum functionalities, competitors involved but not all roles covered (Director 2)	• Many ecosystems combining competitors and different industries, not interrelated (Architect) • Ecosystems possibly represent the standard way of working (Head of architecture)
Tax office	• Some solutions in 2 years, even more in 5 years, global solutions regarding digital identity in 5 years (Advisor)	• Finland-wide, possibly Europe-wide solutions (Analyst)

As the Table 11 illustrates, organizations' management agreed that the DLT ecosystems might still need a couple of years to develop and after three years, the industry might be mature enough for more serious solutions. Tax office seemed to be the most convinced organization, while bank was the most skeptical one. Operative level interviewees saw that there are many existing ecosystems in five years, but they had controversial opinions about the interrelatedness of ecosystems. The advisor from the tax office was the only interviewee, who believed that there might be a global solution in one limited area in five years.

When it comes to different industries inside the finance sector, all interviewees had quite similar ideas. Interviewees from the bank said that DLT ecosystems first find use in areas, which still have manual processes and are not included to the main business of organizations. Both bank and IT-service provider mentioned that trade finance would be a good place to start. The product manager from the bank said that the technological risk is not so big in this area, and the head of R&D explained that the current process is so bad that any digital solution would be better. Furthermore, all interviewees considered digital real estate business as a promising area for DLT ecosystems. When it comes to insurance business, tax office and IT-service provider saw many opportunities but the bank was more reserved. Other potential areas for DLT ecosystems would be, for example, health care, retail, transport and food, while traditional banking and financial administration might still be too conservative for new solutions.

When it comes to different countries, the organizations saw that Finland is somewhere in the middle – it is not a pioneer but not the worst place to develop new distributed solutions either. The architect (2) from the bank noted that smaller European countries, e.g. Estonia, are leaders considering distributed ecosystems. When it comes to blockchain technologies, Asian countries have head start. The analyst from the tax office added that there is already an ecosystem for digital real estate in Sweden, and Estonia has developed a digital identification (ID) already 10 years ago. However, ecosystems and platforms are some of the main governmental projects in Finland.

Furthermore, interviewees revealed some of their wildest thoughts regarding the potential of DLT ecosystems. The management of the bank and IT-service provider explained that DLT ecosystems could lead to a world, where no one needs to own anything. In this scenario, houses and cars could be seen as tokens in the network, and one could just use these tokens to rent or lease objects and services. However, the head of R&D from the bank was quite skeptical about this scenario. He explained that due to existing systems, permission-based solutions, such as DLT ecosystems, face difficulties, and permissionless solutions, such as bitcoin, have more potential. All other interviewees from the bank and other organizations argued that bitcoin is definitely the wrong direction for developing distributed technologies.

The operative level interviewees from the IT-service provider and tax office added that in the future, one could integrate other technologies, e.g. artificial intelligence, into the ecosystems. The interviewee from the tax office explained:

"I think it would be great, if I do not need to care about insurances at all -- I would have a digital twin (AI), who manages my insurances in real time." (Analyst tax office)

The head of architecture from the IT-service provider added that artificial intelligence could be utilized to find the cheapest insurances, for example. Thus, in this scenario, everything would be digital and automated. The architect (2) from the bank illustrated that in a couple of decades the companies could be automated and they would not need to exist more than for one transaction. In this kind of a digital society, there would be digital signatures, identities and contracts. This would lead to digital law contracts, and finally to digitalizing the law itself. This raises questions, for example, if law could be dynamic in certain situations and different for different people. This would even question the role of governments and democracy, because they are no longer needed for verification purposes. The architect (2) from the bank summarized the future:

"Soon we are starting to have all the elements, which allow us to change the way the business, even states, work. Possibly, we could bring equity to countries, where people do not have identities, no kind of legal security -- I do not think that this will stop – more likely, we are just opening the top of the bottle, this will change everything." (Architect 2, bank)

When it comes to the tax office, the interviewees also acknowledged the huge potential of DLT ecosystems. First, the tax office would like to participate in the ecosystems of commercial actors, said the advisor. Later, governmental agencies could try to apply DLT ecosystems to their own purposes when building distributed registers, for example. This would mean new kinds of concepts, like government as a service. Even if all organizations admit that the potential of DLT ecosystems is big, the actors should also know how to utilize the value of these ecosystems in their own business. Thus, the next chapter discusses, what affects value creation, delivery and capture in DLT ecosystems.

5. DISCUSSION

The goal of this thesis was to understand, how disruptive innovations affect value creation, delivery and capture in business ecosystems, and how these ecosystems should be built and managed. This chapter aims at finding answers to these questions by discussing the most notable similarities and differences between the ecosystem roles that surfaced in the interviews and were identified in the previous chapter. This chapter focuses on explaining them by utilizing theory and the framework discussed in Chapter 2. Finally, the chapter concludes by analyzing the meanings of these explanations and finding answers to the research questions. The most notable similarities and differences to be discussed here are presented in the table below.

Table 12. *Most notable similarities and differences of empirical results*

Comparison	Similarities	Differences
IT – Bank	• focus and motivation • challenge of actors • ecosystem's credibility • coopetition and trust	• projects and resources • security • end-user related issues • challenge of change resistance • leader's responsibilities
IT – TAX	• security	• projects and resources • focus and motivation
Bank – TAX	• projects and resources • joint venture • international environments	• focus and motivation • security • end-user related issues • challenge of change resistance

This chapter only discusses those similarities and differences, which are related to roles and responsibilities of different ecosystem actors, and not to their company specific characteristics. For example, if only the size of the organization creates a difference to other organizations, it is not discussed here, since it would not be relevant considering the aim of this thesis. Furthermore, some of the factors are listed in both columns (e.g. security) in Table 12, but these are discussed in the chapter, where their effects are more significant. For example, security will be discussed in Chapter 5.2 about differences. This is because the discussion about organizations' different opinions regarding security reveals more of the nature of their roles than the discussion regarding similar opinions. Furthermore, the things that all organizations perceived similarly or differently are discussed at the end of each chapter.

5.1 Similarities between different ecosystem roles

First similarity between IT-service provider and bank is related to focus and motivation of these organizations. According to the results of the interviews, both IT-service provider and bank have started to approach distributed technologies from a strongly technological perspective. They have conducted internal technology rehearsals, and the IT-service provider has developed a demo application for a DLT platform. According to the framework, these companies represent developers. Thus, it is natural that they start getting to know a new technology by developing and testing it. However, tax office emphasized that some of their employees only focus on evaluating different ecosystems and thinking, which systems might provide benefits for them. This behavior is strongly linked to the user role of the tax office. As remarked by Danneels (2004), concentrating only on technology can cause failures, when firms face disruptive technologies. If firms do not know to whom they should market disruptive technologies or how they should serve new customer segments, they often fail (Danneels, 2004). That is why a user perspective is important in any ecosystem, and especially in DLT ecosystems.

IT-service provider and bank also share the motivation to participate in ecosystems. These actors want to gain competitive advantage and new business opportunities. Partly, this is due to the commercial nature of these actors, but partly, due to their roles as developers. Since a developer-leader and a developer-follower contribute a great deal to the value creation in the ecosystem, they want to capture a lot of that value, too. However, tax office will be satisfied, if the system provides efficiency and considers the regulations of this authority. This again differentiates users from developers. As Dedehayir et al. (2016) present, users focus on defining the problem or need, which developers try to fulfill. Thus, in order to truly create value, developers need input from users. However, when it comes to disruptive technologies, it is important to get this input especially from users, who understand the needs of potential customers (Danneels, 2004). Otherwise, developers easily create value for existing customers only.

The next similarity between IT-service provider and bank refers to the ecosystem actors. These companies mentioned that it will be difficult but important for the ecosystem's success to find and engage enough right and diversified actors. Right actors and their diversity and sufficient number are identified as success factors for ecosystems in the literature, too (Pellinen *et al.*, 2012; Clarysse *et al.*, 2014; Adner, 2017). As developers and value creators, bank and IT-service provider are concerned to find participants, who can properly contribute to development activities and ensure value creation. Long-term engagement is also important for the success of ecosystems (Fransman, 2007; Ritala *et al.*, 2013). In case of disruptive innovations, firms often fail because they do not have the necessary resources and competences (Danneels, 2006; Bergek *et al.*, 2013). In DLT ecosystems, firms can ensure the availability of these necessary resources and competences

by including the right actors. Long-term engagement is also important in DLT ecosystems, since it often takes time to gain profits from disruptive innovations (Walsh *et al.*, 2002).

