Tuomas Lappi

FORMATION AND GOVERNANCE OF A HEALTHY BUSINESS ECOSYSTEM
TUOMAS LAPPI

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Abstract

The objective of this dissertation is to identify how to make business ecosystem formation more efficient and how to evaluate ecosystem success capabilities. Business ecosystem formation consists of transition of a front-end phase ecosystem into an operational ecosystem. How the formation takes place and how it can be governed is approached through five formation elements: dynamics, strategy, governance, behaviour and evolution. The elements are defined based on literature review as the dissertation body of knowledge.

Through inductive case studies and defined body of knowledge this dissertation presents as a synthesis a multidimensional model to support healthy business ecosystem formation. The model describes how ecosystem formation should be driven by key end customer requirements and how those contribute to ecosystem planning. Based on the key end customers it is possible to define initial joint value proposals and core service providers. This dissertation introduces roles of anchoring and moderator actors to business ecosystem discussion as actors leading the ecosystem formation and maintaining the ecosystem structure through strong relationships. The dissertation proposes conceptual models to assess ecosystem health and stakeholder salience. Ecosystem health can be assessed with sustainability, resilience, innovativeness and renewal capabilities. Importance of actors and their impact probability can be identified with salience assessment. Both assessment models enable ecosystem planners to monitor the formation progress and to focus governance activities.

This dissertation is qualitative and inductive based on literature review and conducting empirical case studies in multiple business ecosystem type of environments in Finland and Taiwan. The dissertation consists of five academic publications and synthetization of them into this compilation book.

The principal results of this dissertation include more detailed insights to support business ecosystem definition and scoping. Ecosystem formation expands the earlier contributions on business ecosystem evolution. Roles of anchoring and moderator actors complement the ecosystem roles enhancing planning. The assessment models provide for both practitioners and academics framework for evaluating ecosystem status.

Keywords: business ecosystem, business networks, ecosystem formation, joint value creation
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Oulun yliopiston tutkijakoulu; Oulun yliopisto, Teknillinen tiedekunta
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Tiivistelmä

Asiayön: ekosysteemin muodostuminen, liiketoimintaekosysteemi, liiketoimintaverkostot, yhteinen arvoehdotus
Formation and governance of a healthy business ecosystem
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Aku and Sampo, my dearest sons: This work is dedicated to you. Without your love, support and simply being there in my life this project would not have made any meaning. Daddy has been busy but you guys tolerated that very well. Thanks also to my parents Timo and Ritva for always believing in me and supporting me even when the ride gets tough. And to C: I love you. As simple as that. Your love, encouragement, passion and commitment even in the lonely months of Taiwan exchange has pushed me for getting this far. We create the magic forest together.

There is a time to live and a time to die they say. Now it is the time to live.

Oulu, 4th October 2017

Tuomas Lappi
### Abbreviations and definitions

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Definition</th>
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<tr>
<td>AHP</td>
<td>Analytical Hierarchy Process</td>
</tr>
<tr>
<td>IMP</td>
<td>Industry Marketing Research</td>
</tr>
<tr>
<td>Business ecosystem</td>
<td>A perspective or metaphor to approach complex value constellations using analogies from ecology</td>
</tr>
<tr>
<td>Business ecosystem actor</td>
<td>An individual, team or organization involved either directly or indirectly into the business ecosystem value creation. Actors interact in multiple ways and operate in different roles in different relationships and ecosystem evolution phases</td>
</tr>
<tr>
<td>Central actor</td>
<td>Lead actor or main integrator of value in business ecosystem who has access to critical ecosystem resources and has capabilities to govern the ecosystem</td>
</tr>
<tr>
<td>Ecosystem planner</td>
<td>Any actor in the business ecosystem with capabilities or motivation to steer ecosystem formation or guide the ecosystem evolution</td>
</tr>
<tr>
<td>Formation</td>
<td>Transition of an unstructured group of networks, groups or project front-end into an operational business ecosystem</td>
</tr>
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</table>
**Original publications**


Four of the articles have been published in journals and one in a conference. All of the five articles have undergone a double blind review process. The author of this dissertation has been the primary author in all of the original publications. The researcher has been defining the research problems, reviewing the relevant literature, formulating the research questions, coordinating the empirical studies, analysing the material, drawing conclusions and finally being the primary author in all the five articles. The role of the co-authors included reviewing and commenting on the article manuscripts of the first author.
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1 Introduction

1.1 Background and research environment

The megatrends of digitalization, deregulation, globalization and more active participation of stakeholders are changing the value creation in business networks and supply chains. Instead of traditional company or individual actor driven process, value creation is becoming more and more market and end customer driven interactive engagement (e.g. Wu 2008; Romero and Molina 2011; Pinho and Fisk 2014; Vargo et al. 2015). Products are more complex and diverse and various embedded service elements expand the traditional view of a product to a unique customer specific experience. More and more of the value is delivered as complex projects whose life time is extended beyond traditional temporal implementation and delivery to more permanent operational entities (e.g. Artto et al. 2016; Aaltonen and Kujala 2010). Roles of the actors in business networks are more dynamic due to fast development of technologies and information democratization (Adomavicius et al. 2006). Relationships are multidimensional making the value creation unlinear and blurring the boundaries of value constellations (e.g. Barradas et al. 2016; Camarinha-Matos et al. 2009). Networks and their actors emerge, evolve, dissolve and re-join across industries, social groups and geographic locations.

Other major driving forces behind the rapid and unpredictable change in the business environment include privatization, fast technological evolution and increased availability of data (Williamson 2007; West and Bogers 2014). These trends increase transparency and access to information leading to higher interaction level between the actors in a networked economy (Voelpel et al. 2004; Kowalkowski et al. 2012)

The increased complexity in today’s business environment create challenges to the actors. Challenges such as complexity of interactions, fast changes and global competition can be analysed using business ecosystem as a perspective. Business ecosystem is a rising concept in business collaboration literature applying terms, analogies and metaphors from ecology or biology ecosystems into business domain (e.g. Moore 1993; Moore 1998; Gossain and Kandiah 1998; Iansiti and Levien 2004). Its foundations are in organizational and strategy research, business network research, service and customer dominant logic and project business literatures.
As a relatively novel concept, the position of business ecosystem amongst the related academic discussions is not established (Peltoniemi 2006; Kortelainen and Järvi 2014) and scoping of a business ecosystem is not unambiguously defined in present literature. Business ecosystem is not an own organization form as such but a perspective to view value constellations such as organizational networks, business networks, value networks, supply chains, meta-organizations, complex adaptive systems, project networks, projects and stakeholder networks (e.g. Powell 1990; Jones et al. 1997; Borgatti and Foster 2003; Savage et al. 1991; Post et al. 2002).

Many of the recent studies on business ecosystems (e.g. Gobble 2014; Gawer and Cusumano 2014; Ramachandran and Mukherji 2007; Lu et al. 2014; Kinnunen et al. 2013) state that business ecosystems are formed around certain core technology, product or service that is being operated by a focal company or central actor of the ecosystem. Examples of these central entities discussed widely in both academic and practical settings are Apple in the iOS mobile handheld ecosystem or Google in the Android ecosystem.

There exists several useful contributions (e.g. Thomas and Autio 2014; Tsevetkova and Gustaffson 2014; Zahra and Nambisan 2012; Lu et al. 2014; Kinnunen et al. 2013) on business ecosystem characteristics and applications of the concept mostly into modelling the networks of organizations, power relationships of the actors and dynamics related to joint value creation. In the recognized literature business ecosystem is defined as an interaction network of actors sharing a common goal and a common end customer. Each of the actors may have own targets but the dependency on other actors create an interaction network as an ecosystem where the actors together co-create more value to the end customer than they could provide independently (Iansiti and Levien 2004; Peltoniemi 2006).

Following project business literature (e.g. Arto and Kujala 2008; Freeman 1984; Mitchell et al. 1997) actors in a business ecosystem can be either internal or external stakeholders. Based on their role they either impact or are being impacted by the ecosystem operations. Iansiti and Levien (2004), Hu et al. (2008) and Lu et al. (2014) for example discuss about different actor roles in business ecosystems. Diversity in roles is recognized as an important aspect for a healthy ecosystem (Thomas and Autio 2014) but categorization of the actors to roles on high level provides room for interpretations and limits the practical applicability.

Business ecosystems have an explicit focus on collective value creation. Value is always co-created and mitigated by markets (Vargo and Lusch 2004; Payne et al. 2008) and customers participate as ecosystem’s active actors in the value creation process (Heinonen et al. 2010; Kowalkowski et al. 2012). This view differs from
the traditional approach where innovation and thus value creation is driven by services providing actors in the network. Value creation is a complex dynamic system of actors that co-create value and at the same time provide the context where the value gains its asset (Pinho and Fisk 2014). How the business ecosystems create value as network and provide success through important relationships is a topic derived from business network research (e.g. Powell 1990; Snehota and Håkansson 1995; Romero and Molina 2011) and applied since into business ecosystem literature for example by Clarysse et al. (2014).

Like biological ecosystems the business ecosystems evolve over time driven by economical and social aspects of relationships (e.g Hayek 1945; Jones et al. 1997; Adomavicius et al. 2006). Business ecosystem evolution is due to competitive and co-operative interactions amongst the actors. During the evolution the actors create cumulative learning for the ecosystem. Mechanisms for ecosystem evolution, learning and triggers that initiate the evolution are not studied extensively. Evolution and transition of the ecosystem from a phase to another is a fruitful source for a research project.

Fuzzy front-end phase, turbulent and complex environment, changes in stakeholders, difficulties to consolidate the key requirements and customer needs for ecosystem scoping are challenges common to project management and evolution of a business ecosystem (e.g Williams and Samset 2010; Olander and Landin 2005; Olander 2007; Lundrigan and Gil 2015). In order to plan ecosystems efficiently the ecosystem central actors need capabilities to manage complex implementation projects and multi-dimensional stakeholder networks. The emergence (or formation as presented in this dissertation) of business ecosystem can be approached as an ecosystem implementation project.

Ecosystems are in general moving towards more decentralized and autonomous direction. Strict management of a global ecosystem is time and resource consuming activity for the central actor and may not be a successful long term strategy (Stadenmayer et al. 2005; Anggraeni et al. 2007). Key challenges for ecosystem governance can be derived from the interfirm modularity (Gundlach and Foer 2006; Gulati et al. 2012; Brusoni 2005; Baldwin 2007). These challenges are system level value and end customer definition, management of the architectural interdependencies within the ecosystem and managing the relationships of the ecosystem actors (Staudenmayer et al. 2005; Capaldo 2014). The central actors need to identify who are the customers of the upcoming ecosystem and who are the service providers that need to be involved already in the very beginning. Establishment of a healthy business ecosystem (denHartigh et al. 2006) requires
focus on actors and their relationships in targeted operational phase, not in project phase only.

Ecosystem governance core logic is based on complexity logic from strategy research (Minzberg and Waters 1985; Lengnick-Hall and Wolff 1999; Gulati et al. 2000; Göttlich and Wenzek 2004). Core logic defines the operational mode and actor strategies but systematic ecosystem management is a nearly impossible task due to unlinear impact of actions in complex and multidimensional environment (Capaldo 2014; Campagnolo and Camuffo 2010). Central actors need to focus their governance activities to the actors and relationships that drive the formation process and create value delivery channels for a healthy ecosystem. Tools and methods to evaluate the health and success capabilities of the ecosystem are not established in the related literature. This dissertation aims to add value to both academic discussion and practical application in the area.

This dissertation elaborates the perspectives of business ecosystem from the theoretical foundations and present literature to provide more insights to address the challenges in todays’ business networks. The dissertation uses business ecosystem as the term for complex value creation networks and seeks to complement the knowledge base on business ecosystem formation, roles of the actors and ecosystem governance.

An empirical case study based research is conducted in this dissertation to build knowledge on business ecosystems from practice. As a perspective to approach complex business networks, the business ecosystem fits well into built environment projects and operational value networks in them. Built environment forms a major part of the empirical context of the research in this dissertation. Especially business ecosystem scoping is elaborated through case studies in Finland. Structural challenges in built environment are similar to discussed megaproject challenges in project business literature (Lundirgan and Gil 2015; Flyvbjerg 2014; Mok et al. 2015): Complexity in relationships, alignment of goals, involvement of the end customers, public-private-partnership mode of operation and requirements of the stakeholders are themes that resonate with business ecosystem discussion.

In built environment context the construction projects are fundamentally different entities with established operational built environment settings. Different actors, goals and processes are the typical differences between project and operational phases (Mok et al. 2015) but how those phases are interrelated has received less attention. Mostly the research and managerial focus in built environment business is on the construction projects and the upcoming ecosystem
is not taken into account for example in early planning (Aapaoja and Haapasalo 2014; Newcombe 2003).

In addition to built environment the research in this dissertation utilizes business ecosystem as perspective to approach multi-actor business networks in Taiwanese health and wellbeing domain. The business culture in Taiwan emphasizes deep, informal and trust based relationships across industries (Chang and Lu 2007; Hsieh, Yen and Chen 2010) proving a fruitful environment for relationship and actor role research as business ecosystems.

As business ecosystem concept is still developing, there are areas such as ecosystem formation where the knowledge base is not well established (Kortelainen and Järvi 2014). Business ecosystems cannot be managed and their formation patterns from independent networks or implementing projects to interactive organic ecosystems are not widely discussed in academic research (Daft and Levin 1993). Facilitation or governance are preferred terms to describe how ecosystem formation can be impacted towards a healthy value creation network (Camarinha-Matos et al. 2009). To plan effectively the ecosystem formation the scope, actors and relationships that constitute the ecosystem need to be defined on needed level of detail. The formation related characteristics that are regarded as knowledge gaps addressed in this dissertation research are ecosystem scoping, role description, relationship description, success evaluation and governance.

1.2 Objectives and scope

The key motivation to this dissertation comes from multiple studies in business ecosystems and founding theoretical perspectives while regardless of the previous contributions, the formation of the ecosystem and dynamics related to it have received less attention. Business ecosystem formation is about transition of early front-end (project-type) ecosystem into an operational ecosystem. The formation is not linear and can also take step backwards, depending on the impact of the stakeholders. Insights on how to guide the limited governance resources into right actors and relationships at right time could benefit the evolution and success capabilities. Hence this dissertation aims to observe different aspects of business ecosystem characteristics and identify actors, behavioural patterns and relationships that would build the knowledge on ecosystem formation. The research problem of this dissertation is defined as:

How to make business ecosystem formation more efficient and how to evaluate the success capabilities of the ecosystem?
The objective of this dissertation is to provide new information and conceptual tools to support planning of a healthy business ecosystem through systemizing the formation phase. This dissertation focuses on understanding the key business ecosystem elements and how those could be applied to address the identified research problem. The dissertation approaches the complexity of ecosystem formation by sharpening the definitions or roles and relationships and providing conceptual tools to model business ecosystem as end customer driven entity. The dissertation introduces for further academic research process and tools about ecosystem health and stakeholder assessment. Dynamics related to ecosystem formation are approached in Table 1 through five research questions that support the research problem.

### Table 1. Research questions

<table>
<thead>
<tr>
<th>RQ#</th>
<th>Research question</th>
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<tbody>
<tr>
<td>RQ1</td>
<td>How to define the scope of business ecosystem before formation?</td>
</tr>
<tr>
<td>RQ2</td>
<td>How the system level value proposals define the core service providers?</td>
</tr>
<tr>
<td>RQ3</td>
<td>How to identify actors in formation and operational phases that keep the ecosystem active?</td>
</tr>
<tr>
<td>RQ4</td>
<td>How to evaluate ecosystem success capabilities through health assessment?</td>
</tr>
<tr>
<td>RQ5</td>
<td>How to identify the actors to focus the governance activities in ecosystem formation?</td>
</tr>
</tbody>
</table>

The five research questions in Table 1 all contribute to the research problem from different viewpoints related to a healthy business ecosystem formation. The first three questions discuss about how to define business ecosystem scope, targets, actors and relationships. Through a built environment case study in Finland the dissertation introduces in RQ1 how ecosystem scope can be defined as customer centric value creation entity instead of service provider or actor driven value network traditionally used to describe business networks. RQ2 takes the customer centricity as the starting point to identify in early planning the actors who need to be involved into ecosystem formation so that it becomes successful in operational phase. RQ3 focuses on bringing more detailed information about actors and relationships that are crucial for the ecosystem formation, joint value creation and keeping the ecosystem structure in place in operational phase. In RQ3 Taiwanese health and wellbeing ecosystem as the case study research subject provides a fruitful context to analyze the social, behavioral and relational aspects of business ecosystems against its core logic.

RQ1, RQ2 and RQ3 are defined to strengthen the role of business ecosystem in context of the theoretical foundations, to sharpen how a business ecosystem can
be scoped and to complement the discussion about the descriptions of the roles and relationships in the ecosystem formation phase. As another dimension to analyze the transition of a project-type ecosystem to an operational ecosystem, the research introduces concepts to support business ecosystem application to define, plan and monitor the formation process. RQ4 investigates how ecosystem health could be evaluated to support governance in formation using again Taiwanese health and wellbeing ecosystem as empirical research environment. RQ5 utilizes as a case study an operational built environment in Finland. The characteristics of the RQ5 case study enable application of project business originated stakeholder assessment to improve business ecosystem governance. Through a structured operational case study subject the RQ5 aims to scrutiny the discussion about ecosystem stakeholder governance and direction of the ecosystem for efficient formation.

The five research questions are discussed in more details in four published academic journal articles and one conference article defined based on the research problem. The articles and research questions are presented below in table 2. The mapping between research questions and articles is not linear as the research set-up was modified during the research process.

<table>
<thead>
<tr>
<th>Article</th>
<th>RQ#</th>
<th>Article title</th>
<th>Name of the journal</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>5</td>
<td>Business ecosystem definition in built environment using a stakeholder assessment process</td>
<td>Management</td>
</tr>
<tr>
<td>II</td>
<td>2</td>
<td>Customer roles in a business ecosystem – a case study in health and wellbeing campus</td>
<td>CIB 2016 conference proceedings</td>
</tr>
<tr>
<td>III</td>
<td>1</td>
<td>Customers and service providers in business ecosystem front-end – case study of health and wellbeing campus</td>
<td>International Journal of Innovation and Learning</td>
</tr>
<tr>
<td>IV</td>
<td>3</td>
<td>Connecting the modules: The importance of strong and weak relationships in a business ecosystem</td>
<td>International Journal of Sustainable Strategy and Research</td>
</tr>
<tr>
<td>V</td>
<td>4,3</td>
<td>Assessing business ecosystem health: Role of anchoring actor in formation phase</td>
<td>International Journal of Management, Knowledge and Learning</td>
</tr>
</tbody>
</table>

The articles are linked together through three case study projects, Haukipudas school campus, Health City Oulu (a health and wellbeing oriented campus in Oulu) and Taiwanese health and wellbeing ecosystem (a self-organized collaboration network in health and wellbeing domain in Taichung City area in Taiwan). The
articles published based on the case study research findings elaborate business ecosystem concept and bridge the gaps between business ecosystem and the theoretical foundations. The dissertation illustrates how business ecosystem formation consists of transformation of front-end (project) ecosystem into an operational ecosystem. Planning of ecosystem can be sharpened in two dimensions following the research problem and research questions: Defining roles and responsibilities and assessing ecosystem health and stakeholder salience. The core logic and joint value creation of the business ecosystem are elaborated with analysis on business ecosystem relationships and their importance. To support governance of the ecosystem and to enhance the formation process the research introduces concepts to evaluate the health of the ecosystem in four dimensions and salience and impact probability of the actors.

The positioning between the research questions and articles is presented in figure 1 as the dissertation logic. To complement the dissertation logic the figure 1 illustrates how the research questions support the overall research problem set in the beginning of this chapter.

![Fig. 1. Positioning of the research questions and articles as the dissertation logic](image)

### 1.3 Research approach and methodology

As Eriksson and Kovalainen (2016) state, ontology, epistemology and methodology are the key concepts in social sciences related philosophy. As business ecosystems are social entities by the very nature through their actors (Götlich and Wenzek 2004; Clarysse et al. 2014), the research approach and methodologies are derived from the social sciences (Jones et al. 1997). Social reality is made from consequences of social actors. The ecosystem perspective on
complex networks builds on the social relationships and social constructivism. As the human capital is one of the key transaction items in ecosystem mode of operation (Benkler 2002), the social sciences lay foundations to the research approach and methodology.

Research ontology is a subjective constructionism perception of how the researcher sees the phenomenon under research (Eriksson and Kovalainen 2016). Research ontology in this dissertation is defined as how the researcher utilizes the existing knowledge and approaches the case study subjects as dynamic, co-evolving and multidimensional value constellations (Barradas et al. 2016). The research ontology acknowledges that the ecosystem analysis results are subjective and similar research as conducted in this dissertation can provide different experiences if similar set-up would be applied by another researcher (Kortelainen and Järvi 2014). Therefore the business ecosystem research is a social constructive set-up as the entity is an output of social and cognitive processes (Guba and Lincoln 1994; Bryman and Bell 2003).

Research epistemology based on critical realism is about the elements that build the knowledge for the research. According to subjective view for research epistemology (Eriksson and Kovalainen 2016) building the research knowledge elements is based on researcher’s observation and interpretations. This dissertation follows the subjective epistemology as the research questions are addressed as subjective in-depth qualitative case studies. Critical realism as the philosophical position (Eriksson and Kovalainen 2016) builds on the research subjectivity as it takes into account reality as the research material but emphasizes that the reality can have multiple interpretations (Guba and Lincoln 1994). Critical realism forms the epistemology for the research as the business ecosystem actors, roles, relationships and formation process can be interpreted in different ways (Bryman and Bell 2003).

Research methodology is closely related to epistemology. Methodology describes also how the researcher sees the phenomenon but from a practical perspective (Eriksson and Kovalainen 2016). Methodology is a description of how a phenomenon can be studied. Methodology in this dissertation defines how the research builds up knowledge on business ecosystems in a valid manner (Guba and Lincoln 1994; Romero and Molina 2011). The theoretical foundations of the research methodology come from organizational and strategy research (e.g. Minzberg and Waters 1985; Porter 1985; Powell 1990), business network research (e.g Snehota and Håkansson 1995; Möller and Rajala 2007), service and customer dominant logic (e.g. Vargo and Lusch 2004; Payne et al. 2008) and project business
(e.g. Arto and Kujala 2008; Mitchell et al. 1997) academic fields. Social network theory and cultural aspects are important underlying sources of behavioural understanding of the research phenomenon especially when the research is conducted in two different countries and different socioeconomical cultural set-ups.

Selecting both operational and front-end (project) ecosystems into the research scope creates a valid case study research framework as a methodology to approach the identified research problem (Yin 1994). The business ecosystem as a loose business collaboration framework increases the level of complexity of research methodology as described by Kortelainen and Järvi (2014) and Peltoniemi (2006) in the context of ecosystem research. Roles and relationships are multidimensional and ecosystem borders are not clearly set (Baldwin 2007). The researcher has to be familiar with the ecosystem characteristics and the context where it is being applied and the defined methodology provides a good framework for this (Bryman and Bell 2003).

This dissertation applies schematically qualitative methodology and precisely case study methodology (Eisenhardt 1989; Yin 1994). The methodology that guides the research process and design is qualitative and inductive by nature. In inductive research the theoretical implications are defined based on the empirical results (Eisenhardt 1989). The research process starts from empirical results and defines concepts, themes and models through interpretations of empirical research results. The research epistemology is explanatory as the research questions are “how” types of questions (Eriksson and Kovalainen 2016).

The selected research methods analyse existing phenomenon and conceptualize the rationalities behind it (Eriksson and Kovalainen 2016) in different contexts. The methods provide detailed information about the case study objects and provide a fruitful source of data for analysis and interpretations that can be used to consolidate concepts as inductive qualitative research to support business ecosystem planning (Guba and Lincoln 1994). The research results generalization opportunities are limited due to selected single case study approach (Yin 1994). Applying the used methods with different cases and building quantitative research set-ups about the collected data would reinforce the role of this dissertation as part of business ecosystem research streams as noted also earlier by Kortelainen and Järvi (2014).
1.4 Research realisation and data

Research realisation methods are often divided into data collection and analysis methods (Eisenhardt 1989). The research realisation methods of this dissertation include

- literature review on organizational and strategy research, business network research, customer and service dominant logic and project business research
- literature review on business ecosystems
- three qualitative case studies on built environment and one on health and wellbeing domains based on semi-structured interviews
- Analysis of recorded interview data and complementary documentation in specialist workshops

Single case study as the primary source of data provides in depth access to data but the generalization opportunities of the identified results are limited (Yin 1994). It applies to conceptualize now widely studied topics that have been applied in several business ecosystem research contexts (Peltoniemi 2006). Primary data of the case studies was collected in semi-structured interviews using snowball sampling technique (Goodman 1961). In snowball sampling technique the interviewee names the next actors to be interviewed based on the perceived relevancy to the research topic. In this dissertation the snowball sampling technique was used in the case studies to organize the interviews as a process that was continued until it was saturated, i.e. no new relevant actors were named. Obtained data was supported by publicly available documentation, project plans, presentation materials and research reports when applicable.

This dissertation contains five articles. The collection of data for the articles was done using inductive single case study design (Eisenhardt 1989) and reviewing available documentation. How the articles are linked with case studies and data collection is presented in table 3.

<table>
<thead>
<tr>
<th>Article</th>
<th>Data collection</th>
</tr>
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<tbody>
<tr>
<td>I</td>
<td>Case: Haukipudas school campus, 8 semistructured stakeholder interviews</td>
</tr>
<tr>
<td>II</td>
<td>Case: Heath City Oulu: 50 semistructured customer candidate interviews, public documents,</td>
</tr>
<tr>
<td>III</td>
<td>Case: Heath City Oulu: 50 semistructured customer candidate interviews, public documents</td>
</tr>
<tr>
<td>IV</td>
<td>Case: Taiwan health and wellbeing ecosystem: 27 semistructured ecosystem actor interviews</td>
</tr>
<tr>
<td>V</td>
<td>Case: Taiwan health and wellbeing ecosystem: 27 semistructured ecosystem actor interviews</td>
</tr>
</tbody>
</table>
Haukipudas school campus case study research was done in February-March 2015 and Health City Oulu between March and June 2015. Taiwanese health and wellbeing ecosystem was investigated during research exchange period in Taichung Taiwan in March-June 2016. Haukipudas school campus and Taiwan health and wellbeing ecosystems are both operational ecosystems. As established ecosystems they provide a salient environment to study the roles, relationships and behavioural patterns of business ecosystem actors and how these are related to the success of the ecosystem. Haukipudas school campus as a more coherent and condense ecosystem provided an opportunity to complement the stakeholder assessment through Analytical Hierarchy Process (AHP). AHP was used to prioritize the ecosystem actors using pairwise comparison (Al-Subhi Al-Harbi 2002).

The data collected in Taiwan was translated from Chinese to English language during the interviews. The data was analysed in separate specialist workshops where recordings and notes collected during the interviews were reviewed and findings were consolidated against the defined research questions.

Health City Oulu is in early front-end phase where construction project for ramping up the built environment was in planning phase at the time of the research. As an early phase case study subject the Health City Oulu served as research environment to study how business ecosystem is formed and what are the dynamics and challenges related to formation phase. Health City Oulu presented also centrally governed type of network in the research.

Cases in Finland and in Taiwan provided opportunities to compare the ecosystems in different cultural contexts and gather more detailed understanding about the roles and relationships in ecosystems. Articles IV and V expand the identified results of I, II and III through taking the research into Taiwan and analysing deeper the actor roles and relationships in social context for the ecosystem success. Taiwan was selected as the case study environment as in the local business culture strong personal and social aspects, trust and multi-dimensionality characterize the relationships in networks (Chang and Lu 2007; Hsieh et al. 2010). These aspects were identified as an important factors in ecosystem formation during the research process based on the findings discussed in articles I, II and III. Taiwanese business ecosystem was self-organized by nature.
2 Literature review

Business ecosystem is not a new organizational form as such but provides a framework or a perspective to approach dynamic business networks and complex organizations where interdependent actors jointly create value for the end customers in a coevolving interaction with multiple stakeholders. In this dissertation the term “business ecosystem” refers to this perspective.

Business ecosystem takes analogies from ecology but the theoretical foundations of it in the context of this dissertation come from multiple organizational, strategy, business, marketing and project business related academic discussions. The contributions of Powell (1990) on networked organizations, Choi et al. (2001) on metaorganizational desing and Lengnick-Hall and Wolff (1999) on strategic logics are utilized with business network research driven by Snehota and Håkansson (1995) to scope and position the business ecosystem concept. Customer and service dominant logic key contributions from Vargo and Lusch (2004), Grönroos (2006; 2008) and Heinonen et al. (2010) from the baseline for business ecosystem value creation. Project business research provides through work for example from Mitchel et al. (1997) and Artto and Kujala (2008) on project lifecycle view concepts to analyse the dynamics and evolution related to business ecosystems.

These foundations are not inclusive but business ecosystem concept can also be approached from other perspectives excluded from the scope of this dissertation. For example in social sciences the work from Mitleton-Kelly (2003) describes the business ecosystem as complex socioeconomic system but this view is not included in this dissertation to keep focus on areas relevant to the research problem. The research perspectives and elements that form the theoretical foundation for this dissertation are introduced in figure 2. They lay the baseline for the literature review of this dissertation.
2.1 Theoretical foundations for ecosystem perspective

Business ecosystem as a concept or perspective to analyse complex networks and value constellations has gained increasing attention in recent years. The ecosystem concept taking analogies from ecology was first introduced in business management and organizational research by James F. Moore (1993) in his seminal paper “Predators and Prey”. The definition of business ecosystem itself and related characteristics such as roles of actors, scope, relationships, evolution and governances has been developed further by several scholars in their research including Gossain and Kandiah (1998), Iansiti and Levien (2004), Adomavicius et al. (2006), Anggraeni et al. (2007) and Adner and Kapoor (2010).

The research perspectives introduced in the figure 2 have multiple themes that bring applicable insights to definition of business ecosystem as a concept and how the concept could be applied to increase knowledge base on complex value constellations and their dynamics both in academic and practical domains. The research perspectives, themes and related authors are presented below in table 4 to frame the scope of the literature review in this dissertation.
<table>
<thead>
<tr>
<th>Research perspectives</th>
<th>Themes</th>
<th>Authors</th>
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</thead>
<tbody>
<tr>
<td>Project business research</td>
<td>Megaprojects, project life-cycle, project front-end, project management,</td>
<td>Mitchell et al. (1997), Lundrigan and Gil (2015), Williams and Samset (2010),</td>
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The research perspectives and themes in table 4 are defined for this dissertation. As the perspectives are interrelated, they may have overlapping or common themes. This dissertation focuses on how formation of complex business networks and their actors and relationships can be approached using business ecosystem as the research perspective. Therefore the business network research is considered as the leading research perspective. The research perspectives and themes related to individual actor performance in the network, such as business models, product management and innovation are excluded or only very briefly discussed in this dissertation. Furthermore the concept of networked value is addressed as part of ecosystem success, not as own theme.

Strategy and organizational research (e.g. Johnson and Scholes 1999; Porter 1985; Lengnick-Hall and Wolff 1999; Beckham 1997; Gulati et al. 2012) perspective provides themes to approach business ecosystems and map business networks. According to knowledge based theory (Hayek 1945) the actors in business networks know more than they do and therefore the boundaries of the network can be wider than physical transaction network (Hayek 1945; Powell 1990; Daft and Levin 1993; Provan and Kenis 2009). Insights such as organizational
learning and transaction costs from social network theories (Daft and Levin 1993; Langlois 2006) can be used to enrich roles and behavior of actors as their position in the network is influenced by them.

Powell (1990) definition of networks as form of organizing transactions can be considered as an early illustration of how the actors form networks as organization (Jones et al. 1997; Beckham 1997; Savage et al. 1991) and define value creation processes. Granovetter (1983) introduces how strong and weak relationships can be defined and how they are vital for the networked organization to succeed and adapt to changing environment.

Complex adaptive systems theory (Choi et al. 2001, Gundlach & Foer 2006) strengthens dynamic and interactive nature of organizations and networks of organizations. Co-evolution, internal mechanisms and interaction with external environment (Choi et al. 2001) are characteristics from complex adaptive systems theory that apply for business ecosystem perspective (Gundlach & Foer 2006; Ritter and Gemunden 2003).

Jones et al. (1997) definition of network governance modes brings applicable framework to ecosystem steering, especially shared governance mode discussed by further Provan and Kenis (2009) and Capaldo (2014) is a suitable framework for the scope of this research.

Business network research (eg Porter 1985; Ford 1990; Snehota and Håkansson 1995; Möller & Rajala 2007) forms the most significant research baseline for this dissertation. Business network research builds on the organizational and strategy research focusing on the dynamics of actors and their relationships in network (Håkansson and Snehota 1995; Ford and Håkansson 2013). It describes different network capabilities like self-organization, interdependency and how to orchestrate the business networks (Möller and Halinen 1999; Ritter and Gemunden 2003). Business network research has developed from organizational and social network theory to relational, contextual and systemic understanding of self-organized and managed organizational networks (Porter 1985; Granovetter 1983; Ford and Håkansson 2013). Network is a set of actors (“nodes”) connected by relationships (Snehota and Håkansson 1995).

In business network research modelling the networks as stakeholders builds on the Industrial Purchasing and Marketing (IMP) group’s approach in that the relationships should be analysed as networks, not as dyadic nodes (Ford 1990; Snehota and Håkansson 1995). The Activities, Resources, Actors (ARA) model defined by Håkansson and Johansson (1992) describes how a network and transactions in the network can be analysed through individual substance levels.
Network modularity (Baldwin 2007) is a theme derived from business network research that advocates designing system structures based on minimizing interdependence between modules and maximizing it within the modules (Borgatti and Foster 2003; Campagnolo and Camuffo 2010). Campagnolo and Camuffo (2010) present based on Gulati (2000), that the structure should enable new module configurations without loss of the system basic functionality. Network modularity is key to enable adaptability and collaboration (Baldwin 2007; Barradas et al. 2016) but there are cognitive limits for it (Brusoni 1995). Same module can be part of multiple networks (Ritter and Gemunden 2003; Dittrich et al. 2014).