The ecosystem should also include enough participants in order to create enough value. This means that there is enough value available to be captured, too. However, the IT-service provider highlighted that the amount of actors in the ecosystem should still be manageable. This reflects the IT-company's role as a leader. The leader is concerned that it is capable of managing the ecosystem and its actors. If the ecosystem is too big, this causes problems to the leader. This again causes problems in value creation, delivery and capture, because the leader takes care of the connectivity of actors in the ecosystem. The role of the leader regarding the success of the ecosystem is acknowledged in the literature, too (Moore, 1993; Iansiti and Levien, 2004; Clarysse *et al.*, 2014). When facing disruptive technologies, managers' capabilities can help firms to survive (Danneels, 2004). In DLT ecosystems, leaders' capabilities can help the system to survive. Furthermore, someone needs to manage the uncertainty related to disruptive innovations (Bower and Christensen, 1995), in order not to scare existing participants to exit or potential participants to join the ecosystem. Thus, the role of leaders is crucial especially in DLT networks.

Another important factor to involve and engage participants is the credibility of the ecosystem. This was emphasized by both bank and IT-service provider. For a leader, credibility is important, because it boosts its position in the market. A follower demands credibility, because it attracts significant actors, who give other actors confidence to join. Because disruptive innovations and the threat related to them are hard to recognize, there is a great deal of uncertainty related to these innovations and they often look unattractive in financial terms (Bower and Christensen, 1995; Walsh *et al.*, 2002; Govindarajan and Kopalle, 2006b; Schmidt and Druehl, 2008), credibility is especially important in DLT ecosystems. Because the building phase of the ecosystem is often more chaotic than its later stages (Dedehayir *et al.*, 2016), credibility along shared vision and common goals is an important factor for success in the beginning (Pellikka and Ali-Vehmas, 2016). Building a credible ecosystem is especially on the leader's responsibility (Iansiti and Levien, 2004; Dedehayir *et al.*, 2016).

Furthermore, bank and IT-service provider shared opinions, when it comes to coopetition and trust in DLT ecosystems. Both of them argued that cooperation among competitors is definitely required in a successful ecosystem, but it will not be easy for them to trust and share information with competitors. Because the bank and IT-company represent developers, they understand the need for coopetition. However, their expectations of value capture make them protect their knowledge. In the literature, trust is seen as one of the most important success factors for ecosystems (Blomqvist and Levy, 2006; Dhanaraj and Parkhe, 2006; Ritala *et al.*, 2013). If there is no trust among participants, cooperation is

difficult, which impedes value creation and delivery. As a result, there is less value available, which increases competition. This shifts the balance from cooperation to competition in the ecosystem and makes value creation even more difficult.

Lack of trust has severe impacts on value delivery, too. If ecosystem participants do not truly cooperate, it is harder for them to predict the market and spot signals of significant technological or business model changes (Pellikka and Ali-Vehmas, 2016). Because disruptive innovations are particularly difficult to identify (Schmidt and Druehl, 2008), cooperation and trust are even more important in DLT ecosystems. Otherwise, it is possible that the ecosystem does not recognize the threat of disruptive innovations and fails to respond. This easily leads to the failure of the whole ecosystem. Furthermore, when it comes to disruptive innovations and turbulent environments, it is important to be able to commercialize innovations fast (Walsh *et al.*, 2002). If there are problems related to value delivery, this might delay the commercialization of new innovations and decrease the competitive advantage of the ecosystem.

One way to manage and create trust in DLT ecosystems is to make actors change their views regarding valuable knowledge and capabilities. According to Walsh et al. (2002), strategic flexibility and dynamic capabilities help firms to survive disruptive changes. Thus, ecosystem participants' ability to change strategies and adjust their resources and capabilities is actually more important in DLT ecosystems, than knowledge and resources as such. If participants understand this, it is easier to maintain and increase trust in ecosystems, because actors are more willing to share their information in the network. This contributes to value creation and delivery, and helps to maintain their efficiency.

Furthermore, trust affects value capture, too. Bank, IT-service provider and tax office admitted that the book of rules is perhaps the most difficult thing to create in the ecosystem, but a key factor for success, too. Because not all relationships in the ecosystems cannot be governed with contracts (Poppo and Zenger, 2002), trust can be seen as a complementary governance mechanism (Zaheer and Venkatraman, 1995; Blomqvist *et al.*, 2005). Thus, trust among ecosystem participants makes it easier and simpler to create the book of rules. When all ecosystem members approve this book, they facilitate the premises for value capture (Dhanaraj and Parkhe, 2006), i.e. they know how much value they can capture. This contributes to the satisfaction of ecosystem members, which is also one success factor for ecosystems (Adner, 2017). Furthermore, an ecosystem with less internal tension and conflicts is easier for the leader to handle. That is why the IT-service provider especially emphasized the need for trust.

When it comes to topics about security, and projects and resources, the differences between organizations are more relevant than the similarities. That is why these topics are discussed in the next chapter. However, one important similarity between the bank and the tax office is related to joint ventures. Both of these companies stated that all commercial ecosystem participants could establish a joint venture together and this entity could

take the role of the neural leader in the ecosystem. In the literature, there are many reasons that speak in favor of this kind of an entity. A separate unit is a good way to develop disruptive technologies (Bower and Christensen, 1995), and it would be most successful, if it had its own decision-making autonomy and budget, investment policies, procedures, culture and values (Markides and Charitou, 2004) – like a joint venture would have. Furthermore, this entity could completely focus on developing distributed technologies, maintaining the platform and leading the ecosystem. Neither would it have any existing customers, who it should serve. These factors contribute to the development of disruptive technologies (Bower and Christensen, 1995; Walsh *et al.*, 2002; Danneels, 2004).

Because followers are often dependent on other actors in the ecosystem (Iansiti and Levien, 2004), a joint venture would give the bank protection and security. Especially in case of disruptive changes, the capabilities of followers can become obsolete, which puts their position in danger in the ecosystem (Iansiti and Levien, 2004). Owning a part of the leading entity would give the bank possibilities to control and direct the development activities in the network. A joint venture would also minimalize the threat of dominators in ecosystems, which benefits tax office, too. Since all actors would have assigned resources to the joint venture, the possibility of value dominators would shrink (Iansiti and Levien, 2004). The same would happen with physical dominators, since the all participants could impact the decisions of the joint venture (Iansiti and Levien, 2004). A shared unit would have a positive impact on trust and knowledge sharing, too. Establishing a joint venture would force the ecosystem participants to agree on the book of rules. This is especially important in a DLT ecosystem, because its disruptive and technologically uncertain nature exposes to opportunism and problems related to equitable value capture.

However, the IT-service provider did not mention a joint venture, since it wants to lead the ecosystem itself. According to the results, a leader would have a wide range of responsibilities. When building the ecosystem, it is important that the leader facilitates the premises for value creation and defines the premises for value capture (Ritala *et al.*, 2013). The leader does this by engaging right participants, establishing credibility and a shared vision of the future, developing the technology and providing a platform (Ritala *et al.*, 2013; Dedehayir *et al.*, 2016; Pellikka and Ali-Vehmas, 2016). These activities require competence, existing capabilities and industry knowledge, which a newly established joint venture might lack. This supports the IT-service provider's role as a leader in a DLT ecosystem. However, the company should consider the need for a separate unit, ensure its neutrality and prevent the system from dominators. It has to succeed in building the system in order not to end up being replaced by other ecosystem participants.