Taking collaboration and competition as interaction forms the Collaborative Networked Organizations theme described by Camarinha-Matos et al. (2009) extends the business network research perspective. Concept of Collaborative Networked Organizations (CNOs) applies to this dissertation especially from Virtual Breeding Environment (VBE) definition. Collaboration involves mutual engagement of participants to create value together (Dittrich et al. 2014) and to enhance their capabilities (Camarinha-Mantos et al. 2009).

Service-dominant logic, first introduced in marketing context by Vargo and Lusch (2004), is focused on producing value creation and consumption processes. Customer and service dominant logics as the third research perspective in this dissertation (Vargo and Lusch 2004; Hakanen and Jaakkola 2012; Heinonen et al. 2010; Nätti et al. 2014) introduce themes for further scholar research such as customer centricity (Payne et al. 2008), customer internal processes (Grönroos 2008) and value proposition co-creation (Ballantyne et al. 2011). They describe the business network in terms of customer driven value constellation (Kowalkowski et al. 2012) where the unique value proposals are being jointly developed with customer engagement (Majava et al. 2015; Prahalad and Ramaswamy 2004). These themes bring important insights on how the business networks operate, how the strategic targets are defined and how the value is being created in them.

Due to customer involvement in these processes, both the suppliers and customers are co-producers of the service and co-creators of the value (McColl-Kennedy et al. 2012) based on that service (Payne et al. 2005; Grönroos 2006; Grönroos 2008). Customer-dominant logic builds on the integrated value creation and consumption (Heinonen et al. 2010; Hakanen and Jaakkola 2012; Zhang et al. 2015). According to Heinonen et al. (2010), customer-dominant logic emphasizes customers’ internal processes, customer communities (Wu et al. 2008; Romero and Molina 2011) and requirements as the driver of the integrated value processes. The customer dominant logic puts the customer and different customer typologies (Wu
2008) into the central role instead of service: what end customers are doing, and what services they wish to utilize to accomplish their own goals (Heinonen et al. 2010; Pinho and Fisk 2014).

The fourth research perspective that contributes to business ecosystem concept in this dissertation is project business research (Cleland et al. 1986; Artto and Kujala 2008). Stakeholder assessment and stakeholder salience model (Freeman 1984; Donadson and Preston 1995; Mitchell et al. 1997; Agle et al. 1999; Aapaoja and Haapasalo 2014; Newcombe 2003) provide framework for assessing actors as stakeholders (Fassin 2008; DeSchepper et al. 2014; Olander and Landin 2005). When projects as temporal organizations (Hällgren and Söderholm 2011; Aaltonen et al. 2013) are extended with life-cycle view (Aaltonen and Kujala 2010; Artto et al. 2016) a single project or networked value deliverable can be seen as a temporary value proposal (Artto et al. 2008; Cleland 1986) embedded in a more durable ecosystem based on the actor relationships and roles (DeFilippi and Sydow 2016) with similarities in governance modes (Bryson 2004; Jawahar and McLaughlin 2001) and performance measurement (Clarkson 1995; Davis 2014). Business ecosystem can also be viewed as a project network (Hellgren and Stjernberg 1995). This applies also in context of megaprojects (Lundrigan and Gil 2015; Metcalf and Sastroowardoyo 2013; Mok et al. 2015; Flyvbjerg 2014) whose organizational complexity (Jepsen and Eskerud 2009; Olander 2007) and long life cycle (Artto et al. 2016) brings them close to more permanent value constellations (Post et al. 2002). Dynamics of organizational interactions and roles of actors in the project front-end phase (Williams and Samset 2010; Aapaoja et al. 2013) share valuable insights to address ecosystem formation challenges.

The four research perspectives introduced above provide theoretical foundation for this dissertation and act as inputs to review further the literature on business ecosystems. The business ecosystem perspective and the relevant characteristics of it for this research are presented below in the figure 3 and discussed in the following chapters in context of their theoretical foundations and how they are positioned against the objectives of this dissertation.
2.2 Business ecosystem definition and characteristics

Business ecosystem has different interpretations in academic discussion (e.g., Moore 1993; Gossain and Kandiah 1998; Iansiti and Levien 2004; Adomavicius et al. 2006). Positioning the ecosystem concept with other networked organizations, temporal organizations and metaoorganizations is not unambiguous. Ecosystems are not strictly defined. They are not systematically governed and they have multiple business and non-business actors either directly or indirectly impacting the value creation (Moore 1993; Gossain and Kandiah 1998). Selected business ecosystem definitions and sources of the definitions are presented in table 5.

Table 5. Definitions for business ecosystem

<table>
<thead>
<tr>
<th>Source</th>
<th>Definition</th>
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<tbody>
<tr>
<td>Moore (1998)</td>
<td>&quot;Business ecosystems are communities of customers, suppliers, lead producers and other stakeholders interacting with one another to produce goods and services…These communities come together in a partially intentional, highly self-organizing and even somewhat accidental manner. But the result is that the members provide contributions that fill out and complement those of others. Like biological ecosystems, these communities develop over time, not unlike the process of ecological succession.&quot;</td>
</tr>
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Fig. 3. Theoretical foundations and business ecosystem perspective characteristics
Source | Definition
--- | ---
Gossain and Kandiah (1998) | "We have extended and refined Moore’s (1998) original concept to recognize the importance of creating value for customers through the provisioning of additional information, goods and services. Value creation enables business to distinguish itself from competitors and provides means of establishing a bond with the consumer. Partners interact with customers through a single channel."
Iansiti and Levien (2004) | "There are certainly strong parallels between business networks and biological ecosystems. Both are characterized by a large number of loosely interconnected participants that depend on one another for their effectiveness and survival. If the ecosystem is healthy, individual participants will thrive; if the ecosystem is unhealthy, individual participants will suffer. Drawing the precise boundaries of an ecosystem is an impossible and, in any case, academic exercise."
Peltoniemi (2006) | "The members of a business ecosystem are capable of conscious decisions on their own behalf. Firms aim at innovations and commercial success and hope to take advantage of other members and their capabilities. This is challenging since a business ecosystem is coupled to its environment, which may change rapidly and unpredictably. Thus, a business ecosystem is fundamentally a dynamic structure that evolves and develops in time."
Adomavicius et al. (2005) | "The traditional notion of an ecosystem in biological sciences describes a habitat for a variety of different species that co-exist, influence each other, and are affected by a variety of external forces. Within the ecosystem, the evolution of one species affects and is affected by the evolution of other species. By considering the technology ecosystem as an interrelated set of technologies and environmental forces, a manager can more successfully identify factors that may impact innovation, development, and adoption of new technologies—and ultimately the success of the business activities that use the innovations."
Anggraeni et al. (2007) | "...use the business ecosystem concept as a perspective to understand business networks, rather than as a new organizational form. Such a perspective will provide a logic, different from the current logic of understanding inter-organizational relationships from the network perspective. The business ecosystem perspective offers a new way to obtain a holistic view of the business network and the relationships and mechanisms that are shaping it, while including the roles and strategies of the individual actors that are a part of these networks."

Business ecosystem is an ecology driven metaphor (Moore 1993; 1998) to approach complex value creation entities such as self-organized business networks (Möller and Halinen 1999; Möller and Rajala 2007). The ecology metaphor has been discussed widely in strategy research (e.g. Beckham 1997) but most of the research on ecosystems are conceptual with lack of analytical value adding tools for practitioners (Kortelainen and Järvi 2014; Anggraeni et al. 2007).

A business ecosystem can be seen as an extended system of mutually impacting and evolving organizations building on multi-organizational innovation and learning (Gossain and Kandiah, 1998; Anggraeni et al. 2007). Indefinite timing, continuous learning and self-organization extend the ecosystem to be a wider concept than for example business networks discussed in business network research scope (Iansiti and Levien, 2004; Moore 1998; Möller and Rajala 2007).

Instead of new organization form, the business ecosystem applies natural ecosystem metaphor to advance the understanding of relationships or interactions amongst actors and their environment (Moore 1998; Pinho and Fisk 2014; Romero and Molina 2011), roles and interests of the actors and mechanisms to guide the interactions towards shared goal (Choi et al. 2001; Capaldo 2014). The natural ecosystem as a metaphor drives business studies to expand beyond atomistic and internal views of the firm as natural ecosystem is a complex, self-organizing entity (Anggraeni et al. 2007).

According to Powell (1990) the transactions in networks occur through individuals engaged in reciprocal, preferential and mutually supportive actions. Basic assumption in networks and their operational logics is that one party is dependent on resources controlled by other (Lengnick-Hall and Wolff 1999). As individual units do not exist by themselves in networks, the relationships determine the network structure and transaction processes (Håkansson and Snehota 1995; Daft and Levin 1993). This definition can be seen as a baseline for how relationships are formed in business ecosystems, how the actors are dependent on each other and how the value of the ecosystem is networked (Powell 1990; Iansiti and Levien 2004; Gawer and Cusumano 2014).
Iansiti and Levien (2004) discuss that defining precise borders for a business ecosystem is impossible, but based on Moore (1998) and Peltoniemi (2006) there are different approaches to describe the scope on a detailed level enough for research purposes and practical interventions. The defining element for an ecosystem scope is not a product but a coherent set of interrelated technologies and associated organizational competences (Peltoniemi 2006; Gawer and Cusumano 2014). Business ecosystem boundaries are considered to be fairly open and permeable (Moore 1998). They are not strictly defined but need to be determined in order to model the ecosystem actors and their relationships (Dass and Kumar 2014).

Complexity related to ecosystem scoping can be approached through modelling the ecosystem as a stakeholder network (Freeman 1984; Donaldson and Preston 1995). The network and relationship analysis starts by identifying the organizations with which the central actor interacts and presenting them as a stakeholder network diagram (Fassin 2008; Freeman 1984). The identified stakeholders can be categorized using resource dependency relationships such as ARA model (Håkansson and Johansson 1992) to formulate their roles in value co-creation and to identify relevant stakeholders for further assessment (Donaldson and Preston 1995; Aapaoja and Haapasalo 2014).

Defining the relationships between the stakeholders extends the stakeholder network from an actor specific business network research view (Snehota and Håkansson 1995) to a business ecosystem view (Moore 1998). Business model description of the stakeholders characterizes the business ecosystem view on value co-creation process through the interaction web and clarifies whether the actors’ incentives are aligned with the system level goals (Aaltonen and Kujala 2010; Kowalkowski et al. 2012).

Large scale business ecosystems can be seen to be built from individual actor centric business networks as modules. Network modularization (Borgatti and Foster 2003; Campagnolo and Camuffo 2010) can be used to combine individual business networks as a business ecosystem. The approach to extend scope to larger organizational scale is similar as project network concept advocated for example by Hellgren and Stjernberg (1995). Extending the organizational and network research from a single network or project opens up a module based view to analyze organizational structures, technologies, customers and products of the ecosystem (Gundlach and Foer 2006; Adomavicius et al. 2005; Borgatti and Foster 2003; Hellgren and Stjernberg 1995).
Approaching a business ecosystem visualization through network modularization can be done with design rules through the task dependencies and how the process of creating value in the ecosystem is phased (Baldwin 2007). Modularization can decrease dependencies between the actors and decrease risk of opportunistic behavior (Campagnolo and Camuffo 2010). For ecosystem it can also be a sign of dissolution if the modules disintegrate into independent value networks (Gundlach and Foer 2006). Modularization can be seen also as a substitute for trust that is considered as a key characteristic behavior in business ecosystem relationships (Anggraeni et al. 2007; Borgatti and Foster 2003; Gawer and Cusumano 2014). Modularization acts as an ecosystem change agent as it makes transactions feasible where they were previously impossible or very costly (Baldwin 2007). This extends the network value creation to larger multi-industrial business ecosystem where networks as modules interact through capabilities of individual actors connecting the modules (Ritter and Gemunden 2003; Gundlach and Foer 2006).

Following the stakeholder network and network modularization the actors in a business ecosystem have multiple types of roles (Cegganoli et al. 2012) in different life-cycle phase (Peltoniem 2006). The focus is on system level relationships between modules and their dynamics (Borgatti and Foster 2003; Gulati et al. 2000) rather than on business relationships of individual actors. The ecosystem metaphor as combination of network modules can be seen according to Daft and Levin (1993) as “flexible and learning organization that continuously change and solve problems through interconnected self-organizing processes”. Modularity in business ecosystems is key to enable adaptability for changes and a module can be part of multiple ecosystems (Campagnolo and Camuffo 2010; Gulati et al. 2000).

### 2.3 Value creation and operational logic

Business ecosystem actors are interconnected and dependent on each other in value creation (Moore 1998; Iansiti and Levien 2004; Adner and Kapoor 2010). The ecosystem creates new value for actors only when the actor is not capable of commercializing the value on its own (Adner and Kapoor 2010). Ecosystems provide actors with resources and information to navigate in a constantly changing competitive environment. The ecosystem has operational logic, way of working, that is based on the actors’ business models and strategies (Johnson and Scholes 1999; Lengnick-Hall and Wolff 1999; Kinnunen et al. 2013). The operational logic reflects the value creation process of the ecosystem. Value creation in business
ecosystems is unilinear and many ecosystem actors come outside traditional value chain making the value creation a multidimensional process. (Clarysse et al. 2014; Vargo et al. 2015; Kinnunen et al. 2013)

Interdependencies between actors, unilinear processes and involvement of customers into value creation position ecosystem value creation as a joint value creation process (Vargo and Lusch 2004; Payne et al. 2008). The joint value creation process emphasizes uniqueness of the value proposals, involvement of multiple actors and customer focus (Vargo and Lusch 2004; Hakanen and Jaakkola 2012), Joint value creation process brings a holistic view to networked value creation, as the value generation does not reside on products or services alone (Hearn and Pace 2006). It also argues that competition and co-operation are in interaction with each other and with the surrounding environment contributing to the network value (Kinnunen et al. 2013).

Joint value creation in business ecosystems include (Clarysse et al. 2014; Hearn and Pace 2006; Vargo et al. 2015) following characteristics:

1. Value is created in multiple directions, not in one-directional chains
2. Networks hold value, not products
3. Interactions in networks are characterized as complex co-opetition relationships, not as simple competition or co-operation
4. Strategy is related to value ecology as a whole, not for individual actor only
5. Consumers become co-creators of value as peer producers, they are not passive customers

These characteristics describe how actors are contributing in different ways to the ecosystem’s system level value. Positioning the networks as multidirectional value and strategy focus areas takes foundations the business network research and organizational and strategy research perspectives but involvement of competitors into the scope of ecosystem value creation distinguish business ecosystem as a concept for example from IMP (Håkansson and Johansson 1992; Snehota and Håkansson 1995) views on business or industrial networks.

A distributed peer production model (Benkler 2002) allows the actors to define themselves how they contribute to the ecosystem. Peer production suits best for the human capital involved tasks (Benkler 2002). Human capital is highly varied and individuated making it difficult to standardize and specify. Peer production concept describes well the multidimensional contributions in a business ecosystem (Adner and Kapoor 2010).
If the tasks to be contributed are designed on needed level of detail, the voluntary contribution to ecosystem becomes more attractive to its members due to low entry barrier (Benkler 2002). Peer production supports the business ecosystem definition from Gossain and Kandiah (1998) as involved actors provide resources, information or products to each other, ultimately as a joint value proposal for the ecosystem end customer following Vargo et al. (2015). Reciprocal peer production transactions require personal level trust (Benkler 2002; Anggraeni et al. 2007).

Joint value creation process and peer production provide various contributions on different levels that increase the ecosystem resilience and strengthen the relationships making the ecosystem stronger and more dynamic (Benkler 2002; Anggraeni et al. 2007). Peer production, loose boundaries, free information and free entry attract participants forming an ecosystem as unbounded set of actors (Choi et al. 2001; Benkler 2002).

A single project or networked value deliverable can be also considered as a temporal value proposal embedded in a more durable ecosystem based on the actor relationships and roles (Hällgren and Söderholm 2011; Pinho and Fisk 2014). From project management perspective an ecosystem represents a more permanent value constellation whose boundaries and joint value creation are based on permanent actor roles and strong relationships between them (DeFilippi and Sydow 2016; Granovetter 1983).

In strategy research stream (e.g. Minzberg & Waters 1985; Porter 1985; Prahalad and Hamel 1990; Johnson and Scholes 1999) the term core logic describes the underlying principles and hypotheses that actors base their strategies and operational practices on. Lengnick-Hall and Wolff (1999) introduce capability, guerrilla and complexity logics as concepts to approach what are the founding assumptions to form strategies in networked organization (Powell 1990). From these logics the complexity logic support most the business ecosystem strategic thinking (Zahra and Nambisan 2012) and is thus discussed in this dissertation as a basis for business ecosystem operational mode.

The important premises of complexity logic (Lengnick-Hall & Wolff, 1999) adapted into business ecosystem context are:

1. Success of actors and the whole networked system requires a healthy ecosystem
2. Unpredictable, nonlinear and natural consequences of actions are significant drivers
3. Initial conditions and underlying capabilities define how influence can be achieved
4. System is in constant, undirected change and coevolution is a result of interdependent relationships
5. Cultural integrity, like common values and targets, defines the scope of the ecosystem
6. Self-organization drives evolution and ecosystem scope changes during the evolution

Following the organizational research (Borgatti and Foster 2003) complexity logic premises can be used to describe the underlying assumptions that the actors embed their behavior in the ecosystem mode of operation (Dass and Kumar 2014; Zahra and Nambisan 2012). Shared goals, interdependencies of actors, conscious decision making and integrity of activities and value of the relationships and network over actors’ incentives are ecosystem operational mode characteristics (Moore 1993; Moore 1998; Iansiti and Levien 2004; Peltoniemi 2006) that are position the complexity logic as the ecosystem core logic.

The end customer in this dissertation refers to the customers that participate into creation and consumption of the ecosystem system level value. To achieve the shared goals and to increase the system level value of the ecosystem, the joint value creation process and ecosystem operational mode need to satisfy the ecosystem end customer needs and consider the end customers as integral part of the ecosystem (Kowalkowski et al. 2012; Romero and Molina 2011, Dass and Kumar 2014). A business ecosystem needs to operate as a value integrating entity providing superior value over competing entities in terms of products, services and experiences (Gossain and Kandiah 1998; Cegganoli et al. 2012; Prahalad and Ramaswamy 2004). The end customer needs are derived from their internal processes (Eichentopf et al. 2011).

Customer and Service dominant logics are research perspectives to approach the value creation and operational logics of business ecosystem as customer driven and customer involved processes with integrated value proposals (e.g. Vargo and Lusch 2004; Vargo et al. 2015; Hakanen and Jaakkola 2012; Pinho and Fisk 2014). Value proposition planning through customer-dominant logic consists of a script (understandings, procedures, engagements), which is a consolidation of the customers’ stories about their internal processes (Heinonen et al., 2010). As a cognitive concept, such a script organizes the activities the service providing actors
in the ecosystem conduct to design supporting value proposals (Romero and Molina 2011; Payne et al. 2008).

The customer script based initial value proposals in business ecosystem perspective can be approached as service blueprints (Eichentopf et al. 2011). A service blueprint represents a framework of the service elements performed to create value proposals and can be positioned as a similar concept as script but on the service providing ecosystem actor side. Both script and blueprint model ecosystem actors’ internal processes and how those processes as part of the core logic form the baseline of value joint value creation. Alignment between the script and the blueprint determines the success of the encounter process where scripts and blueprints are reviewed and modified towards joint value proposals (Eichentopf et al. 2011; Payne et al. 2008).

In the encountering process (Chakraborty and Kaynak 2014; Dass and Kumar 2014) the end customers’ inputs triggers different responses in the service providing actors. This leads to a cumulative interaction process modifying the original idea into an acceptable value proposition (Eichentopf et al., 2011; Kowalkowski et al., 2012). The more knowledge intensive, intangible and unique the defined value proposal is, the more collaboration and interaction is needed (Hakanen and Jaakkola, 2012; Romero and Molina 2011).

Following the customer dominant logic the ecosystem actors need to include active end customer role into their core logic and contribution to the joint value creation (Hakanen and Jaakkola 2012; Heinonen et al. 2010). The end customers are connected, informed and empowered to influence the services they are utilizing. The services are often highly complex consisting of interaction, exchange and performance (Grönnroos 2006; McColl-Kennedy et al. 2012). The ecosystem end customers should not be treated as passive consumers of the products the supplier provides (Prahalad & Ramaswamy 2004; Wu 2008).

Committed interplay between the actors is a prerequisite for ecosystem success (Peltoniemi 2006; Vargo and Lusch 2004; Näätä et al. 2014). The ecosystem actors can introduce a value proposal, but customers need to be involved into further development of it (Romero and Molina 2011; Näätä et al. 2014). The customers commit to the value proposal when they understand the benefits and are they able to utilize them in their internal processes (Frow & Payne 2007). Customers appreciate being able to influence and control the value process even if they do not use the outcome as such (Eichentopf et al. 2011; Wu 2008).

Vargo and Lusch (2004) present that the specialized competences are the service dominant logic’s fundamental exchange units. This is aligned with Iansiti
and Levien (2004) view on how the ecosystem actors bring different resources and competences to the ecosystem complementing each other. Customer dominant logic extends the active and integral role of customer from service dominant logic. Ballantyne et al. (2011) challenge the role of unique knowledge or resource asset as critical exchange element by positioning those merely as enablers. The actual transaction is built by the interfacing actors on top of the enablers as relationships and that the relationships are the critical elements for the joint value creation (Ballantyne et al. 2011; Frels et al. 2003). The interaction in the relationships needs to be spontaneous, collaborative and dialogical to set up a joint value creation (Ballantyne et al. 2011). This is a cornerstone of a prospering business ecosystem that is centered on end customer needs and deploys efficiently those needs across the ecosystem actors (Gossain and Kandiah 1998; Chakraborty and Kaynak 2014).

2.4 Actor roles and relationships in business ecosystem

In the business ecosystem discussion the term “actor” refers usually to an individual or a group impacting or being impacted by other actors in the ecosystem (Dass and Kumar 2014; Iansiti and Levien 2004). Actors in a business ecosystem can be teams, companies, non-profitable organizations or individual contributors that interact in multiple ways (Peltoniemi 2006). According to Moore (1993; 1998) including external actors like government offices, associations or standardization offices into the business network analysis expands the analysis scope towards a multidimensional ecosystem.

The definition of a business ecosystem actor follows project stakeholder definition in project business literature (e.g. Cleland et al. 1986; Artto and Kujala 2008; Freeman 1984; Donaldson and Preston 1995; Mitchell et al. 1997; Agle et al. 1999). Like stakeholders of a project the business ecosystem actors have multiple roles, their roles change and their contribution to the surrounding ecosystem can be direct or indirect (Moore 1998).

In business ecosystem literature the authors (e.g Moore 1993; Moore 1998; Iansiti and Levien 2004; Gossain and Kandiah 1998; Lu et al. 2014; Ceggagnoli et al. 2012) use different terms to describe the actor roles in the ecosystem. A common role is the **keystone** role that is also referred as **focal company**, **central actor** or **key architect**. Common to these role descriptions is that there is a central player in the ecosystem that hold critical capabilities and resources for the ecosystem (Iansiti and Levien 2004). This research uses term **central actor** for this role.
Many recent studies (e.g. Ceccagnoli et al. 2012; Dass and Kumar 2014; Gawer and Cusumano 2014; Gobble 2014) conclude that ecosystems are formed around a certain project, innovation or service that is being operated by the ecosystem’s central actor. Business ecosystem forms a loose web of interconnected “network of network” of co-evolving organizations that have specific relationship with the central actor (Borgatti et al. 2003; Peltoniemi 2006). The central actor controls the access to these capabilities for the other participants and is in a key position to define the system level value creation process and success of the ecosystem (Gossain and Kandiah 1998; Ceccagnoli et al. 2012).

Other business ecosystem roles have more diverse descriptions in business ecosystem literature. Iansiti and Levien (2004) and Zhang et al. (2011) define the five ecosystem strategic roles as

1. **Keystone**: Controls key ecosystem hubs, work with others to create value and share value with contributors
2. **Landlord**: Controls key ecosystem hubs and extract maximum value depending on its hub position
3. **Dominator**: Integrates vertically or horizontally to own and control key ecosystem assets and extract maximum value
4. **Niche**: focus on a narrow domain and develop specialized assets and capabilities
5. **Commodity**: focus on the lowest cost offerings

Lu et al. (2014) utilize a more simplified role categorization with three key roles based on the contribution to the ecosystem: **dominator, participant** and **opportunist**. Dominator controls the critical resources for the ecosystem and sets the exit and entry barriers. Participant contributes and invests actively to the ecosystem with major incentives based on the business model. Opportunist is referred as silent partner who is active when requested but maintains the presence by possessing essential capabilities to the ecosystem success (Lu et al. 2014).

Diversity of roles is a as key ecosystem health enabler (denHartigh et al. 2006). Diversity provides the ecosystem with a portfolio of innovations and capabilities that can be combined in different ways via relationships (Ceccagnoli et al. 2012; Ramachandran and Mukherji 2007). Diversity makes ecosystem less vulnerable to external shocks but as an attribute it cannot be specifically managed in the ecosystem (Hearn and Pace 2006). Diversity comes as a result of self-organization and flexible boundaries of the ecosystem (Ramachandran & Mukherji 2007). Diversity is present in business ecosystems also over time as the actors change their
roles during the evolution of the ecosystem (Adomavicius et al. 2005; Adner and Kapoor 2010; Lu et al. 2014).

In a business ecosystem the actors in general are all organizations involved – either directly or indirectly – in the ecosystem value co-creation process orchestrated by the central actor. Actors that operate in different roles and change their roles over time share a common system level goal and are mutually dependent in performing value against the goal (Iansiti and Levien 2004; Gossain and Kandiah 1998).

Relationships between the actors and transactions in the relationships define the ecosystem scope and joint value creation process (Ballantyne et al. 2011; Vargo and Lusch 2004). Based on transactions, each ecosystem actor operates as a customer through the relationships they have with each other and the actors are interdependent in their relationships due to complementing capabilities they possess (Baldwin 2007; Dass and Kumar 2014). The role of customer in the relationship can be either internal or external, depending on the position and role of the actor in the ecosystem (Gossain and Kandiah 1998).

Relationships in business ecosystem develop as self-organized connections between actors (Romero and Molina 2011; Ritter and Gemunden 2003). Based on their own business models and the ecosystem core logic the actors define how they interact with other actors and what are the transaction items in the relationship (Voelpel et al. 2004; Tsvetkova and Gustafsson 2012). Diversity of relationships, self-organizing nature and loose connection between actors in business ecosystem can help to overcome cognitive limits to the division of labor in value constellations (Brusoni 2005). To develop into self-organized undirected relationships, the interaction between the actors need to be based on trust (Borgatti and Foster 2003; Capaldo 2014). Trust evolves from previous relationships that reduce transactional uncertainty and increase shared understanding of the needed complementing competences of actors (DeFilippi and Sydow 2016). Trust is considered as essential for openness and innovation sharing in ecosystems (Provan and Kennis 2008; Gawer and Cusumano 2014). Central actors can build trust by modelling the ecosystem, relationships and the roles of the actors in it (Gawer and Cusumano 2014).

Interdependency in customer relationships enable application of customer dominant logic into relationship analysis (Heinonen et al. 2010). Pinho and Fisk (2014) present three types of interdependencies in the relationships between ecosystem actors: dynamic role interdependency (roles change over time), temporal interdependency (interactions occur sequentially) and self-interdependency (value
The proposal is based on actor’s own actions). Interdependencies also increase risk for the actors as the success is not solely in their own control (Adner and Kapoor 2010). This is likely to happen if the actor has critical capabilities but its incentives are not aligned with the ecosystem goals (Adner and Kapoor 2010; Gawer and Cusumano 2014). The nature of interdependency has implications into designing of actor roles in the ecosystem and mapping the scope of the ecosystem (Pinho and Fisk 2014; Gulati et al. 2012).

Relationships in business ecosystem are driven by diverse interdependencies, complementing capabilities, changing roles and multidimensional transactions. The interdependencies between actors and characteristics of the relationships can be approached also using stakeholder assessment (Freeman 1984; Fassin 2008; DeSchepper et al. 2014; Olander and Landin 2005). Stakeholder assessment where the actors’ roles, relationships and transaction resources are reviewed against the connected stakeholder actors enables modelling the ecosystem as a network diagram of stakeholders (Post et al. 2002; Bryson 2004; Freeman 1984). Interaction between the actors or stakeholders may also happen at a higher level between ecosystems (Majava et al. 2014).

Based on the stakeholder theory the actors can be divided into internal or external (Clarkson 1995) or viewed in a wide sense or a narrow sense (Freeman 1984), depending on whether they are acting within the identified system or hold critical capabilities with respect to the system functions (Frels et al. 2003). Internal stakeholders – primary, secondary and key supporting stakeholders- are considered critical for the central actor to survive (Clarkson 1995). Tertiary and extended stakeholders are considered as external stakeholder (Clarkson 1995).

The division of actors into internal and external ones in stakeholder assessment is different from customer dominant logic. In customer dominant logic the external actors are the end customers of the joint value creation (Hakanen and Jaakkola 2012; Grönroos 2008). In the stakeholder theory the external actors contribute indirectly into the joint value creation regardless of their position in the ecosystem (Davis 2014; Aaltonen and Kujala 2010). These actor and relationship characteristics set interactions, goals and the resource exchange process as central elements in stakeholder assessment, making it an applicable research perspective for business ecosystems.

The actors with most dense relationships in the stakeholder network lead the ecosystem’s joint value creation process as the value integrating actors. The value integrating actors can have any of the five ecosystem strategic roles, depending on the situation (Iansiti and Levien 2004; Zhang et al. 2011). The value integrating
actors enjoy both efficiency and control benefits as network nodes (Campagnolo and Camuffo 2010). They hold positions between the actors that are not directly linked. In case these actors are removed, the ecosystem would be dissolved into disconnected subnetworks (Baldwin 2007; Borgatti and Foster 2003).

Through visualization of the business ecosystem as stakeholder network diagram the actors can evaluate how to preserve, protect or transform their position in the ecosystem through potential alliances and strategic partnerships (Lacoste 2016). Visualization can also provide an immersive environment for what-if scenarios as well as support for strategic and operative decisions following the ecosystem core logic (Basole 2009; Iansiti & Levien 2004; Lengnick-Hall and Wolff 1999).

Building on the characteristics of service and customer dominant logic and stakeholder assessment the ecosystem perspective brings three advantages to network relationship analysis (Moore 1998; Iansiti and Levien 2004):

1. Networks are sources of renewal, not passive elements
2. Actors have several roles and strategies to success and to contribute to the success of the ecosystem
3. Both cooperative and competitive relationships and their interplays are important for the survival of an actor and the ecosystem

Including both cooperative and competitive relationships Moore (1998) and Iansiti and Levien (2004) expand the scope of business ecosystem from business network (e.g. Snehota and Håkansson 1995). Network of actors interacts with its environment in terms of cooperation, competition and co-evolution (Anggraeni et al. 2007). Competing actors and relationships competition shape the business ecosystem. They provides the ecosystem with divergence and innovation that are necessary for long term sustainability. Finding right balance between cooperation and competition to react to external threats or opportunities is essential for a successful ecosystem (Hearn and Pace 2006).

Cooperation between competitors as relationship interplay is referred as co-opetition (Carvalho and Moreira 2015). The term suits well into business ecosystem description. Co-opetition can increase exponentially the joint value especially in case of new open innovations where technology enablers are shared and ideas are collected from both external and internal sources (Adner and Kapoor 2010; West and Bogers 2014).
Regular interaction between the actors strengthens their relationship and builds up knowledge base (Brusoni 2005). Due to interdependent cooperative and competing relationship the actors shape their roles and capabilities during the business ecosystem evolution. Simultaneous development of actors’ competences and relationships dynamics with cumulative organizational learning is called co-evolution (Choi et al. 2001; Aapaoja et al. 2013; Adomavicius et al. 2005). Co-evolution has been used by several authors in business ecosystem literature to describe the relationship and role dynamics (e.g. Moore 1998; Iansiti and Levien 2004; Peltoniemi 2006; Gawer and Cusumano 2014). Co-evolution of actors drives the co-opetition and bundling of complementary functions to the value as characterizing forms of interaction in value ecology (Hearn and Pace 2006).

As a summary of the business ecosystem roles and relationships discussed in the reviewed literature this research presents a business ecosystem relationship analysis framework in figure 4.

![Fig. 4. Analysis framework for business ecosystem relationships](Image)

An underlying assumption in business ecosystem relationship analysis is that the relationships are based on trust, reciprocity and open-endedness (Defilippi and Sydow 2016; Choi et al. 2001; Capaldo 2014). Trust evolves from previous relationships that reduce transactional uncertainty and increase shared understanding of the needed complementing competences of actors. As the actor roles change in business ecosystem and the value of the ecosystem is in the network,
the relationships are positioned as the primary mechanism for business ecosystem operational logic and governance mode (Defilippi and Sydow 2016; Zhang et al 2014; Benkler 2002)

2.5 Business ecosystem evolution

Like ecological ecosystems, business ecosystems evolve over time. The structure and actor portfolio change as the patterns of ecosystem evolution (Adomavicius et al. 2005; Lu et al. 2014). Moore (1993) defines the ecosystem evolution as the ecosystem’s translation from a random collection of elements to a more structured community. As with the roles, there are different descriptions about ecosystem evolution and lifecycle phases in business ecosystem literature (e.g. Moore 1993; Adomavicius et al. 2005; Lu et al. 2005; Gawer and Cusumano 2014).

Moore (1993) describes the stages of ecosystem lifecycle with the focus areas for the ecosystem central actor as following: Birth (Define who the end customers are their needs are), Expansion (Bring the new offer to a large market by working with suppliers and partners), Leadership (Provide a compelling vision for the future that encourages suppliers and customers to work together), Self-renewal/death (Work with innovators and new partners to bring new ideas to the ecosystem).