The last similarity between bank and tax office is related to international environments. Both of these organizations expressed their aspirations to expand the DLT ecosystem globally. For the follower, international environment would bring many benefits. Bank would have access to technologies, resources and new markets (Chiaroni *et al.*, 2008;

Pellikka and Ali-Vehmas, 2016). It could strengthen its position as a developer by learning and acquiring new competences in the ecosystem, and access international markets that would otherwise be out of its reach. For the user-supporting actor, the global environment would provide a more efficient operational environment. For example, tax office can better guide the DLT ecosystem's development according to global standards and requirements. However, the IT-service provider did not mention international environments during the interviews. One reason for this might be that this company is not so keen to expand the system, since that would weaken its own position in the lead.

However, international environments pose threats to ecosystems, too. Ecosystems change and evolve all the time (Iansiti and Levien, 2004; Weber and Hine, 2015; Oh *et al.*, 2016; Pellikka and Ali-Vehmas, 2016), which requires the participants to be able to change their roles (Adner, 2006). When it comes to DLT ecosystems, their disruptive nature makes the ecosystems even more turbulent (Bower and Christensen, 1995). Furthermore, when it comes to international DLT ecosystems, changes are most likely even more frequent. This requires dynamic capabilities and a lot of flexibility from the participants (Walsh *et al.*, 2002). Understanding the ecosystem, its structure and participants, and constant monitoring are important factors for success, too (Adner, 2006; Möller and Rajala, 2007; Basole, 2009). However, these actions and competences are hard to master in international environments. Thus, especially in case of DLT ecosystems, the ecosystem should be stable and functional before expanding to international environments.

There are also some factors that all interviewed organizations perceived the same way – for example, biggest problems in the industry, need for DLT solutions, main benefits, challenges and success factors and the future of DLT ecosystems. Since discussing these similarities in detail does not reveal further effects of disruptive innovations on business ecosystems, it is more relevant to focus on the differences between ecosystem roles.

5.2 Differences between different ecosystem roles

As mentioned before, the similarities and differences related to projects and resources are discussed in this chapter. When it comes to this topic, bank and tax office have a similar situation. Both of these organizations have participated in DLT ecosystem projects and they have also worked together in some of these projects. As a follower and a supporting actor, these organizations do not have big responsibilities (Dedehayir *et al.*, 2016), and trying out new technologies seems to be easy. As a developer, the bank has the desire to participate these projects in an early phase. On the other hand, since the tax office has the role of a user, it has the urge to communicate its needs to the ecosystem in the beginning in order to lead the development to the right direction. Because these organizations have actual ecosystem projects, it might be easier for them to justify the allocation of resources. That is one reason, why they have full time resources working with DLT ecosystems.

When it comes to the IT-service provider, this actor is still rehearsing and it has only launched a DLT based ecosystem concept. Since the leader has more responsibilities than followers and supporting actors, e.g. it takes time to gather participants and build a platform (Dedehayir *et al.*, 2016), the IT-service provider is a bit behind the activities taken by tax office and bank. However, if the assumed leader is not ready to take the lead in the ecosystem, this causes big problems (Iansiti and Levien, 2004; Adner, 2017). Since failure of ecosystems is often liked to delays (Adner, 2006), the leader should have the courage to launch projects quickly and take an active role already in the beginning. When it comes to DLT ecosystems, there is a lot of technological uncertainty because of the disruptiveness of the technology (Bower and Christensen, 1995), and thus, it is especially important that there is someone in the ecosystem, who tries to manage this.

The problems related to resource allocation are one of the biggest reasons leading to failure, when firms confront disruptive innovations (Christensen and Raynor, 2003). Resource allocation problems also impede the IT-service provider and its development activities in case of DLT ecosystems. Contrary to the bank and the tax office, the IT-service provider only has part time resources working with DLT solutions. Because the development of disruptive innovations is difficult to justify financially, and it takes resources away from serving existing customers (Bower and Christensen, 1995; Walsh *et al.*, 2002; Govindarajan and Kopalle, 2006b), the IT-service provider might be afraid of assigning enough resources to DLT ecosystems. Furthermore, the company explained that it is especially hard to get financing and resources to participating in ecosystem activities. If the IT-service provider wants to lead the ecosystem and its development, it might have to cannibalize some of its existing services, as Govindarajan et al. (2011) suggest. Thus, when it comes to DLT ecosystems, one should tackle the problems related to resource allocation and focus on developing capabilities to work in the ecosystem environment, too.

Similar to projects and resources, the topic of security will be discussed in this chapter, too. It is the only significant similarity between IT-service provider and tax office. Both of these organizations believe that the distributed architecture protects data and provides better security than before. Since IT-service provider only has concepts related to DLT ecosystems, it might not have experienced all technological problems yet. On the other hand, it is the leader's responsibility build the ecosystem, gather the participants, provide a platform for the them and ensure value creation, delivery and capture (Moore, 1993; Iansiti and Levien, 2004; Clarysse *et al.*, 2014; Dedehayir *et al.*, 2016). Thus, it would be against the leader's benefit to highlight the problems related to ecosystems. When it comes to the tax office, a user-supporting actor does not need as detailed understanding of the technology as a developer does. As a user, tax office neither has similar responsibilities related to technology and data security. Thus, even if these actors have similar opinions, they are most likely based on different kinds of perspectives.

However, bank has a different opinion, when it comes to data security in DLT ecosystems. Especially the management level was concerned that when data sharing becomes easier, security can no longer be guaranteed. They were also afraid of losing control to their products and services. When it comes to disruptive innovations, it is common that technologists have a more positive opinion about these innovations than business people (Bower and Christensen, 1995). This justifies the assumption that DLT ecosystems truly represent a disruptive innovation. Because the bank has conducted some actual projects related to DLT ecosystems, it can have a better understanding of the practical problems related to distributed technologies. There is also a lot of highly classified information in the finance industry, and the bank operates closer to the end-users than the IT-service provider. These reasons can explain its more reserved attitude.

Furthermore, followers are dependent on other players in the ecosystem, and they have to be well aware of the network in order to maintain their position (Iansiti and Levien, 2004). Since the bank cannot ensure the security of its data alone in the ecosystem, it is more concerned than the tax office and the IT-service provider. Adner (2006) justifies this by arguing that the amount of intermediaries in ecosystems increases uncertainty. Because technological difficulties can lead to failures of ecosystems (Adner, 2006; Ritala *et al.*, 2013), these uncertainties and problems related to security and data protection in DLT ecosystems should be taken seriously.

When it comes to end-users, the bank sees security being only one problem for them. Neither IT-service provider nor tax office were worried that customers might find DLT ecosystems difficult to understand and trust. According to the bank, users cannot know what rules they commit to when using DLT ecosystem applications. These concerns and perspectives are important in ecosystems, because those networks should be built for customers in the first place. Thus, followers' knowledge regarding end-users and specific industries is crucial for ecosystems' success. However, one should not only focus on existing customers and their needs but consider potential customers, too (Bower and Christensen, 1995). This is one success factor when facing disruptive innovations, and hence, especially important in DLT ecosystems. In order to find a balance between listening to existing and potential customers, there should be several followers and supporting actors in the DLT ecosystem, who can communicate the market needs.

Since the bank has concerns regarding security and end-users, it worries about change resistance in the industry, too. This topic was only mentioned by the bank, who explained that customer resistance and existing systems pose the biggest threat to distributed technologies and DLT ecosystems. As a follower the bank knows its customers and the finance industry very well, which might explain, why it was the only organization mentioning this challenge. Bower and Christensen (1995) explain the impact of existing systems with performance trajectories: if existing systems do not overshoot the market's performance demand, there is no place for a new solution in the market. Since customers do not see the need to change their value emphasis (Bergek *et al.*, 2013), they resist the

disruptive innovation. This resistance causes a high risk of failure for disruptive innovations (Walsh *et al.*, 2002). That is why the bank's management was concerned that only some limited sectors in the finance industry will adopt DLT ecosystems and find use for them.