Based on this founding division of ecosystem lifecycle phases Lu et al. (2014) splits the development phase into two and presents a following five stage lifecycle model: Emerging (New solution proposal), Diversifying (New solution diversity is encouraged, partner network is flexible with high interoperability), Converging (Partner network becomes integrated and focused on certain specialized markets and solutions), Consolidating (Partner network is stable and a close alliance for dominant design and delivery is formed), Renewing (Original market is replaced with new niche markets or the partner network is reorganized).

As another alternative Hu et al. (2014) provide a simplified model for the ecosystem lifecycle definition with the viewpoint of ecosystems as cyclic continuum. New industry ecosystem emergences due to the convergence of previous industries' business ecosystems. In the adjustment phase, the actors start to adjust their strategies to cope with new challenges. In the adoption phase, the actors imitate the appropriate strategies in the ecosystem where they are newly positioned.

This dissertation merges characteristics of different business ecosystem lifecycle descriptions and utilizes terms formation as the ecosystem establishment phase and operational as the phase where ecosystem structure is in place and joint
value creation process is active. Formation refers to birth and expansion (Moore 1993), emerging and diversifying (Lu et al. 2014) or emergence and adjustment (Hu et al. 2014) stages. Operational refers to leadership (Moore 1993), converging and consolidating (Lu et al. 2014) or adoption (Hu et al. 2014) stages. Ecosystem renewal or dissolution are not discussed in this dissertation.

Business ecosystem evolution is being impacted by governmental, social, technological and economical forces that create shocks and regulations to the ecosystem (Göttlich and Wenzek 2004). The evolution paths are driven by product development, product/infrastructure alignment, feed-forward and feed-back activities (Adomavicius et al. 2005). These paths form phases that make ecosystem evolution incremental. The incremental evolution triggered by forces change the actor roles and impact the length of the evolutionary cycles (Adomavicius et al. 2005; Hu et al. 2014).

Ecosystems’ birth or emergence is not a widely studied subject (Komulainen 2010; Kortelainen and Järvi 2014). According to Ceccagnoli et al. (2014) the business ecosystems are formed as customer centric value constellations and have considerable potential to become successful platforms for innovation and learning. Emerging ecosystems’ business potential is unclear as the operative mode or actors is not defined and structured. Temporality and learning are the defining characteristics for an emerging ecosystem customer value in a similar manner as in establishment of complex megaprojects discussed by Flyvbjerg (2014). Customer relationships are temporary and un-institutionalized and the partner relationships are flexible and entry/exit processes are not structured making the formation very complex and dynamic phenomenon (Komulainen 2010; Flyvbjerg 2014). Lu et al. (2014) describe “nurturing” as the way how definitive actors approach an emerging ecosystem and set the ground rules for the ecosystem to drive it through formation process.

Business ecosystem transformation from formation phase to operational phase can be described as explorative and exploitative development and innovation in value creation (Dittrich et al. 2004; Brady and Davies 2004). As dynamic and not strictly boundaries having entities the emerging ecosystems consists of weak and informal relationships between the actors (Gawer and Cusumano 2014). These relationships promote explorative, new alternative and new technology seeking innovation (Dittrich et al. 2004). Compared to more formal value constellations business ecosystem provides opportunities for easy exit for the actors in case the technologies being investigated prove not to be useful (Majava et al. 2015). Strong relationships between the actors that are characterized by intimate, recurrent and
trustful relationships are more common with exploitative strategies in more developed phases of business ecosystem (Dittrich et al. 2004). Exploitation requires intensive knowledge exchange and sufficient economies of scale. Healthy ecosystems should have both weak and strong relationships (Granovetter 1983) to enable both explorative and exploitative learning for successful value creation (Göltlich and Wenzek 2004; Dittrich et al. 2004; Ritter and Gemunden 2003).

A dynamic approach to business ecosystem is needed to make use of its evolving properties (Pinho and Fisk 2014). Co-evolution as an ecosystem relationship attribute was presented in the relationship analysis framework in figure 4. From ecosystem evolution perspective co-evolution is essentially about triggers from the end customer that travel through the system and cause new triggers to be sent and therefore the whole ecosystem develops (Romero and Molina 2011; Zahra and Nambisan 2012). This applies to all actors involved in the ecosystem, including the end customers (Dass and Kumar 2014). Feedback and changes in the ecosystem or its environment make the business ecosystem a fundamentally dynamic structure (Moore 1993).

Ecosystem evolution, especially formation, can be approached from project business literature perspective. Cova and Salle (2005) argue that a project should be managed before it is formally established, and management should continue after completing the execution (Morris, 2013; Cova and Salle 2005). Projects as temporal form of organizing (Hällgren and Söderholm 2011) can be seen as ecosystem formation vehicles in complex environment where fuzzy project front-end activities are consolidated into a formal project (Williams & Samset, 2010; Flyvbjerg, 2014). This system lifecycle view supports the business ecosystem evolution characteristics when a project is approached as a system that transits between the project and operational phases (Cleland & King 1968; Artto et al. 2016). Recent project business literature has also highlighted the importance of the front-end phase for the strategic success of a project as success is evaluated through value deliverables after the actual project execution has ended (Morris, 2013; Artto et al. , 2016).

Organizational learning processes can enable smooth transition of a complex project into an operational ecosystem but they need to support innovative behavior (Peltoniemi 2006). Innovation in routines creates new combinations of already established practices to transit a project to ecosystem (DeFillippi and Sydow 2016). Survival of an actor in ecosystem change depends on ability to select successful routines and to generate new alternative ones (Brady and Davies 2004).
Based on the project business literature the project front-end phase has similarities with very early phase of ecosystem and ecosystem formation. Project front-end phase includes all activities from the time the idea is conceived until the final decision to finance the project is made (Williams and Samset 2010). It includes concept identification and selection but not the detailed planning. Front-end phase governance mode need to focus on stakeholder requirements (Freeman 1984), several changes and managing the concept definition in a very turbulent environment (Aaltonen et al. 2013). The governance mode should build flexibility from the very beginning to find the best solution for the project and upcoming ecosystem (Provan and Kenis 2008).

Central actor who drives the ecosystem formation and evolution should focus on sense-making rather than detailed planning in the front-end phase (Williams and Samset 2010). When decisions are made in the front-end where the uncertainty is highest, the lack of detailed information can actually be benefit rather than a negative item in providing focus and flexibility for the decision maker (Aaltonen et al. 2013; Williams and Samset 2010).

Innovations play very important role in ecosystems’ formation especially if the architecture is new. Boudreau (2007) discuss the innovation role in hand held devices’ technology platform context analyzing integrated innovation (closed ecosystems or ecosystems with a dominant key architect) against open innovation (joint ventures, co-creation of the technology standards as open forums). In integrated innovations where original innovator controls the system development the probability to establish a successful ecosystem is higher due to advantages like cross-component optimization, more tightly integrated working groups and coherent design choices. Williamson (2007) also identifies innovations as essential “magnets” for ecosystem emergence. Innovations built around a lead customer or a common platform are in cornerstone position to attract dispersed knowledge and put the knowledge to work to solve problems either driven by latent or ill-defined customer need or by good understanding of the future customers’ requirements.

To support business ecosystem evolution through innovation Clarysse et al. (2014) define cross-network or cross-industrial alignment as a method to transpose ideas or models in business ecosystem and between business ecosystem modules. Idea transposition is essential for the ecosystem to move from formation to operational phase (Clarysse et al. 2014; Hearn and Pace 2006). Transposition is about change of logic between the ecosystem actors and sometime change of actors when the actors relevant to form the ecosystem are replaced with operational phase actors (Anggraeni et al. 2007). The actors to be involved into operational ecosystem
need to commit to provide an environment that attracts innovation and ensures that value created can be co-captured and commercialized (Clarysse et al. 2014).

For the ecosystem formation as a project Majava et al. (2015) discuss the importance of stakeholder identification compared to actual project drivers. Aapaoja et al. (2013) present that early involvement of stakeholders in the project definition has a significant impact on the project’s success. If the actors do not support the ecosystem strategic goals, the project implementing the ecosystem will fail strategically regardless of tactical success in scope, schedule, budget and resource targets (Morris 2013; Samset and Volden 2016; Aapaoja et al. 2013).

To facilitate ecosystem formation the technological, activity and value architectures need to be defined (Adomavicius et al. 2005). Complexity logic as the ecosystem core logic (Lengnick-Hall and Wolff 1999) can be used as a guideline to define the technology, economic, behavioral and institutional strategic activities to establish an environment for a business ecosystem to born.

2.6 Health and success of business ecosystem

As being characterized as symbiotic, co-evolving entities, the change dynamics of business ecosystem are dependent on the ecosystem participants, relationships, resources, competences, customers and environment (Kinnunen et al. 2013). A successful operational business ecosystem needs to be able to utilize the change dynamics to increase the networked value of the ecosystem and to adapt the core logics to the disruptions related to the change dynamics (Aggraeni et al. 2007; Williamson 2007). Due to the interdependency of actors the success of the ecosystem determines whether the actors in it are successful or not (Thomas and Autio 2014).

After Moore (1993; 1998) Iansiti and Levien (2004) consolidated the business ecosystem concept and provided a way to enrich the study of business networks by stressing the importance of collective health for the whole ecosystem success. There is lack of empirical research with practical applications and consensus on how the ecosystem success and health can be measured (Anggraeni et al. 2007, denHartigh et al. 2006).

Business ecosystem success level can be derived from the ecosystem operational logic, strategic goals and how the joint value is created and integrated with the end customer (Lengnick-Hall and Wolff 1999; Gossain and Kandiah 1998; Vargo and Lusch 2004). Measuring the ecosystem successfulness is challenging
due to the ecosystem characteristics, multidimensional relationships and change dynamics (Letaifa 2014).

Stademayer et al. (2005) formulate the key challenges for ecosystem success based on network modularity (Borgatti et al. 2003; Baldwin 2007). These challenges are system level value proposal definition (including the end customer definition), management of the architectural interdependencies within the ecosystem and managing the relationships of the ecosystem actors (Staudenmayer et al. 2005).

As the ecosystems are co-evolving and self-organized value constellations, direct controlling activities to manage the success challenges of network modularity rarely apply. In business ecosystem context Iansiti and Levien (2004) state that productivity and robustness together with ecosystem’s capability to foster new business determine the business ecosystem success. Robustness is defined as the ability of the ecosystem to adapt to technical perturbation through resilience and complexity (Ceccagnoli et al. 2012). Productivity is defined as the ability to transform resources into customer value proposals (Porter 1985). Capability to foster new business is about variety and diversity of the ecosystem in terms of interfaces for new entrants, services and value proposals (Iansiti and Levien 2004).

The ecosystem success can be evaluated in more detail through ecosystem health (denHartigh et al. 2006). As the success measurement is challenging, evaluating health of the ecosystem represents more appropriate approach to determine the networked value of the ecosystem and benefit opportunities for individual actors in it. Business ecosystem health consists of long term financial wellbeing and long term network strength (denHartigh et al. 2006) as every relationship contributes to the value co-creation either positively or negatively (Ramaswamy and Gouillart 2010). In a case where the ecosystem actors’ incentives are not aligned, the ecosystem will not become successful in the long term (Letaifa 2014). The ecosystem dependencies increase the risk for actors, as the success is not controlled by their own effort (Adner and Kapoor 2010). This is likely to happen in a case where an actor has critical capabilities for the value co-creation, but the targets do not support the system-level goals (Letaifa 2014). Actors and goals are interdependent through relationships in a business ecosystem and thus the healthiness of the ecosystem can be approached through actors and relationships (Adner and Kapoor 2010).

Actors and relationships are used as the business ecosystem health defining characteristics in this research. Following denHartigh et al. (2006), Iansiti and Levien (2004) and Ramachandran & Mukherji (2007) the ecosystem health
dimensions and related capabilities are defined as sustainability (capability for long
term success), resilience (capability to adapt to changes), innovativeness
(capability to explore new value opportunities) and renewal (capability to modify
roles, practices and relationships). These health dimensions are interlinked to the
ecosystem success parameters presented by Iansiti and Levien (2004) as
sustainability and innovativeness contribute to productivity, resilience and
sustainability contribute to robustness and innovativeness and renewal represent
the ecosystem’s capabilities to foster new business opportunities (Iansiti and Levien
2004; denHartigh et al. 2006; Anggraeni et al. 2007; West and Bogers 2014). From
the ecosystem health dimensions resilience describes how well the ecosystem
returns to stable position after an external shock (Gotlich and Wenzek 2004).
Resilience is also important as it describes the velocity of adaptation to the shock
(Gotlich and Wenzek 2004) making it more descriptive health dimension definition
compared for example to network adaptability and flexibility (Campagnolo and
Camuffo 2010). Measuring the health status can provide ecosystem central actor a
“compass” to guide the ecosystem governance (den Hartigh et al. 2006). Ecosystem
health is results of efficient formation (Gossain and Kandiah, 1998).

Health and success of the business ecosystem can also be evaluated using
project performance measurement (e.g. Aaltonen and Kujala 2013; Clarkson 1995;
Davis 2014) in ecosystem formation. Aaltonen and Kujala (2013) and DeFilippi
and Sydow (2016) present that the importance of social and environmental
performance for the success of the project especially in complex megaprojects is
increasing expanding the project business perspective from project itself to the
surrounding business ecosystem. Artto et al. (2008) present that services and joint
value proposals have multiple impact types to the performance of project-based
firms interlinking the ecosystem health to the performance of the actors.
Relationships that are another key ecosystem health defining characteristic can be
evaluated for example using stakeholder assessment (Freeman 1984) and
stakeholder salience model (Mitchell et al. 1997) from project business literature
perspective.

Business ecosystem health and project success are measured against the
ecosystem goals. Following Dvir & Lecher (2004) findings on project business the
detailed project planning does not lead directly to success but capability to change
the plans is essential for long term success. Similarly the forced goals are dangerous
to the project and business ecosystems. To enable success, the ecosystem goals
should be jointly developed and not forced (Letaifa 2014). Changes of goals can
have negative impact to project success but in ecosystem they can be considered as part of ecosystem evolution (Dvir and Lecher 2004, Iansiti and Levien 2004).

Trust is an essential parameter in a healthy business ecosystem. Trust can be defined (McEvily et al. 2003) as an aspect of relationship that reflects the willingness to accept vulnerability base on positive expectations about another’s intentions or behaviors. Business ecosystem’s capability to build long-term trust based relationships where the actors understand each other’s strengths and weaknesses and are willing to act to maximize the network outcomes increases stability in the ecosystem (Provan and Kenis, 2008). Stability and trust are important underlying enablers for the ecosystem health (denHartigh et al. 2006; McEvily et al. 2003).

Another underlying enabler besides stability and trust that contributes indirectly to the health of the business ecosystem is macroculture. Jones et al. (1997) conclude macroculture as a system of shared assumptions and values between the ecosystem actors that coordinates the interdependent activities so that complex tasks can be completed. Presence of macroculture reduces coordination effort needed. Macroculture can be considered as enabler for the ecosystem co-evolution and core logic (Jones et al. 1997; Lengnick-Hall and Wolff 1999).

The underlying enablers and the ecosystem health dimensions provide a framework to evaluate the success opportunities of a business ecosystem (denHartigh et al. 2006; Jones et al. 197; Provan and Kenis 2008). Complex business ecosystems emphasize co-opetition, flexibility, self-organization, interdependency and co-evolution from actors and their relationships (e.g. Moore 1998; Choi et al. 2001; Lengnick-Hall and Wolff 1999; Gulati et al. 2000). These attributes are built to the ecosystem core logic in the formation (Anggraeni et al. 2007). The activities conducted in the ecosystem formation and the involved actors set the scope and targets of the operational ecosystem and lay the baseline for ecosystem health (denHartigh et al. 2006; Hearn and Pace 2006; Kinnunen et al. 2013). Stratification and control provided by the central actors in terms of who is eligible to participate into ecosystem and what are the technical and organizational interfaces to participation set targets for governance activities (Capaldo 2014; DeFilippi and Sydow 2016).

2.7 Governance mode

Business network research perspective classifies networked organizations as managed or self-organized networks (e.g. Snehota and Håkansson 1995; Möller
Managing a complex business ecosystem consisting of multiple business network modules (Borgatti and Foster 2003) can be considered as a nearly impossible task due to the business ecosystem characteristics discussed in the earlier chapters, but in practice the actors even in self-organized networks take regularly managerial actions to influence the surrounding business network through relationships (Möller and Rajala 2007; Ritter and Gemunden 2003). The relationships can be directed or undirected (Gulati et al. 2000). Undirected relationships are typical in business networks either as dichotomous (close, based on trust, usually strong, multidimensional connections) or valued (measured in scale, usually transaction based connections). Business perspective ecosystem advocates dichotomous relationships. As influencing managerial actions in dichotomous relationships have only certain and sometimes unpredictable impact to the ecosystem not under the actors’ sole control (Anggraeni et al. 2007), term governance is used instead of management in this research as a description of indirect management of business ecosystem.

Governance is another not widely discussed topic in business ecosystem literature (Kortelainen and Järvi 2014; Peltoniemi 2006). Partly the reason might be that the organizational scholars are focusing on the organizations, not multi-organizational entities (Provan and Kenis 2008). Furthermore, developing a deep understanding of business ecosystem is time and effort consuming requiring data collection of multiple network modules (Borgatti and Foster 2003).

As the ecosystems are self-organized amorphous entities, managerial mechanisms including hierarchy and control do not apply (Hearn and Pace 2006; Götlisch and Wenzek 2004). Business ecosystems comprise of co-operating and competing actors and as not being legal entities, the legal governance imperatives have only limited impact (Provan and Kenis 2008).

Regardless of the identified challenges, the governing actions in business ecosystems have important role to align actor goals with the system level goals, to execute the ecosystem operational mode and to guide the ecosystem evolution (Adner and Kapoor 2010). In self-organized business ecosystems the governance is mostly informal, based on uncoordinated efforts of actors who have a stake in the ecosystem success (Provan and Kenis 2008). Governance actions in business ecosystems go beyond dyadic approaches discussed in organization and strategy research perspective (Granovetter 1983; Powell 1990; Jones et al. 1997; Gundlach and Foer 2006).

According to Moore (1998) the most applicable governance modes in business ecosystems are community governance systems and quasi-democratic mechanisms
reflecting that the business ecosystems are self-organized entities with limited control opportunities. In addition the ecosystem actors have limited formal accountability for the ecosystem level goals. Conformity to rules and agreed operational practices is voluntary (Hearn and Pace 2006).

Network governance (Provan and Kenis 2008; Jones et al. 1997) involves selected and autonomous set of actors engaged in joint value creation of products and services based on implicit and open-ended contracts that are socially but not necessarily legally binding. Network governance is set to adapt to environmental contingencies and to coordinate and protect the transactions within the ecosystem and with the external stakeholders (Jonet et al. 1997; Baldwin 2007; Gulati et al. 2000).

Network governance discusses business network driven governance modes and their effectiveness. Those modes apply also to the business ecosystems and contribute to the health and success of the ecosystems. Following the network governance the ecosystem governance can be organized as shared governance mode among the participating actors, a lead actor can govern the ecosystem or a dedicated administrative or facilitating actor can be set up to manage or support the governance activities and processes (Provan and Kenis 2008; Jones et al. 1997).

Distribution of trust amongst the ecosystem members is critical to understand the ecosystem relationships and the structure of ecosystem as a whole (McEvily et al. 2003; Ritter and Gemunden 2003). The ecosystem governance has to be aligned with the distribution of trust in the ecosystem relationships (Gulati et al. 2012; Clarysse et al. 2014).

The effectiveness of each of the governance mode depends on the level of trust among the ecosystem actors, size of the ecosystem, alignment of actors’ business targets and need for ecosystem level competence sharing (Gunlach and Foer 2006; Ritter and Gemunden 2003). For example shared governance is effective in business ecosystems where trust is pervasive and perception of trust is shared between the actors (McEvily et al. 2003). It can also be considered more suitable for cohesive, stable and relatively small scale ecosystems (DeFilippi and Sydow 2016; Capaldo 2014).

Business ecosystems with coherent macroculture, stability and trust as underlying health enablers are based on social relationships (Powell 1990; Romero and Molina 2011). The social relationships stimulate knowledge access, sharing and creation increasing furthermore potential for the actors to achieve strategically significant outcomes (Capaldo 2014). Social relationships create mechanism for network governance of the ecosystem (Jones et al. 1997). The social relationship
mechanisms that define the governance mode for the business ecosystem consists of relational (interpersonal relationships, trust etc.) mechanisms and network structural (macroculture, norms, reciprocity etc.) mechanisms (Capaldo 2014; Borgatti and Foster 2003; Frels et al. 2003). Both of the mechanisms affect the ecosystem actors’ behavior but the processes they impact the ecosystem governance are different. Both relational and structural mechanisms are important contributors to multidimensional ecosystem health and success as they influence a number of different knowledge benefits and value proposals (Capaldo 2014; denHartigh et al. 2006; Anggraeni et al. 2007).

Relational and structural social relationship mechanisms are based on the actors’ position in the network and their behavior based on the position (Borgatti and Foster, 2003). Centrally positioned actors who have several connections and access to strong relationships (Granovetter 1983) hold considerable power access to the ecosystem because other actors are dependent on them. Anggraeni et al. (2007) propose following governance activities for centrally positioned actors that pursue to guide the business ecosystem evolution: Provide incentives and vision of shared goals to the members; Empower the members to strive for the goals with their own incentives; Apply steering mechanisms to ensure that activities are aligned with the shared goals; Improve ecosystem internal innovativeness and capabilities to cope with external changes (Anggraeni et al. 2007).

The purpose of the governance activities defined by Anggraeni et al. (2007) is to enable the resources and willingness to prosper the ecosystem actors already have rather than to provide resources and guidelines to the actors. The activities support Moore (1998) suggestion about community or quasi-democratic governance modes and Jones et al. (1997) suggestion about shared governance mode as the most effective business ecosystem governance mode.

Project network governance mechanisms presented by DeFilippi and Sydow (2016) can be applied to describe business ecosystem governance mode. The project network governance mechanisms can be summarized under responsibilities, routines, roles and relationships (DeFilippi and Sydow 2016; Artto et al. 2016). In business ecosystem context the responsibilities refer to the ecosystem mode of operation and core logic (Lengnick-Hall and Wolff 1999). Responsibilities represent contract based governance, routines and roles reflect administrative processes and relationships define social governance modes. The mechanisms interact and they are relevant in both business network module and whole ecosystem level analysis.
When applied to the business ecosystem formation, the project network governance framework should recognize the realities of uncertain environment and be sufficiently flexible to enable the front-end phase to adapt to change and to avoid pre-mature concept lock-in (Artto et al. 2016; Aapaoja et al. 2013). The governance framework needs to develop simultaneously somewhat conflicting capabilities, flexibility and controllability (Ritter and Gemunden 2003). The governance mode in project front-end and ecosystem formation requires structure that will maintain strategic alignment of involved actors and control the concept definition with sufficient flexibility in complex environment (Williams and Samset 2010; Hälggren and Söderholm 2011; Samset and Volden 2016).

From project business research perspective stakeholder assessment is another relevant approach to describe governance in business ecosystems. A project stakeholder is defined by Bryson (2004) as an individual or a group who has an interest or some aspect of right or ownership in the project, can contribute to the project or be impacted by the project. Business ecosystem actor as a term has similarities to a stakeholder in project business research, with higher emphasis on ecosystem definition through relationships between actors (e.g. Iansiti and Levien 2004; Peltoniemi 2006). Stakeholder assessment and stakeholder theory (Donaldson and Preston 1995) attracts attention in academic research, since as a governance mode those can be used to build appropriate balance among stakeholder interests and gaining their support includes potential benefits (Mok, Shen, and Yang 2015).

Based on the stakeholder assessment (e.g. Freeman 1984; Clarkson 1995; Donaldson and Preston 1995), Mitchell et al. (1997) introduced nowadays well recognized stakeholder salience model that is based on three attributes – power, legitimacy and urgency that define the actors’ influence to the network they belong to. In the stakeholder salience model power is the attribute of actor to purposefully impact decision making. Legitimacy can be defined as impact the actor has for the decision making with respect to socially appropriate claims such as contracts, legal rights or a moral concerns (Mitchell et al. 1997; Agle et al. 1999). Urgency is about actor’s capabilities for immediate impact due either to the time sensitivity or to the criticality of the issue in question. In the Mitchell et al. (1997) definition power and legitimacy are considered as the core attributes whereas urgency is a dynamic or catalytic attribute. Actors’ total salience is the sum of the attributes. Salience is context-specific and a relative measure valid only in the ecosystem or project under investigation (Fassin 2008; Mitchell et al. 1997).
Salience can be assessed in terms of impact and probability to impact (Johnson and Scholes 1999). Two-dimensional power-interest stakeholder assessment matrix model has been applied by several scholars with that used stakeholder assessment as baseline for governance action definition (Olander and Landin 2005; Aapaoja and Haapasalo 2014). The matrix presents the actors as dynamic stakeholders, allocates suitable stakeholder management based governance actions per actor and extends the applicability of assessment model beyond projects to more dynamic and permanent networked organizations (Aapaoja and Haapasalo 2014; Winch and Bonke 2002).

Business ecosystem’s dynamic and complex relationships enable the actors to form alliances or coalitions to combine salient attributes for stronger impact especially if the coalition is formed with a more powerful or legitimate partner (Fassin 2008; Savage et al. 1991; Aaltonen et al. 2013). Coalitions can be used to push through challenging decisions in the network and are identifiable via stakeholders’ relationships in between (Newcombe 2003).

Stakeholder salience model on individual actor and network context can be used as baseline for ecosystem governance (Mitchell et al. 1997; Fassin 2008). For example in shared governance mode the salience model can provide insight on what governance activities should be applied with different actors and in what phase of the ecosystem evolution (Hearn and Pace 2006).

Based on the reviewed literature the main difference between project stakeholder management and business ecosystem governance is that business ecosystem governance should focus on empowering the actors to contribute to the ecosystem value creation in peer production mode and to develop their capabilities rather than guiding the actors’ initiatives and utilize the capabilities (denHartigh et al. 2006; Möller and Rajala 2007). Business ecosystem can also change the governance mode over time.

Shared governance mode or quasi-democratic governance mode advocated as the most applicable ecosystem governance mode (Moore 1998) may become inefficient when the ecosystem grows and the network activities and involvement take increased effort from the actors (Provan and Kenis 2008; Moore 1998; Ritter and Gemunden 2003). In such cases change to lead organization or external facilitator driven governance mode can release the managerial burden of actors. Healthy ecosystem recognizes and responds to both external and internal demands in both selection of the governance form and managing tensions that arise from the selection (Adomavicius et al. 2005; Provan and Kenis 2008; denHartigh et al. 2006).
2.8 Theoretical synthesis: Business ecosystem formation

The theoretical foundation of this dissertation builds on four research perspectives that contribute to business ecosystem framework. The identified main elements of business ecosystem perspective are elaborated on top of the themes of the research perspectives. This chapter synthetizes in figure 5 the theoretical foundation building blocks as elements of business ecosystem formation. Despite the increased research effort put into the business ecosystems, there are still divergent views on how the ecosystems are formed, what are the mechanisms driving the formation process of a healthy business ecosystem and how the formation can be governed. The five elements in figure 5 are considered as the most relevant theoretical baselines or dimensions to approach these aspects of business ecosystem formation that have received less attention in previous studies therefore contributing to the objectives of this dissertation.

Fig. 5. Elements of business ecosystem formation (Lappi et al. 2017, with permission of ToKnowPress)

Figure 5 describes the dimensions identified from the literature that impact most the formation of a healthy operational business ecosystem. Each of the elements has links to reviewed literature and theoretical foundations. Dynamics of the
business ecosystem formation can be approached using project front-end concept (e.g. Williams and Samset 2010; Flyvbjerg 2014; Artto et al.; Edkins et al. 2013) via the project business literature. **Strategy** related to ecosystem formation takes insights from concepts of core logic (Lengnick-Hall and Wolff 1999) and modular networks as forms of organizing (e.g. Powell et al. 1990; Jones et al. 1997; Borgatti and Foster 2003). Defining **governance** activities for ecosystem formation can be based on business network research (e.g. Snehota and Håkansson 1995; Möller and Rajala 2007) and complex adaptive systems theory (e.g. Choi et al. 2001; Gundlach and Foer 2006). The roles of actors and their **behaviour** through the relationships they possess in the ecosystem can be discussed through stakeholder assessment (e.g. Freeman 1984; Mitchell et al. 1997; Aapaoja and Haapasalo 2014), service and customer dominant logic based value creation (e.g. Vargo and Lusch 2004; Grönroos 2006; Hakanen and Jaakkola 2010; Eichentopf et al. 2011) and social, industrial and business networks (e.g. Powell 1990; Romero and Molina 2011; Capaldo 2014; Håkansson and Johansson 1992). **Evolution** of a business ecosystem has similarities with project life-cycle view (e.g. Artto and Kujala 2008; Artto et al. 2016) and self-organized business networks where actors learn and develop value together (e.g. Dittrich et al. 2004; Baldwin 2007; Ceccagnoli et al. 2012).

How the elements complement the current understanding on business ecosystem formation is presented in a visual format in figure 6. The body of knowledge attempted to be created in this research consists of relevant research perspectives, application of them into business ecosystem context and consolidation of the findings into the five elements of business ecosystem formation.

![Fig. 6. Body of knowledge of business ecosystem formation](image-url)
Business ecosystem is not a new organizational form itself but as a metaphor it provides a salient perspective to analyze network of modules, actors and their relationships. Ecosystem can be seen as a compilation of network modules (e.g. Borgatti and Foster 2003; Baldwin 2007) where the actors contribute in different ways to joint value creation (Payne et al. 2008). Roles of the actors and their goals have been described in the ecosystem related academic discussion (e.g. Kortelainen and Järvi 2014) but the interactions between the roles and how those interactions can be used to broaden the understanding of ecosystem formation are not widely addressed amongst the scholars. The body of knowledge in figure 6 provides a prominent tool to address the formation of business ecosystems, defining health status of an ecosystem, and making the ecosystem formation more efficient to support establishment of healthy and successful business ecosystem.
3 Research contribution

The previous chapter synthesizes the body of knowledge of business ecosystem formation. The research in this dissertation is set to explore formation of a complex modular business networks using business ecosystem as research perspective. First phase of ecosystem formation is to define its goals. Purpose of the business ecosystem comes from the value it creates to the end customer(s) placing the end customer(s) into the centre of the ecosystem planning. End customers and the value the ecosystem delivers to them defines the scope of the ecosystem in terms of actors and their relationships. End customers are active members of the ecosystem participating into the joint value creation process. Customer and service dominant logic provides a framework to analyse customers, their contribution and requirements for the ecosystem value proposals and scope.

3.1 Customer needs define ecosystem scope

The research question RQ1 **How to define the scope of business ecosystem before formation** is answered in article III. The article conducts a case study in a built environment campus project “Health City Oulu”. The results of the case study identified that there are different types of end customers (campus residents who would be living in the environment) whose capabilities and motivation to contribute determine their role in the ecosystem formation. Most capable and motivated end customers should be involved into early planning of the ecosystem to ensure that the ecosystem value proposals meet the strategic targets. Categorization of the end customer in the built environment campus case study in terms of their capability and motivation to contribute is presented as a two dimensional matrix in figure 7.
Based on the preferences and requirements from these key end customers it is possible to identify the most important value elements for the system level value creation that need to be included into ecosystem scope already in the beginning to ensure that the operational ecosystem becomes successful. The preferred value elements in the built environment campus case study were identified through semi-structured interviews. The end customers candidates were asked to prioritize the service elements they would prefer to have on the campus. The results are presented in figure 8.
Fig. 8. Preferred value (service) elements on a built environment campus Health City Oulu (Lappi et al. 2017/1, with permission of Inderscience Publishers)

Based on profiling the customer candidates and interviewing them it was possible to consider training gym, grocery store, catering and digital services as the most valuable service elements on the case study campus as presented in the figure 8. These service elements represent the system level value on the ecosystem operational phase. Following customer dominant logic the end customers and their requirements need to reflect the operational business ecosystem from the very beginning for a healthy ecosystem to emerge. This finding from the built environment case study is important for project based business as in many cases the end customers and their requirements are determined from the project or front-end ecosystem. This can lead to sub optimized planning and incorrect managerial actions.

Integration of the end customers into the value creation was researched further in another case study conducted in Taiwan health and wellbeing domain in articles IV and V. Results of the Taiwan case study enhanced the end customer role as active value proposal specifier and active member of the ecosystem value processes, and presented that different customers have different capabilities and motivation to participate into the ecosystem. Changes in the customer requirements impacted directly ecosystem actor portfolio and the relationships between the actors.
This dissertation presents as the answer to the RQ1 that end user centric ecosystem scoping needs to include following activities: definition of ecosystem targets, categorization of end customer candidates, engagement of the key end customers, mapping of customer internal processes as scripts, definition of requirements for the value proposals based on the scripts and identification of the preferred value elements based on the system level value. The customer engagement activities need to be iterative, i.e. the interaction with the key end customers should be frequent during the ecosystem formation to maintain their commitment and to keep the formation flexible to adapt to changes in customer preferences.

Due to complex relationships and unpredictable impact of interventions in business ecosystem mode of operation, involvement of all end customers is challenging and effort consuming activity. Complete requirement assessment in the turbulent front-end phase of the ecosystem has limited value add compared to focused and deep thriving key end customer engagement. The customer categorization and presented ecosystem scoping process based on key end customer insights and preferred value elements is proposed as an efficient mode to scope the ecosystem before formation.

3.2 System level value proposals define the core service providers

Following the business ecosystem metaphor, complex adaptive systems theory (Gundlach 2006; Choi et al. 2001) and complexity logic (Lengnick-Hall and Wolff 1999) as the ecosystem’s core logic the value of the ecosystem is in the network relationships as the actors cannot produce the value themselves only. Networks hold the value, not the individual value proposals, products or actors. Business ecosystem value is service driven, all actors including customers contribute to unique value creation and consumption following the customer driven logic. Business ecosystem actors derive their own requirements and strategic targets from the system level requirements by reflecting them against their business models.