However, the DLT ecosystems can be seen as disruptive business model innovations, too. This is because they have the possibility to change the operating logic of the whole finance industry. According to Markides (2006), disruptive business model innovations capture a certain market share but never fully displace the old models. Thus, it is completely possible for the DLT ecosystems to be successful in some sectors of the finance industry, even if some sectors would not be ready to adopt them. All organizations explained that the sector of traditional banking services might still be too conservative for new solutions, for example. However, if some sectors find use for these DLT ecosystems and give them time to develop, they have the potential to disrupt the more change resistant sectors, too. Thus, it is normal that some ecosystem participants doubt the technology and the solutions. That is why the leader's role in convincing the members is even more important in DLT ecosystems.

However, when it comes to leader's role, bank and IT-service provider had different opinions regarding the responsibilities. While IT-service provider was ready to take all the leader's responsibilities, bank recommended dividing them and sharing the responsibilities between two leaders. Thus, despite of the shared vision, actors can have different expectation about roles and structures in ecosystems (Ritala *et al.*, 2013; Adner, 2017). According to the results, the leader's responsibilities can be divided into technology related (development, maintenance, guarding), and management related. The bank would like to follow this division, since it sees that there is too much to do for one leader. As a follower bank wants to eliminate the threat of dominators and ensure that the ecosystem succeeds. If the IT-service provider failed, all other participants would most likely fail, too – each member of the ecosystem eventually shares the fate of the network (Iansiti and Levien, 2004).

However, IT-service provider wants to be in charge of everything, since it wants to capture as much value as possible. The company neither wants another leader, since this would lead to internal tensions and conflicts between leaders. When it comes to DLT ecosystems, it is highly important to succeed in both technology and management related responsibilities – especially in the beginning in order to launch the system. Thus, this implies that both a developer-leader responsible for the technology and a user-leader responsible for management and governance would be needed in DLT ecosystems. However, this structure requires a book of rules, which defines the responsibilities and rights clearly and eliminates the conflicts between the two leaders. If the members cooperate and the ecosystem is internally strong, this helps it to survive external disruptions, too (Afuah, 2000).

Finally, when it comes to the most important benefits and problems in DLT ecosystems, all organizations emphasized slightly different things. IT-service provider highlighted innovations and new business possibilities, bank efficiency, data sharing and practical benefits, while tax office emphasized automatic information, visibility rights and real-time, accurate and reliable data. In case of challenges, IT-service provider listed resources, finance and trust, bank mentioned book of rules, change resistance and existing systems and tax office emphasized regulatory environment.

These aspirations reflect the organizations' roles. Leader wants to gain competitive advantage but is worried, whether it can assign enough resources and ensure that the system creates enough value. Follower strives for efficiency and wants to serve its customers better, but it is worried about its own position in the ecosystem. Furthermore, the company is concerned whether the finance industry is ready for DLT solutions. Tax office wants to fulfill the regulatory requirements and just use the network, but it is worried, if the current legislation will enable the use of DLT ecosystems. These aspirations of the organizations reflect their roles as developers and users, too. IT-service provider and bank have the need to build something new, while tax office only has a clear vision how the system should look like. After that, the organization is satisfied, if it can use the system. Thus, this discussion confirms that the roles assumed for different organizations were correct.

5.3 Effects of disruptive innovations on value processes

The discussion in previous chapters led to identifying the effects of disruptive innovations, which one should consider when building DLT ecosystems. In order to summarize and generalize these discoveries, these effects of disruptive innovations on different value processes are discussed in the ecosystem context. This discussion leads to answering to the research questions. Table 13 below illustrates, which topics affect which value processes.

Table 13. *Effects of disruptive innovations on different value processes*

Effects of disruptive innovations	Value creation	Value delivery	Value capture
Need for user roles	X		X
Enough right and diversified actors	X		
Leaders' capabilities	X	X	X
Relationship management	X	X	X
Strategic flexibility & dynamic capabilities	X	X	X
Resource allocation	X	X	X
Book of rules			X
Technological difficulties	X	X	X

When it comes to ecosystems with a disruptive nature, there is a clear need for user roles. Developers need inputs from users in order to create value – otherwise, they will develop products and services, which customers will not find valuable. However, it is not enough that users understand and communicate the needs of existing customers. In order to create disruptive innovations, users especially need to know and communicate the needs of potential customers. Furthermore, user roles are important regarding value capture, too. The categorization of actors into developers and users makes their responsibilities and roles clearer, which helps in assessing the rights for value capture for each party. Thus, the book of rules, which was emphasized by all organizations as the biggest challenge and the most important success factor of DLT ecosystems, is easier to create. When value capture is clear, there are less conflicts and the leader can better manage the ecosystem. Thus, the categorization into users and developers clarifies the roles of leaders, followers and supporting actors.

In order to ensure that the users can communicate the needs of potential users, one has to succeed in engaging the right actors to the ecosystem. Right and capable actors are also important because they bring resources and competences to the ecosystem. If these actors have been selected correctly, their capabilities help in developing disruptive innovations and in surviving external disruptive changes. The disruptive nature of ecosystems also requires enough actors. There should be several users, who can communicate the needs of customers, so that the developers can create a comprehensive understanding of the market. These actors should also be diversified and represent different industries. This is a way to find new segments and potential customers for disruptive innovations. Thus, in case of disruptive innovations, it is important that the ecosystem has marketing and customer competence, i.e. the system knows who to target and how.

Furthermore, right actors, who commit themselves to the ecosystem for a longer period, can help the leader to manage the uncertainty related to disruptive innovations. Picking up respected participants can convince other important actors to join, if they are still suspicious about the network. Long-term engagement is also significant, since it often takes time to develop and especially to profit from disruptive innovations. If there is no long-term basis, the prospects for the ecosystem to develop and survive disruptive innovations are poor. Engaging enough right and diversified actors is mainly the leader's responsibility but disruptive innovations require other capabilities from this actor, too.

Since there is a significant uncertainty related to disruptive innovations and the building phase of the ecosystem is often relatively chaotic, the leader has to be able to manage all of this successfully. Hence, it should create credibility to the ecosystem and communicate this to other ecosystem actors. As the empirical results illustrated, the leader has many responsibilities. Thus, it should consider establishing a separate unit and be possibly ready to cannibalize some of its existing products and services in order to contribute enough to the ecosystem and to the development of disruptive innovations. When it comes to value delivery, the leader should provide the means for the ecosystem to communicate and

measure value. Disruptive innovations need to be developed and commercialized as quickly as possible, which is not possible, if there are problems in communicating value. When it comes to value capture, disruptive innovations might quickly change the amount of value, which is available in the ecosystem. This can happen, if an external disruptive change quickly changes the customers' value emphasis and as a result, customers do not value existing products and services. The leader needs to ensure that the value is divided equitably among the ecosystem members, and that it can capture some amount of this value itself, too.

Leaders also have the important task to enhance trust and coopetition among ecosystem participants – factors, which have significant impacts on all different value processes. When it comes to value creation, disruptive innovations require effective cooperation among ecosystem participants. It is important that competitors trust each other and are ready to cooperate in order to develop and commercialize disruptive innovations fast. This requires effective value delivery, too. Open communication and sufficient information sharing make the ecosystem internally stronger but affect positively to participants' ability to monitor external environment and spot disruptive changes and market opportunities. Furthermore, if there are problems in value communication and measurement, ecosystem members do not know, how much value there is available to be captured. These transparency issues make them uncertain and suspicious, and increase their dissatisfaction regarding the value they get. This is because they cannot be sure, if they were able to capture all the value they think they were entitled to. As a result, competition, tension and the risk of conflicts increase, which again impedes value creation, delivery and capture. This might lead to ecosystem failures.

Because disruptive innovations make ecosystems more turbulent and unstable, ecosystem members need to have strategic flexibility and dynamic capabilities. This means that they have to be able to change strategies and roles, and adjust, change and develop new competences in case of disruptive changes. If ecosystem participants succeed to do this, value creation stays effective. Of course, a capable leader is needed, who can restructure and reorganize they ecosystem – it is not enough that the parties are able to change roles, if the overall composition of the ecosystem is a mess after the disruptive change. If ecosystem actors understand that flexibility and dynamism are more important than the resources and capabilities themselves, the parties might be more willing to cooperate and share information. This contributes to value creation and delivery.