Article II addresses the RQ2 How the system level value proposals define the core service providers. Article II presents through the Health City Oulu case that the system level value proposals and service elements related to them are driven by business ecosystem core actors. The article concludes that these core actors can be identified by analysing the system level value proposal elements and related customer relationships using a tier model described in the figure 9.
The tier model in the figure 9 presents that the ecosystem actors can be classified as end customers, core service providers, 2nd tier service providers and indirect stakeholders or supporting service providers. The ecosystem central actor facilitates the relationships. The tier model can be used to unveil the control points in the system level value creation driven by the ecosystem core service providers in the operational phase. These core service providers as the value integrators should be involved into the early planning of the ecosystem and they should be actively participating into the ecosystem formation. With the tier model the ecosystem planners can model the actor portfolio and system level value proposals of the upcoming ecosystem.

The system level value proposals are unique value proposals that define the existence of the business ecosystem. They are created in multiple dimensions and they are iterative and complex deliverables specific to the ecosystem in question. In the formation phase the initial system level value proposals and related value or service elements can be defined as blueprints based on the scripts described from customer processes and requirements.

Service elements that create the system level value can be linked to the ecosystem actors. Linking the services with actors follows customer dominant logic characteristics where integration points of value elements define the relevant actors. Using the tier model and customer dominant logic it was possible to conclude in the Health City Oulu case study that the core service providers were grocery store, training gym, senior services and kindergarten based on the service elements listed in the figure 8.
All relationships in the business ecosystem are customer relationships, either internal or external. They involve transaction of tangible resources or intangible assets such as information, competences or knowledge relevant to the creation and delivery of the system level value. Iteration of the system level value proposals and actors involved into creation, integration and delivering them presents how the ecosystem actors form different layers or tiers in the ecosystem, depending on their contribution to the system level value.

The tier model and categorization of the ecosystem actors according to it was applied further in articles IV and V to model the business network modules of the Taiwanese health and wellbeing ecosystem. The tier model validated the modular structure of the ecosystem and made it possible to identify the connecting actors between the ecosystem modules. Articles IV and V complemented article III answer for RQ2 by illustrating further how the system level value creation and delivery is driven by the core service providers between the ecosystem actors and the network modules.

3.3 Anchoring and moderating actors drive the ecosystem strong relationships

Business ecosystem actors have different characterizations based on their position in the ecosystem and in the relationships between actors and ecosystem modules. Same actors can have different roles in different modules and their contribution to the inter-modular relationships can differ. Also the relationships between the actors have different role for the health of the ecosystem that can be evaluated in terms of sustainability, resilience, innovativeness and renewal capabilities.

The actors who create and host the relationships that keep the ecosystem structure in place provide a baseline for the ecosystem to be active and to pursue for success. Therefore these relationships and the actors who create those in the ecosystem formation and facilitate them in the operational phase should be focused in ecosystem governance. To address this topic articles IV and V provide answer for RQ3 How to identify actors in formation and operational phases that keep the ecosystem active? as a case study on operational Taiwanese health and wellbeing ecosystem.

Articles IV and V explored the different roles of actors and the relationships in a modular business ecosystem by mapping a business ecosystem in Taiwanese health and wellbeing domain. Eight business networks modelled using the customer tier model were combined as a business ecosystem where actors were
categorized as end customers, business ecosystem module lead actors, core service providers, 2nd tier service providers and external/supporting stakeholders. The relationships between the ecosystem modules were defined in separate specialist workshops. The overview of ecosystem combined from business network modules is presented in figure 10.

Fig. 10. Taiwanese health and wellbeing business ecosystem (Lappi and Lee 2017, with permission of Kasetsart University, Faculty of Business Administration)

Business network module structures were defined in semi-structured interviews with the ecosystem module central actors presented as black boxes in figure 10. From the interview results it was possible to define the actors and relationship types that connect the ecosystem modules with each other. Connections between the ecosystem modules define the ecosystem system level value proposals and keep the ecosystem structure in place. In article IV those connections are named as business ecosystem’s strong relationships. The number of common actors and how many different roles in terms of customer tier model define the strength of the relationship as a multiplied score. The results of the article IV relationship analysis
in the Taiwanese health and wellbeing business ecosystem are presented in the table 6.

Table 6. Strength of the relationships between network modules in Taiwanese health and wellbeing business ecosystem

<table>
<thead>
<tr>
<th>#</th>
<th>Description</th>
<th>Transaction</th>
<th>Actors</th>
<th>Roles</th>
<th>Score</th>
<th>Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Link between relatives and senior people living in nursing homes</td>
<td>Information</td>
<td>4</td>
<td>1</td>
<td>4</td>
<td>Weak</td>
</tr>
<tr>
<td>2</td>
<td>Carekeepers changing employers and sharing information</td>
<td>Information, effort</td>
<td>3</td>
<td>2</td>
<td>6</td>
<td>Mid</td>
</tr>
<tr>
<td>3</td>
<td>Nurses changing employers, receiving training, sharing info and knowledge</td>
<td>Information, effort, value</td>
<td>5</td>
<td>3</td>
<td>15</td>
<td>Strong</td>
</tr>
<tr>
<td>4</td>
<td>Doctors changing employers, sharing info and knowledge, creating business, co-operating</td>
<td>Information, effort, knowledge, joint value, business</td>
<td>6</td>
<td>3</td>
<td>18</td>
<td>Key</td>
</tr>
<tr>
<td>5</td>
<td>Hospital management comms, relationships, value creation, customers</td>
<td>Information, effort, value, money</td>
<td>6</td>
<td>2</td>
<td>12</td>
<td>Strong</td>
</tr>
<tr>
<td>6</td>
<td>Common government instances regulating, controlling, facilitating, sharing information</td>
<td>Regulations, policies, information</td>
<td>6</td>
<td>2</td>
<td>12</td>
<td>Strong</td>
</tr>
<tr>
<td>7</td>
<td>Local community people and clubs interacting with actors</td>
<td>Information, guidelines</td>
<td>3</td>
<td>1</td>
<td>3</td>
<td>Weak</td>
</tr>
<tr>
<td>8</td>
<td>Nursing home co-opetition</td>
<td>Information, money, people</td>
<td>3</td>
<td>3</td>
<td>9</td>
<td>Mid</td>
</tr>
<tr>
<td>9</td>
<td>Security company providing security services</td>
<td>Service, money</td>
<td>2</td>
<td>2</td>
<td>4</td>
<td>Weak</td>
</tr>
<tr>
<td>10</td>
<td>IT service providers providing service solutions and sw support</td>
<td>Service, money</td>
<td>2</td>
<td>2</td>
<td>4</td>
<td>Weak</td>
</tr>
<tr>
<td>11</td>
<td>Doctors receiving training from training clinics</td>
<td>Information, service, money</td>
<td>4</td>
<td>2</td>
<td>8</td>
<td>Mid</td>
</tr>
<tr>
<td>12</td>
<td>Government regulating medical instrumens, medicine and related transactions with universities</td>
<td>Regulations, policies, information</td>
<td>4</td>
<td>2</td>
<td>8</td>
<td>Mid</td>
</tr>
<tr>
<td>13</td>
<td>Temples offering religious services to people living in nursing homes</td>
<td>Service</td>
<td>2</td>
<td>2</td>
<td>4</td>
<td>Weak</td>
</tr>
<tr>
<td>14</td>
<td>External event providers offering tailored services to nursing homes</td>
<td>Service</td>
<td>2</td>
<td>2</td>
<td>4</td>
<td>Weak</td>
</tr>
<tr>
<td>15</td>
<td>Medical service instruments and related services supplied to hospitals</td>
<td>Service, money</td>
<td>2</td>
<td>2</td>
<td>4</td>
<td>Weak</td>
</tr>
</tbody>
</table>
The actors who hosted the strong relationships in the table 6 were named as the ecosystem moderator actors in article IV. In the case study doctors, nurses, government offices and hospital management had that moderator role. Moderator actors link the ecosystem modules together but are not presented as central actors in any of the business network modules. Their role as moderator becomes visible through connecting the modules into large scale ecosystem using logic of strong and weak connections and network modularity.

The four strong relationships in the table 6 maintain cohesion in the case study ecosystem and are significant for the ecosystem health in terms of sustainability and resilience. The number of strong relationships compared to other relationship types should be limited in order to maintain the structure and simultaneously nurture innovativeness and renewal capabilities that come through the weak relationships.

The importance of strong relationships for the ecosystem resilience comes from complex, uncertain and iterative transactions that connect the network modules together in value creation. The strong relationships in the case study are formed around social relationships, human contributions and trust. The most significant transaction items in the strong relationships are intangible assets such as personal connections, knowledge, competences and information. There is limited direct compensation between the actors or formal promises for future co-operation in the strong relationships. Trust and shared intangible assets make the strong relationships deep but more vulnerable to risks and skimping behaviour. They are less dependent on the physical product transactions that are more likely to be impacted by changes in technologies or ecosystem actors.

Based on the case study results article IV concludes that the strong relationships are hosted by moderator actors in the ecosystem operational phase. Once the ecosystem value creation processes are established, the moderator actors’ role is to enable these processes and keep the ecosystem active. The moderator actors do not drive the value proposals as their primary targets for being part of the ecosystem and thus their contribution to the ecosystem formation is limited.

The actors who have the strongest incentives to establish the ecosystem lead the ecosystem formation. These actors belong to the group of ecosystem core service providers who are to be involved into customer requirement driven ecosystem planning as discussed with RQ1 and RQ2. In the Taiwanese health and wellbeing case study those core service providers formed the ecosystem network modules as the operational phase module lead actors. When the number of actors in the network module was multiplied with the number of involved moderator
actors it was possible to prioritize the contribution of these module lead actors to the ecosystem formation. The results of the module lead actor analysis in article V are presented in table 7.

<table>
<thead>
<tr>
<th>#</th>
<th>Business network module</th>
<th>Involved moderator actors</th>
<th>Total (T)</th>
<th>Size (S)</th>
<th>Score (T*S)</th>
<th>Est.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Hospital nursing home</td>
<td>Doctor, nurse, hospital mgmt., government</td>
<td>4</td>
<td>12</td>
<td>48</td>
<td>2013</td>
</tr>
<tr>
<td>2</td>
<td>Private nursing home</td>
<td>Doctor, nurse, hospital mgmt., government</td>
<td>4</td>
<td>18</td>
<td>72</td>
<td>1986</td>
</tr>
<tr>
<td>3</td>
<td>Chung Teng Medical Instrument (CTMI)</td>
<td>Doctor, nurse, hospital mgmt., government</td>
<td>4</td>
<td>14</td>
<td>56</td>
<td>1995</td>
</tr>
<tr>
<td>4</td>
<td>iHealth</td>
<td>Doctor, hospital mgmt., government</td>
<td>3</td>
<td>16</td>
<td>48</td>
<td>2010</td>
</tr>
<tr>
<td>5</td>
<td>Yong Wei Security</td>
<td>Hospital mgmt., government</td>
<td>2</td>
<td>13</td>
<td>26</td>
<td>2005</td>
</tr>
<tr>
<td>6</td>
<td>Jen Ai hospital long term care</td>
<td>Nurse, hospital mgmt.</td>
<td>2</td>
<td>17</td>
<td>34</td>
<td>2007</td>
</tr>
<tr>
<td>7</td>
<td>Changhua Christal hospital (logistics)</td>
<td>Doctor, nurse, hospital mgmt.</td>
<td>3</td>
<td>15</td>
<td>45</td>
<td>2014</td>
</tr>
<tr>
<td>8</td>
<td>IMC Taichung</td>
<td>Government</td>
<td>1</td>
<td>19</td>
<td>19</td>
<td>2015</td>
</tr>
</tbody>
</table>

The lead actors who had the largest direct business network, widest connections to the moderator actors and the longest presence in the ecosystem were named in article V as the ecosystem anchoring actors. In the case study those actors were private nursing home and Chung Teng Medical Instrument (CTMI). Their most significant contribution to the formation of the case study ecosystem was establishment of the strong relationships and the structure of the ecosystem as a whole.

Article IV and V case study ecosystem formation was self-organized as there was no single actor purposefully setting up the ecosystem from separate networks. The anchoring actors did not purposefully push for the ecosystem formation but by utilizing external and internal stimuliuses to create the strong relationships their actions led in an organic manner to the formation of the business ecosystem. For example CTMI provided training for doctors and connected the hospital management units. Article V concludes based on the case study that in self-organized business ecosystem the anchoring actors lead the ecosystem formation by defining the initial content and interaction frequency for the relationships connecting the separate business networks.
Anchoring actors are the core service providers that drive ecosystem formation by establishing the strong relationships between separate business network modules. In operational phase the strong relationships are hosted by moderator actors who keep the ecosystem structure in place and facilitate the system level value creation. Strong relationships can be identified based on the number of involved actors and different roles, and they need trust and stability to develop. Together the articles IV and V provides as an answer to RQ3 that those anchoring and moderating actors can be identified based on their relationships within and in between ecosystem business network modules.

3.4 Health assessment makes success capabilities visible

Assessing the business ecosystem health status enables the actors willing to guide the ecosystem formation or evolution to direct the governance activities to correct actors, relationships and transactions. For ecosystem formation planning the health status assessment of planned operational ecosystem provides the planners foresight about the ecosystem success capabilities. Article V addresses RQ4 **How to evaluate ecosystem success capabilities through health assessment** and clarifies what are the parameters to assess whether the defined ecosystem targets, customer requirements, involved core service providers and identified anchoring and moderator actors form a value constellation that has capabilities for long term success.

Partially the ecosystem health assessment can be conducted for example when the ecosystem anchoring actors are identified. Article V presents that for a comprehensive overview of the ecosystem current or predicted health status the ecosystem size, anchoring actors, moderator actors and relationship types need to be modelled. Based on the Taiwanese health and wellbeing ecosystem case study article V proposes that the ecosystem health status can be measured through

- Number of moderator actors
- Size of anchoring actors’ business network
- Number of strong relationships
- Number of weak relationships

To enable comparison between the ecosystem the assessment result numbers need to be put into context of overall ecosystem size. As a response to RQ4 article V proposes a business ecosystem health status assessment model described in figure 11. The model links interconnected measurement parameters with the ecosystem
health dimensions providing a framework for both practitioners and academic scholars to evaluate business ecosystem healthiness.

Fig. 11. Business ecosystem health status assessment model (Lappi et al. 2017, with permission of ToKnowPress)

The health status assessment model responds to identified challenges to measure health and successfulness of multidimensional value constellations. Continuous use of ecosystem health status assessment enables monitoring the ecosystem health and steering through governance actions. Due to unpredictability and complexity of ecosystem formation, prediction of impact of management actions is difficult. The model can be used in ecosystem formation to validate whether the current plans would create a successful ecosystem.

For efficient ecosystem formation the front-end phase and operational phase ecosystems should be assessed separately due to differing actor portfolio and targets. Common actors in both of the ecosystems are the anchoring actors and their
Role together with strong relationships are critical for a healthy ecosystem to emerge as a result of the formation process.

3.5 Stakeholder salience assessment focuses governance activities

Managing a business ecosystem can be considered as a nearly impossible task but in practice the ecosystem actors need to take regularly governing actions about how to influence the surrounding network. As the influencing actions have only certain and sometimes unpredictable impact to the ecosystem that are not under the actors’ sole control, term governance is proposed to be used instead of management.

Ecosystem formation is about transition of a project-type front end ecosystem into an operational business ecosystem. The transition can be directed or take place as self-organized phenomenon where transition actions are triggered by external or internal stimuli leading into an complex value constellation where actors are interdependent on system level value creation. Governance of business ecosystem formation should have flexibility from the beginning and the actors should focus on sense-making rather than detailed planning.

Complexity of the ecosystem formation and unpredictability related to the governance is explored in article I with RQ5. RQ5 How to identify the actors to focus the governance activities in ecosystem formation was analysed with a case study on an operational phase Haukipudas school campus ecosystem in Oulu, Finland. Project business literature is applied in article I to frame the case study as it provides a fruitful source of concepts including stakeholder assessment and stakeholder salience model to define governance activities for business ecosystem formation.

Stakeholder salience model (Mitchell et al. 1997) used as article I main concept was selected to identify who are the actors whose impact or capabilities to impact to the ecosystem is most significant in terms of power, legitimacy or urgency. Stakeholders can be either internal or external to the ecosystem following the customer tier model. The impact of the stakeholders can be either positive or negative for the system level value creation. In the case study the impact of the identified ecosystem actors was analysed in interviews and their salience and probability to impact was defined using Analytical Hierarchy Process (AHP) (Al-Subhi Al-Harbi 2002). The results of the stakeholder analysis in the case study ecosystem are presented as two-dimensional salience-probability matrix in figure 12.
Fig. 12. Probability and salience assessment matrix of business ecosystem stakeholders (Lappi et al. 2015)

Actors of the case study ecosystem were positioned into the probability and salience matrix based on their AHP scores. The matrix in figure 12 presents four categories for the actors and suggests the level of governance actions per category. The stakeholders belonging to “key players” category are the ones whose impact probability and salience are highest and thus those actors’ involvement into ecosystem formation and planning of it should be ensured. As a response to RQ5 the article proposes following activities:

- Map the stakeholder network or business ecosystem
- Define stakeholder impact using salience model
- Group and prioritize the stakeholders using the stakeholder assessment matrix

Stakeholder assessment builds on the ecosystem health assessment. At certain lifecycle stage some ecosystem actors are more salient than the others due to their capability to satisfy the stage specific needs and thus their contribution to ecosystem health status is different. The salience assessment should focus on the core service providers and identified anchoring actors in the ecosystem formation. The assessment is applicable in both the front-end and operational ecosystems and
for efficient guiding of the ecosystem the assessment should be conducted on continuous basis.