If some parties fail at changing their roles and developing new capabilities, others might find this a good thing and think that they have more value available to be captured. This might be true for a while, but in order to create sustainable competitive advantage, disruptive innovations require long-term relationships. If some actors fail and new actors join to replace them, they do not only need to learn about the technology but about the ecosystem, too. This takes time and before these new members are completely integrated to the network, they cannot contribute much to value creation. Furthermore, new parties

always change the operating logic of the ecosystem and trust need to be built again. Thus, when it comes to disruptive innovations, stronger ecosystem participants should help weaker ones to gain flexibility and dynamic capabilities in order to stay in the ecosystem. This eventually contributes to the value capture of every actor. However, since there is inevitably going to be some changes among the ecosystem members, the leader should ensure that the integration process is as effective as possible.

It was also recognized in previous chapters that disruptive innovations cause resource allocation problems in ecosystems. Disruptive innovations and activities related to their development and management increase the need for resources in ecosystems, but at the same time, the uncertainty related to these innovations makes actors cautious to assign resources. However, effective value creation requires resources and risk-taking attitude. Furthermore, resource allocation can be optimized, if value delivery works: if actors have information about the ecosystem and its activities, the risk of overlapping development can be reduced. This minimizes the risk of wasting resources. When it comes to value capture, the actors, who have assigned resources, have better rights to capture value, too. However, this requires the book of rules.

All organizations emphasized the need for the book of rules. Especially disruptive innovations create the need for this book, since it helps the ecosystem to manage uncertainty, turbulent environment, changes and actors' satisfaction. The book of rules defines the roles and responsibilities, but preserves the right to change them. Most importantly, the book establishes the premises for value capture. Without this book and the actors' approval, it is difficult to ensure the satisfaction of ecosystem members. Satisfied actors consider the benefit of the ecosystem along their own benefits, ensure equitable value capture and contribute to value creation and delivery, too.

Furthermore, disruptive innovations emphasize the relevance of technology and technological difficulties in ecosystems, too. The technology leader and the platform provider has to ensure that the ecosystem works, as it should. If actors doubt the system, the network fails or does not work, the credibility of the system and the rate of long-term engagement decrease. Technological issues impede or even inhibit value creation and delivery, and as a result, there is no value available to be captured. Thus, disruptive innovations and especially technologies require understanding of the technology from the members and technology management skills from the leader.

The fourth research question of this thesis focused on building and managing a business ecosystem based on disruptive technologies in the finance sector. As the previous discussion pointed out, both users and developers are needed in ecosystems based on disruptive technologies. Users communicate the constantly changing needs of customers in the turbulent disruptive environment and find new potential customers. Developers are needed to build the platform and develop the technology according to the ecosystem and custom-

ers' needs. This categorization into users and developers clarifies the roles and responsibilities, and the key is to find the suitable ratio between these roles. However, this study is not capable to answer, what the best ratio would be. Furthermore, leaders, followers and supporting actors are all needed in DLT ecosystems, too. Their participation was already assumed in the framework develop in Chapters 2.3.2 and 2.3.3, and the results and discussion in this study justify this.

The responsibilities for different roles in ecosystems need to be discussed in detail, too. In the building phase, the leader is more like a facilitator. It has to develop the technology, establish the platform, gather and engage members, organize the entity and manage the value. Technology related responsibilities are strongly linked to development, while management related responsibilities are more linked to organizing and establishing. Because this role's responsibilities strongly highlight development related activities, the ecosystem needs a developer-leader. The need for a user-leader seems to be lesser, because it would not have many responsibilities, when building the ecosystem. Furthermore, several leaders in the beginning might cause conflicts and make it difficult to manage the uncertainty and organize the system.

Developer-followers are also needed, because development activities require many different kinds of resources and industry competence, which followers have. User-followers can contribute to the value creation and their understanding of the needs of potential customers are needed in the network, too. Different kinds of supporting actors benefit the ecosystem: developer-supporting actors can support and contribute to the development, and user-supporting actors communicate the needs from the market. Based on this discussion, the activities of different roles can be re-evaluated. Table 3 in Chapter 2.3.3 presented the assumptions for the activities of different roles regarding coordination, contribution and supporting. The re-evaluated activities are marked with red in Table 14 below.

Table 14. *Re-evaluation for the activities of different roles in DLT ecosystems*

Role		Coordinates	Contributes	Supports
Firm 1a:	**Developer-leader**	X	(X)	
Firm 1b:	**User-leader**	X	(X)	
Firm 2a:	**Developer-follower**	(X)	X	
Firm 2b:	**User-follower**		X	
Firm 3a:	**Developer-supporting actor**		(X)	X
Firm 3b:	**User-supporting actor**			X

The results and the discussion of this study have justified that the assumption made for main activities are correct. That is why these re-evaluated activities represent the secondary activities for different ecosystem roles. Since the leaders have already many responsibilities in the ecosystem, their contributions to value processes remain as secondary

activities. Because the developer-leader develops the technology, it most likely contributes more to the value processes than the user-leader, whose responsibilities are strongly linked to management and governance. Since the developer-follower contributes to the development, and might convince others to join by showing example, it might have some responsibilities regarding coordination, too. Finally, if a supporting actor participates to the development, it can have minor contribution to value processes, too. Thus, this discussion confirms that the assumptions made regarding different activities and responsibilities for ecosystem roles are correct – at least, when it comes to the building phase of the DLT ecosystems in the finance industry.

The results and discussion of this study allow re-evaluating the expectations of different roles regarding value capture in the building phase of the DLT ecosystems, too. The original framework for these expectations was presented in Figure 11 in Chapter 2.3.3. As previously discussed, it is important that user-followers and user-supporting actors communicate the needs of potential customers in the building phase. Thus, they might expect to capture more value than assumed. However, a user-leader might not be needed much in the building phase, because the leader's responsibilities are strongly related to development. Thus, this role might not expect to capture much value in the building phase. Figure 19 illustrates the modified situation of value expectations in the building phase of the DLT ecosystem. However, one should note that not all of these roles are necessarily covered, when the building starts. This naturally affects the expectations of value capture for different roles.

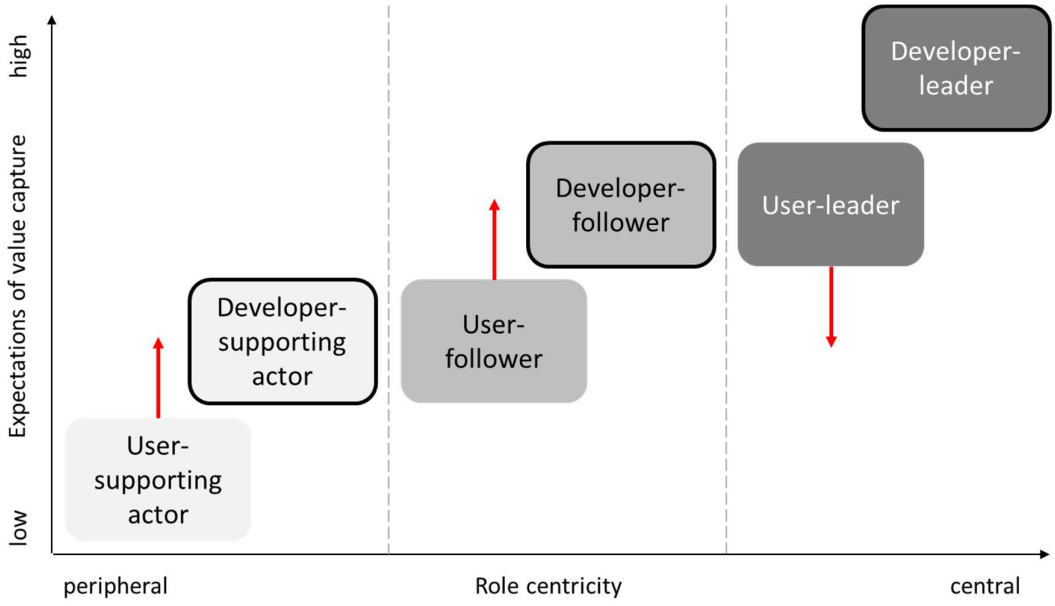

Figure 19. *Re-evaluation for the expectations of value capture for different roles in the building phase of DLT ecosystems*

When the ecosystem matures and moves to the management phase, ecosystem participants' roles most likely alter, too. This study cannot draw explicit conclusions about these changes, but it can sketch some guidelines. When it comes to leading, technology maintenance will become more relevant. If the ecosystem grows as expected, there will be more tasks related to managing and governing. Thus, this might create the need for a user-leader. One possibility to fill this role is to establish a joint venture, as the bank and the tax office suggested. However, because of the disruptive nature of the ecosystem and its constant need to renew in order to stay competitive, development will remain important in the management stage, too. As a result, the need for both developers' and users' competences is high. Thus, making assumptions regarding expectations of value capture for different roles needs further research.

6. CONCLUSIONS

This chapter concludes the results of this master's thesis and summarizes its contributions. First, this chapter discusses the main findings of the research and evaluates the achievement of objectives. Second, the thesis is assessed by evaluating its reliability and validity. Third, this chapter presents the managerial implications and discusses how organizations can benefit and utilize the results of this thesis. Finally, this chapter discusses the contributions of this thesis to existing studies and suggests some directions for future research.

6.1 Main findings

The aim of this thesis was to explore, how disruptive innovations affect business ecosystems in the finance sector. In order to combine these two topics together, the theory of value processes was utilized. In detail, this study investigated, how disruptive innovations affect value creation, delivery and capture in ecosystems. Furthermore, the goal was to find out, how these business ecosystems with a strong technological premise should be built and managed. In order to establish a basis for this master's thesis, a framework defining different roles for ecosystem actors was developed. The empirical part of the thesis focused on interviewing organizations, who could form a functioning ecosystem together. Using the framework to combine existing theories and new empirical knowledge, the study aimed at reaching its objectives.

The premise for all results of this thesis was the development of the framework. There is a lot of research regarding disruptive innovations and business ecosystems, but these topics have rarely been combined. That is why there was a need for a new framework, which could define the different ecosystem roles in detail. The main contribution of this framework was to insert an additional dimension for the traditional ecosystem roles identified in the literature (e.g. Moore, 1993; Iansiti and Levien, 2004; Dedehayir *et al.*, 2016). The framework consists of a 3x2 array, which has the roles of leaders, followers and supporting actors on the x-axis and the roles of developers and users on the y-axis (Table 2). Thus, this study identified six different roles for ecosystem actors. Combining the theory and empirical results, this research could justify that the categorization of ecosystem roles into developers and users is relevant and beneficial, which is one significant result of this thesis. This categorization clarifies the roles and responsibilities for different actors, which helps in managing the chaos related to the building phase of the ecosystem. This is especially important in DLT ecosystems, because their disruptive nature increases the ecosystem uncertainty.

Furthermore, the framework helped in finding similarities and differences between different ecosystem roles. This again helped in identifying some effects of disruptive innovations that one need to consider in business ecosystems, too. Those are uncertainty, turbulence, constant change, resource allocation problems and trust issues, need for fast commercialization and right actors, strategic flexibility, dynamic capabilities and technological difficulties, for example. Analyzing this information made it possible to identify the effects of disruptive innovations on different value processes, which are presented in Table 15 below. These findings represent completely new knowledge and thus, are the second and at the same time, the main finding of this thesis.

Table 15. *Main findings of this master's thesis*

Effects of disruptive innovations	Value creation	Value delivery	Value capture
Need for user roles	X		X
Enough right and diversified actors	X		
Leaders' capabilities	X	X	X
Relationship management	X	X	X
Strategic flexibility & dynamic capabilities	X	X	X
Resource allocation	X	X	X
Book of rules			X
Technological difficulties	X	X	X

When it comes to value creation, disruptive innovations have multiple effects. The ecosystem should have knowledge regarding the needs of potential customers in order to develop disruptive innovations. These innovations require enough right and diversified actors, who bring resources and competences to the business ecosystem. Finding and engaging these actors for long-term is on the leader's responsibility but this actor has to allocate enough resources to the system and create trust among the participants, too. This contributes to fast development, which is important in case of disruptive innovations. Strategic flexibility, dynamic capabilities and working technological solutions are important, too.

Furthermore, trust contributes to effective value delivery, too. Ensuring the communication among participants makes the ecosystem internally stronger and protects the system against external disruptive changes. Along sufficient resources, working platforms and technological solutions contribute to effective value delivery, too. When it comes to value capture, disruptive innovations have again many effects on this process. The book of rules defining the roles and responsibilities is required to know, who is entitled to capture value. Categorization of ecosystem actors into users and developers clarifies value capture, too. Since disruptive innovations make the ecosystem turbulent and cause constant changes,

the participants should have strategic flexibility and dynamic capabilities in order to ensure their own position and ability to capture value. A competent leader is needed to ensure satisfaction of actors, and the balance between cooperation and competition.

Finding out the effects of disruptive innovations on value processes in ecosystems is something that existing studies have also demanded. For example, Nieuwenhuis et al. (Nieuwenhuis *et al.*, 2018) demanded for these kinds of studies conducted in other industries than the IT-sector. This study answers to this demand by conducting a study in the field of finance: this industry is rather conservative but applies the IT-solutions to its traditional products and services. Furthermore, Kumaraswamy et al. (2018) demand for ways to deal with disruptions in the ecosystem context more proactively. Since this study illustrated multiple effects of disruptive innovations on value processes before DLT ecosystems have truly been implemented, it responds to this demand, too. Thus, the novelty value of this thesis is also relative high.

After recognizing the effects of disruptive innovations on value processes in ecosystems, it was possible to draw conclusions regarding the responsibilities and activities of different roles and the composition of the ecosystem. This is the third relevant result of this thesis. This study focused especially on the building phase of the ecosystems, because there is no existing DLT ecosystems yet. Thus, in this phase, users are needed to guide the development and communicate the needs of potential customers to developers. Since leader's responsibilities are strongly related to development, a developer-leader might be needed more than a user-leader. Based on these conclusions, a user-leader might not be expect to capture much value, but user-followers and user-supporting actors have a chance to capture more value as expected (Figure 19). However, the roles most likely alter, when the ecosystem ages.

Finally, this study was able to find out some success factors for DLT ecosystems, which is the fourth result of this thesis. An ecosystem based on disruptive technologies should e.g. have a neutral leader, clear responsibilities and roles, and enough right actors. Furthermore, the system should be transparent and permissioned, and in order to succeed, an enabling legislation is needed. Hence, the thesis was able to reach its goals, and succeeded in answering to the research questions. Even if only three organizations representing three different ecosystems roles were interviewed, the study was able to draw some conclusions regarding all six roles. This was possible, because this study justified that the ecosystem roles are not fixed – actors can change their roles in the user-developer dimension and in the leader-follower-supporting actor dimension, too. Furthermore, this thesis was able to clarify roles and responsibilities in the building phase of the ecosystem.

6.2 Reliability and validity

In order to justify the quality of the study, one need to pay attention to issues related to reliability and validity. Reliability measures that whether conducting the study on another occasion or by alternative researchers would reveal similar results than the original study (Saunders *et al.*, 2012, p. 192). When it comes to the use of semi-structured interviews, as in this study, Marshall and Rossman state that the results are not even intended to be repeatable, since they are strongly linked to the time of data collection (Saunders *et al.*, 2012, p. 382). Thus, the situation that the interviews describe often alters in time, which makes conducting an exactly similar study again irrelevant. In order to explore a certain topic on a certain time, one needs to conduct the empirical study within a certain timeframe. In this study, the interviews were conducted between June and November 2018. This timeframe is long enough that the situation in the industry might have changed making the interviewees' answers not completely comparable. This can reduce the reliability of this study, even if the researcher considered this when analyzing the interviews.

However, semi-structured interviews offer a valuable means to explore the complexity of topics (Saunders *et al.*, 2012, p. 382). Thus, they fit well to this thesis, since it focuses on DLT ecosystems – a complex topic combining disruptive innovations and ecosystems in a new way. Because this study is not repeatable as such, it is especially important to document the research methods, processes and data used during the research in detail (Saunders *et al.*, 2012, p. 382). This makes it possible to evaluate the reliability of this study considering its context and time. Chapter 3 justifies the use of research methods for this study, and this chapter discusses the errors and biases linked to them.

Participant error refers to factors that adversely affect the participant's behavior (Saunders *et al.*, 2012, p. 192). In this study, the interview questions were tested twice before the interviews in order to exclude leading questions. This contributes to reliability. The author sent the preliminary interview structure to the interviewees a couple of days before the actual interviews, too. This gave the respondents an opportunity to familiarize themselves with the questions beforehand, which possibly leads to better answers and decreases the risk of misunderstandings. However, one interviewee seemed to be confused that the actual interview did not exactly follow the preliminary structure. Occasionally, his answers were illogical but the interviewee noticed this and aimed at managing the error by asking defining questions.

Along with the participant error, participant bias might also occur. This refers to any factor that causes a false respond (Saunders *et al.*, 2012, p. 192). Often participant bias is linked to trust issues, which might cause the interviewee to change his or her answers. This bias is especially important to discuss in this study, since most of the interviews were conducted outside the case organization. Thus, in the eyes of the interviewees from the bank and the tax office, the researcher was a visitor rather than a colleague. As a result, these interviewees might have adjusted or changed their answers. However, there was

also a difference regarding trust between bank and tax office. The interviewees from the bank were first contacted by a colleague of the researcher, who knew them well and had worked with them before. Furthermore, the researcher worked for a company, which was a joint venture owned by the bank and the IT-service provider. As a result, the bank's interviewees did not consider the researcher as a complete outsider and most likely trusted her more than the interviewees from the tax office. When it comes to the IT-service provider, the interviewees saw the researcher as a colleague, which increases their trust. When interviewees trust the researcher, the participant bias can be reduced.

Furthermore, the interviews were conducted in a closed meeting room, which eliminates the fear of being overheard. However, the interviews were recorded, which might affect the participants' answers. In order to manage this bias, the researcher explained that the interview is confidential, the data will only be used for the purposes of this master's thesis and organizations' or the interviewees' names will not be published. According to Saunders et al. (2012, p. 383), the quality of the opening comments can help to manage the participant bias. Furthermore, at the time of interviewing the bank's head of R&D, the organization was going through a difficult time. This might have affected the tone of his answers. He had a significantly more negative tone of voice in comparison to other interviewees from the bank. This was considered when analyzing the interviews.

Furthermore, bias related to participation can occur, too. This means that either some relevant participants were left out or some unsuitable participants were interviewed, which can bias the results (Saunders *et al.*, 2012, p. 381). The selection of target organizations was successful, since they could have established an ecosystem together in real life, too. The researcher contacted some managers from the bank and the tax office, who refused the interview invitation saying that they were too busy. However, the researcher found substitutes for these people and was able to interview enough management and operative level employees. Interviewing both managers and technical people helps to reduce distortions in results and reduces the bias. However, when it comes to the IT-service provider, operative level interviewees had some difficulties answering to other than technological questions. This impedes that their knowledge regarding the topic was inadequate to some extent. This bias was managed by focusing and relying more on the answers of management level interviewees from the IT-service provider. Overall, the interviewees had worked a lot with the topic and seemed to have a strong knowledge regarding DLT ecosystems. Hence, the selection of interviewees was mainly successful, which decreases participation bias.

The researcher can cause error and bias to the results of the study, too. Researcher error refers to any factor that affects to the researcher's interpretation (Saunders *et al.*, 2012, p. 192). In this study, the researcher gathered some basic information regarding the interviewees – for example, she checked their LinkedIn profiles before the interviews. This helped her to understand the context of the interviewee and adjust her questions, which

again reduces researcher error. On the other hand, during the first interviews, the researcher focused too much on making notes and did not spot all possibilities for additional questions. However, she noted this behavior and concentrated more on listening during the rest of the interviews. Saunders et al. (2012, p. 383) suggest that this helps in overcoming interviewer error.

The researcher bias refers to all factors that might negatively affect researcher's recording of answers (Saunders *et al.*, 2012, p. 192). All interviews were recorded, which reduces the risk that the researcher does not memorize or understand the content of the interview correctly. Furthermore, the researcher transcribed all interviews. During this process, she was able to deepen her understanding and illustrate the big picture of the content of the interviews. At the same time, she was able to correct some misunderstandings. The researcher got material from the interviewed organizations, too. This material represented secondary data in this research, and it was used to validate some results of the interviews. This reduces the researcher bias, too. However, when the researcher departed from the preliminary interview structure and made some additional questions, she used leading phrases a couple of times. She tried to avoid this, but due to the speed of the conversation, she did not always had time to rephrase her comments. This bias was considered when analyzing the interviews.

In addition to reliability, one needs to consider validity in order to ensure the quality of the research. In case of qualitative studies, like this thesis, the question of validity is strongly linked to the generalizability of the study (Saunders *et al.*, 2012, p. 382). This generalizability can be increased by linking the study to existing theory and conducting further studies in different contexts (Saunders *et al.*, 2012, p. 383). In this study, existing theory was used to develop a framework, which defined roles for the interviewed organizations. Thus, drawing conclusions based on the roles detaches the study from the limitations of specific organizations and their industry. This means that this study can give references from other industries even if this study was based on the finance sector. This study is also possible to conduct on a different industry in order to validate the results. Furthermore, this study can give valuable information regarding the building phase of the ecosystem. Even if the situation in the industry develops and changes in time, it can be assumed that the nature of the building phase will stay the same to some extent. As a result, the generalizability of this study is relatively high.

However, the generalizability of a study is also based on the nature of the sample (Saunders *et al.*, 2012, p. 382). In this study, the sample included only three organizations, which most likely represent only one role at the time of the empirical study. Even if one can assume that the roles of organizations are not fixed in the building phase, and they can especially change in the developer-user dimension, this study could have yielded better results, if it had included three more organizations representing the missing roles.

However, the study covered all roles from different dimensions: both developers and users, as well as, leaders, followers and supporting actors were included. This increases the generalizability.

Furthermore, even if the sample included interviews from both management and operative level, the size of these samples could have been bigger. However, considering the time and scope of the master's thesis, this size of the sample was representative enough. Finally, the interviewed organizations were not necessarily building an ecosystem together, which makes the studied situation experimental. However, as justified in Chapter 3, these organizations have the prerequisites to establish an ecosystem together, and hence, this is not an issue in this study. Overall, even if there would have been ways to increase the generalizability of this study, for a master's thesis the generalizability of this study was relative high.

Even if validity of the data is often not an issue in a qualitative research, it can be used to measure, how well the researcher gained access to the interviewees' knowledge and was able to interpret interviewees' meanings correctly (Saunders *et al.*, 2012, p. 382). In this study, the interview questions were tested with a person, who did not have earlier knowledge about the topic and with colleagues, who had detailed understanding regarding DLT ecosystems. Thus, this validated the quality of the questions. Because the interviews were conducted in different organizations and both on management and operative level, they were diversified and allowed the researcher to gain different perspectives to the topic. Moreover, the researcher recorded and transcribed the interviews, which helped her to study the meanings in detail. Since Saunders et al. (2012, pp. 384, 388–398) argue that these factors increase the validity of the data, the validity of this study was relatively high.

Finally, this study utilized existing research and company materials as secondary data sources. The scientific articles for this study were searched in databases like Web of Science and Scopus, which include peer-reviewed articles. This increased the reliability of the data. Even if the articles are not tailored to the use of this research, they were carefully selected considering the context, and not used as such but to build a framework. Furthermore, the study utilized some web sources. These represented either well-known and acknowledged organizations (e.g. Gartner) or different authorities (e.g. Finanssivalvonta), which increases their reliability, as Saunders et al. (2012, p. 325) suggest. Material from the interviewed organizations was also utilized to support and validate the empirical results. The material related to distributed technologies was considered to be objective and other material was analyzed considering the companies' objectives.

All in all, the validity of this study is high and the reliability relatively high. The quality of the interview process and the overall generalizability of the research ensured the validity. Reliability could have been improved by conducting the empirical study on a shorter timeframe and by interviewing more organizations. However, considering the requirements of the master's thesis, this study achieved a sufficient level of reliability, too.

6.3 Managerial implications

This master's thesis revealed some managerial implications, too. This study contributes to the knowledge and understanding of the interviewed organizations, and it is especially beneficial for the IT-service provider considering its future endeavors. Furthermore, the study provides valuable information for other companies in the finance industry, as well as, for companies in different industries, who are aiming to build DLT based ecosystems. The main managerial implications are listed below:

- **benefits of DLT ecosystems:** efficiency, data sharing and transferring, cost savings, new business possibilities, scalability, digitalization of the industry
- **challenges of DLT ecosystems:** book of rules, regulation and law, confusion and newness, lack of resources and finance, actors and relationships, change resistance and existing systems, technology
- **success factors of DLT ecosystems:** common goals, credibility, book of rules, permission-based and transparent, enough right, diversified and long-term actors, neutral leader, resources, enabling legislation, acceptance of end users
- **leader's responsibilities:** development, maintenance and guarding of the technology and platform, engaging actors, building relationships, managing and organizing the entity, allocating resources

When it comes to the IT-service provider, who aimed to be the leader of the ecosystem, this study is beneficial for this actor in many ways. This thesis clarifies the responsibilities and requirements for the leader and offers guidelines for building a premise for a successful ecosystem. It also suggests which roles are beneficial for the ecosystem, especially in the building phase. Thus, since the leader understands the roles and structures of the ecosystem, it has better capabilities to guide the development and lead the system successfully. It is also more capable of finding and engaging the right actors to the network.

When it comes to the other organizations participated in this study, this thesis contributes to their understanding about the requirements and benefits of DLT ecosystems. They know what kind of roles are available for them and what it means in detail to engage. As a result, they can better reflect their situation and competences and decide whether to join or not. Since this study revealed the general benefits, challenges and success factors for DLT ecosystems, and organizations defined their company-specific benefits and challenges, this study provides valuable insights for other actors in the finance industry, too. For example, this study implies what kinds of benefits there would be available for other banks and authorities in the finance sector, if they joined DLT ecosystems. As justified in previous chapter, the generalizability of this study is high – thus, the general benefits, challenges and success factors of DLT ecosystems in the finance industry can be applied to some extent to other industries, too. This is because the ecosystem roles defined in this study are not industry specific.

In general, this study contributes to the understanding of disruptive innovations, too. It defines the main factors for firms' success and failure when facing disruptive innovations and applies these to the ecosystem context. Since industries are moving more strongly towards operating in ecosystems, this study helps firms to commercialize disruptive innovations and respond to them in the future environments. If companies can apply the implications of this study to their own competences and contexts, they have the possibility to increase their competitive advantage in their respective fields.

6.4 Future research directions

The framework for different ecosystem roles is a significant theoretical contribution of this thesis. This framework provides a new way to approach and categorize the ecosystem actors according to their responsibilities and actions. This thesis was able to justify that the dimension of developers and users is relevant at least in ecosystems, where disruptive innovations have a strong presence. This dimension helps to clarify the roles and responsibilities, which is especially important because of the uncertainty related to disruptive innovations and the chaos in the building phase of the ecosystem. However, because this framework is not developed only for the finance industry or for ecosystems with a technological premise, it can be applied to other industries and different ecosystems, too. This is the way this thesis contributes to the existing field of research.

Based on the discussion above, the framework should be studied in different kinds of ecosystems in the future. It can be applied to ecosystems, which are not linked to disruptive innovations, or which are based on another technology than distributed ledgers. Furthermore, the framework should be studied in different industries in a similar ecosystem context, for example in the health care industry. These studies can reveal how generalizable the ecosystem roles are. For example, the studies can find out, if there are similar roles in the DLT ecosystems in the health care sector.

Furthermore, the framework of this thesis provides an opportunity to study, how ecosystem roles change over the time. Future studies can reveal, if there is a need for additional ecosystem roles, which are not included to this study. It might be possible that one needs to expand the 3x2-matrix developed in this study or to add one more dimension to it. Furthermore, one should study, how actors can change their roles in the ecosystem. This framework provides a premise to find out, how easily actors change their roles in certain dimensions, i.e. from developers to users or from leaders to followers. Future studies should also focus on clarifying, how many actors ecosystems should include, and what roles these actors should represent. It would be interesting to find out what the optimal ratio between different roles during the lifecycle of the ecosystem is, too.

The biggest theoretical contribution of this study is related to the effects of disruptive innovations on business ecosystems. This study was able to combine two topics, which

have not been studied much together before. This thesis utilized the theory of value processes to demonstrate the effects of disruptive innovations on business ecosystems. These findings increases the novelty value of this thesis and contribute to the demand of existing research (e.g. Kumaraswamy *et al.*, 2018; Nieuwenhuis *et al.*, 2018). This study also provides a good premise to study other effects of disruptive innovations on ecosystems in the future. Furthermore, one should study, how the effects of disruptive innovations change when the ecosystem alters and expands. It would be interesting to find out if these effects change or if there will be significant changes in the relevance of certain effects.

The third theoretical contribution of this thesis is related to the building phase of the ecosystem. This study found out how DLT ecosystems should be built and structured, how this can be done successfully and what kinds of responsibilities the leader has in the building phase of the ecosystem. Because the generalizability of this study is high, the results can be helpful for companies in other industries, too. In the future, longitudinal studies could be conducted in order to find out what the dynamics for the ecosystem to develop and move to another phase of the lifecycle are. One should also study the evolution of DLT ecosystems and aim to find out if these kinds of ecosystems follow the similar lifecycle than what existing literature suggests (e.g. Moore, 1993). Longitudinal studies could provide information regarding the reliability and validity of this study, too.

The fourth theoretical contribution of this thesis is related to distributed technologies and DLT ecosystems. This study gave indications of the current state of distributed technologies, their potential and possible use cases for the future. Especially this study focused on a distributed ledger technology called Corda. In the future, studies could also concentrate on how the development of the technology affects different business ecosystems. If the distributed technology, on which DLT ecosystems are based, develops, it can also alter the effects of disruptive innovations on ecosystems. Finally, one could also study the relationships between DLT ecosystems and other ecosystems in the finance industry and in different industries. These studies could find out what the ability of DLT ecosystems to compete against different ecosystems is.

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APPENDIX A: INTERVIEW STRUCTURE

Warm-up questions

1. Could you shortly tell, who you are and what your current position and responsibilities are in your company at the moment?
2. What kind of educational background do you have?
3. Could you tell a bit about your career path to your current position?
4. How much do you work with distributed technologies and ecosystems?

Ecosystem – benefits & challenges

5. Is your company interested about this kind of an ecosystem based on distributed technologies? Why/why not?
6. What kinds of benefits do you expect from the ecosystem?
7. What kinds of challenges might be related to the ecosystem?
8. What could be the biggest restrictions related to the ecosystem?
9. What could be the success factors for this kind of an ecosystem?
10. Do the benefits and challenges divide equally among the different actors in the ecosystem? Why/why not?
11. What could be done in order to ensure that every actor in the ecosystem would be satisfied?

Ecosystem – building & management

12. If your company was to join to this kind of an ecosystem, what would it require?
13. Which role would your company want to have in this kind of an ecosystem?
14. Which roles would be required in the ecosystem?
15. Would you like to be able to affect, which actors will participate to the ecosystem? Why/why not?
16. What kind of cooperation do you expect among the actors in the ecosystem?
17. What kind of role should the ecosystem leader have?

Ecosystem – future

18. Do you believe that these kinds of ecosystems based on distributed technologies will become more common in the future? Why/why not?
19. Hypothetically speaking, how would the ecosystem look like if there were no restrictions at all?
20. Realistically speaking, how would the ecosystem look like in five years?

Closing

21. Is there still something that you would like to say or discuss?

Thank you!