### 3.6 Results synthesis

Ecosystem formation process is a complex and dynamic phenomenon where project-type temporary front-end ecosystem transforms into operational business ecosystem. The transformation takes place either as a result of intentional governance activities or as a result of unification of separate business networks through actions triggered by internal or external stimuli. Uniqueness and irreversibility of decision making leads to lack of routines and established processes in formation where one ecosystem is transformed to another one.

Due to missing established processes and multidimensional and complex relationships the impact of the governance activities is unpredictable. The ecosystem actors willing to plan and direct the formation need to operate with limited information and create balance with structured planning and design flexibility. They need to ensure that the actors to be involved in the formation have needed details to commit to the ecosystem but simultaneously are allowed to feed in their requirements and thus influence the formation process.

This dissertation is focused through research questions RQ1, RQ2 and RQ3 to define ecosystem targets, model the ecosystem and to identify the key roles that need to be focused to form a healthy business ecosystem. Through RQ4 and RQ5 the dissertation illustrates assessment models to evaluate the ecosystem healthiness and actor portfolio in terms of salience and impact probability to monitor how the formation processes.

As a summary of the literature findings and the three case studies this dissertation synthetizes a multidimensional governance framework for the ecosystem formation in figure 13.
Formation of the ecosystem from front-end ecosystem to operational ecosystem is described as a picture in figure 13. The ecosystem governance can be viewed in two dimensions. Defining scope and the relationships is the first dimension. In this dissertation this dimension includes ecosystem scoping based on customer needs, definition of core service providers tiers from system level value proposals and identification of the actors who drive the formation through strong relationships. This dimension of the formation framework is discussed in articles II, III, IV and V. The second dimension focuses on monitoring the ecosystem formation conditions through ecosystem health and stakeholder assessment models. This dimension is discussed in articles I and V.

The formation in the main picture in figure 13 is described as a linear process consisting of two phases. In practice the formation can also be iterative and the two ecosystem phases overlap dynamically making the formation governance a dynamic process.

The ecosystem formation governance framework presents areas as dimensions that benefit from systematic analysis with defined methods and models. The framework does not intend to be comprehensive as business ecosystem formation
is unique, vague and organic process whose complete control can be considered nearly as an impossible task. The governance framework provides business ecosystem central actors or planning actors a set of methods to define critical roles and relationships for a healthy ecosystem to form and assessment models to monitor the ecosystem health and stakeholder conditions.
4 Discussion

This chapter presents the key contributions to the body of knowledge of business ecosystem formation and to the underlying the theoretical foundations. New insights are provided in particular to business ecosystem literature but also to business network and project business research streams. Next, the key theoretical implications and practical applications of the research results are outlined. The chapter finishes with a discussion on the reliability and validity of the conducted empirical research and on the recommendations for further research.

4.1 Theoretical implications

Theoretical implications for the founding academic research streams are structured according to the ecosystem formation framework presented as the body of knowledge of business ecosystem formation. The body of knowledge presents how the business ecosystem literature is connected with the underlying theoretical foundations. Theoretical implications are in line with the existing business ecosystem literature complementing the previous contributions especially in the ecosystem actor role definitions. Opposed to reviewed literature this dissertation presents through empirical research that ecosystem formation can be guided to some extent using the ecosystem formation framework. This chapter discusses the theoretical implications per ecosystem formation element described in the body of knowledge of ecosystem formation.

Business ecosystem definition

This dissertation presents as a summary of research contribution a two dimensional framework whose five elements provide elements that increase coherence on business ecosystem definition. This is in line with Kortelainen and Järvi (2014) and Peltoniemi (2006) who identified the missing coherence of business ecosystem concept definition and positioning of it against other value constellations as a major challenge in related academic discussion.

This dissertation contributes to ecosystem definition and positioning discussion (e.g. Moore 1998; Gossain and Kandiah 1998; Iansiti and Levien 2004; Peltoniemi 2006; Adomavicius et al. 2005; Anggraeni et al. 2007) by presenting how relationships form channels for evolution, modularization and governance. This perspective to analyse complex networks as evolving modular business
ecosystems can bring closer the discussions on self-organized and managed networks in business research stream (e.g. Snehota and Håkansson 1995; Möller and Rajala 2007).

Based on the presented body of knowledge and the empirical results this dissertation strengthens the position of business ecosystem in organizational strategy research (e.g. Powell 1990; Gulati et al. 2000) as not an own organization form as such but as a perspective to approach business or industrial networks (Snehota and Håkansson 1995; Håkansson and Johanson 1992) or complex adaptive systems (Choi et al. 2010; Gundlach and Foer 2006). This dissertation supports considering business ecosystem as a metaorganization design (Gulati et al. 2012) by identifying that strong relationships are based on social mechanisms and the scope of a business ecosystem can extend industrial and organizational boundaries.

**Dynamics**

The case study in Health City Oulu demonstrates how a project such as a construction project can be considered as a business ecosystem implementation vehicle. With clarifying the dynamics of business ecosystem formation this dissertation contributes to project business stream where complexity and uncertainty of complex project front-end are highlighted for example by Aaltonen et al. (2013) and Williams and Samset (2010).

The two interrelated phases of business ecosystem formation identified in this research are in line with Artto et al. (2016) suggestion that the relevant service types and concepts should be taken into account in the project front-end phase. Through the stakeholder assessment model this dissertation builds on the approach of life-cycle management of complex project networks (DeFilippi and Sydow 2016). The key end customer identification through customer typology matrix and definition of core service providers based on the end customer needs provides novel insights to the discussion of early identification of key services, service providers and stakeholders. The importance of early involvement of actors has been raised in both project business and business network research streams for example by Artto et al. (2016), Aaltonen and Kujala (2010), Aapaoja and Haapasalo (2013) and Mok et al. (2013).

Interdependency is identified in this dissertation as a key attribute that drives the ecosystem formation dynamics. Business ecosystem literature has discussed the ecosystem evolution and roles (e.g. Iansiti and Levien 2004; Hu et al. 2014; Lu et
and this research complements the existing knowledge by demonstrating how the interdependent anchoring actors set the actions that contribute to the ecosystem formation.

**Strategy**

This dissertation presents that the business ecosystem mode of operation follow complexity logic as the core logic (Lengnick-Hall and Wolff 1999). By describing how business ecosystem perspective benefits from the strategy logic description this dissertation contributes to the strategy research on core logics of organizations in networks (Powell 1990; Jones et al. 1997; Lengnick-Hall and Wolff 1999). The identified business ecosystem core logic in articles IV and V presents set of strategic principles that define goals, operating principles, competences and success measures of ecosystem bringing closer the discussion on strategies in networks in both business ecosystem and business network research domains (e.g. Anggraeni et al., 2007; Häkansson & Snehota, 2006; Möller and Rajala 2007). Business ecosystem visualized in the articles IV and V follow the complexity logic as the core logic meaning that strategies of the actors are aligned with network success targets and actors’ capabilities to drive dynamic non-linear systems. These actor strategies that focus on the network benefits build on the role of networked feedback and emergent relationships as important business strategy drivers discussed by Anggraeni et al. (2007). As the case study ecosystems in this dissertation include diverse set of complementing and competing actors, the findings support Lengnick-Hall and Wolff (1999) conclusions on that the efficient strategies in complexity logic need to address both competition and co-operation in multidimensional transactions (Lengnick-Hall & Wolff 1999)

Gotzlich and Wenzek (2014) presents a keystone strategy in business ecosystem that emphasize networked collaboration and strive for resilience as key targets for the ecosystem actors. This dissertation presents through the ecosystem health assessment model how these targets can be achieved therefore leveraging the earlier research contributions from Gotzlich and Wenzek (2014) and also Letaifah (2014) who presents that strategic focus of actors should be on the ecosystems rather than linear supply chains.

This dissertation presents business ecosystem as an entity of interconnected business networks. This is aligned with network modularity research views discussed for example by Borgatti and Foster (2003) and Baldwin (2007). The relationships between the modules form the ecosystem structure in the case studies.
supporting Brusoni (2005) view that definition of modules and how they are connected as an ecosystem is important for efficient ecosystem strategy.

Furthermore modularity identified in this dissertation as one of the ecosystem key characteristics for adaptability is in line with Campagnolo and Camuffo (2010). By presenting how the moderating actors, anchoring actors and strong relationships build up sustainability, resilience, innovation and renewal capabilities this dissertation contributes to definition of business ecosystem operating principles (Götlich and Wenzek (2004) and den Hartigh et al. (2006).

Business ecosystem relationships, also those discussed in this dissertation, are complex and multidimensional. Following McEvily et al. (2003) the relationships are based on trust as an underlying enabler. From this perspective this dissertation contributes also on social network research stream (e.g. Jones et al. 1997; Capaldo 2014) by presenting how trust and personal relationships can be used to determine parameters to evaluate strength of relationships in a business ecosystem.

Consolidation of the key end customer internal processes and requirements contributes to customer-dominant logic (Heinonen et al. 2010) by introducing a learning method regarding how customers’ internal processes can be modelled and applied for encounter processes and value definition. This builds on the findings of Eichentopf et al. (2011) and Grönroos (2006, 2008) on central position of the end customer processes in joint value creation in a service driven environment.

**Governance**

In this dissertation the case study subjects represent both managed (Health City Oulu, Haukipudas school campus) and self-organized (Taiwanese health and wellbeing ecosystem) networks following the descriptions discussed in business network research stream. Similarly, the case study subjects differ in terms of network governance mode. Following Capaldo (2014) categorization of governance modes they are centrally governed (Health City Oulu, Haukipudas school campus) or have a shared governance mode (Taiwanese health and wellbeing ecosystem). This is aligned with Moore (1998) proposals on community governance systems and quasi-democratic mechanisms being the preferable governance models in complex and dynamic business ecosystems.

For example Den Hartigh et al. (2005) discuss about ecosystem governance as a way to orchestrate the ecosystem activities and to align the goals of the ecosystem actors. Governance is about enabling the resources and willingness to prosper rather than providing resources and guidelines to the actors in a top-down way. The
findings of this dissertation present novel concepts for ecosystem health and stakeholder salience assessment discussed in business ecosystem and project business literature streams. Though continuous and controlled management does not fit well into scope of self-organized ecosystem metaphor (Moore 1993; Adomavicius et al. 2005; Hearn and Pace 2006) the concepts of this dissertation bring additional perspectives for discussion on ecosystem formation governance challenges.

Stakeholder assessment theory and stakeholder salience model from project business literature (e.g. Freeman 1984; Mitchell et al. 1997; Aapaoja and Haapasalo 2014) are applied in this dissertation to describe how the salience and impact probability of business ecosystem actors can be defined. Through presenting how to focus the governance activities on most salient actors this dissertation merges the project business and business ecosystem discussions on governance of evolving complex networks and projects implementing them.

In this dissertation co-opetition comes up as an identified characteristic of a self-organized business ecosystem in Taiwanese health and wellbeing ecosystem where the system level value is shaped through co-opetition. This strengthens the views of Dass and Kumar (2014), Carvalho and Moreira (2015) and Ford and Håkansson (2013) on how co-opetition is conceptualized in terms of a system of linkages in a network including all products or services whose adoption either increase or decrease the adoption of the ecosystem’s value proposals.

Co-opetition identified as part of the research ecosystems’ mode of operation and governance baseline is in line with the three advantages of the relationship analysis derived from Moore (1998) and Iansiti and Levien (2004) building further the role of business ecosystem as a diverse value constellation. The descriptions of the case study ecosystem present that the network is the value source in the business ecosystem, actors have several roles and interplays of relationships keep the ecosystem structure in place.

These health assessment dimensions complement further the Iansiti and Levien (2004) description on how business ecosystem success is evaluated. Renewal and innovativeness capabilities for example add more details about ecosystem formation process and operating routines that give indication about ecosystem ability to react to either internal or external shocks as described by DeFilippi and Sydow (2016) as one of the tensions related to project network governance.
The identified anchoring and moderator actor roles in ecosystem formation and operations complement the discussion on business ecosystem actor and relationship behaviour. These roles have not been identified in previous discussion on business ecosystem and thus they complete the actor portfolios presented for example by Iansiti and Levien (2004), Hu et al. (2008) and Lu et al. (2014). Anchoring and moderator actor roles sharpen the role descriptions and enhance ecosystem diversity that has been raised as important yet difficult to manage ecosystem characteristic by Ceccagnoli et al. (2012), Hearn and Pace (2006) and Ramachandran and Mukherji (2007). Additional research would be beneficial to strengthen the description of anchoring and moderator actors but already as now described in this dissertation, they contribute to the roles and behavioural aspects especially to the less explored business ecosystem formation in related discussion. Furthermore applying the concept of anchoring actor into research on complex projects or project networks broadens the understanding related to challenges identified by for example Williams and Samset (2010), Flyvbjerg (2014) and DeFilippi and Sydow (2016).

The importance of strong relationships to the ecosystem comes from complex, uncertain and iterative transactions (Baldwin 2007). Following the description from Baldwin (2002) the moderator actors introduced in this dissertation have high contribution to the ecosystem value, but their criticality to the ecosystem comes from the strong relationships they create and maintain. Therefore the moderator role includes also characteristics of the role of intermediator (Nätti et al. 2014) and network structural hole (Gulati et al. 2000) when the findings are viewed from customer dominant logic and organizational and strategy research stream point of view.

As the anchoring actors establish the ecosystem’s strong relationships in the formation phase, they define, based on this dissertation, the structure of operational ecosystem. This contributes to the ecosystem’s mode of operation through embedded actor behaviour (Dass and Kumar 2014; Zahra and Nambisan 2012; Götlitch and Wenzek 2004) can be used to discuss ecosystem’s resilience against internal and external changes (denHartigh et al., 2006).

The more diverse and frequent the transactions in the strong relationships are, the more sustainable the ecosystem is. In the conducted case studies the business ecosystem actors contribute in multiple ways to the value creation by applying peer production model (Benkler 2002) in complex environments. The strong
relationships defined as the joint value creation channel in this research contribute to service and customer dominant logics (Vargo and Lusch 2004; Grönroos 2006; Grönroos 2008; Pinho and Fisk 2014).

Joint value proposal delivered through business ecosystem strong relationships extends the discussion on customer scripts and service blueprints as initial joint value proposals (Heinonen et al. 2010; Eichetopf 2011; Payne et al. 2008) from individual relationship to complex modular network level enabling further discussion about how the business ecosystem literature can benefit from concepts originated in service and customer dominant logic research streams.

Importance of strong relationships as emphasized in this dissertation is based on human contributions and social capital (Borgatti et al. 2003). Analysis framework of ecosystem relationships described in in this dissertation contributes to the business ecosystem relationships analysis and extends the knowledge of how social relationships create mechanisms for network behaviour (e.g. Jones et al. 1997).

**Evolution**

In business ecosystem literature evolution phases are discussed by several scholars such as Moore (1993), Lu et al. (2014) and Hu et al. (2014) but how the ecosystems are formed has received less attention amongst the scholars. This dissertation provides new contribution by focusing on how the ecosystems are formed. The main contribution is the definition of ecosystem formation as a phase where an uncontrolled and unstructured set of actors and casual relationships in ecosystem emergence transitions into operational amorphous self-organized value constellation.

The temporariness of a project results in phase-changing trigger events such as changing stakeholders. This differs from the ecosystem concept, which emphasizes gradual, organic evolution. The interdependency of the business ecosystem and implementing project is an organizational learning finding from this dissertation that supports Artto et al.’s (2016) view on project dynamics. Positioning ecosystem formation as bridging evolution phase between project-type ecosystem front-end and operational business ecosystem merges concepts from project business research in business ecosystem research.

Identification of the anchoring actors and strong relationships for the ecosystem formation requires early involvement of the key stakeholders as presented by Majava et al. (2015) and Aapaoja et al. (2013) in context of project
establishment. In this dissertation the stakeholders in ecosystem front-end phase differ from the operational ecosystem actors, but the anchoring actors belong into scope of both of them. Therefore the identification of anchoring actors support the currently dominant view of early stakeholder involvement in project business research (Aapaoja et al. 2013; Olander and Landin 2005).

Self-organized and centrally managed business ecosystems have different formation mechanisms as identified in this dissertation. However the anchoring actors are present in both types of the ecosystems and they drive the ecosystem formation. Through the anchoring actors and their roles in ecosystem formation it is possible also to investigate the formation triggering events either from internal or external perspective. Depending on the ecosystem type, the sources of triggering events are different. In both types the formation triggering events can be viewed as either explorative or exploitative development activities that contribute to the learning and capabilities of the ecosystem following the work done by Dittrich et al. (2004) and Brady and Davies (2004).

4.2 Practical Implications

Practical implications of this dissertation entail how in industrial and business context the findings can benefit the practitioners. The ecosystem formation governance framework describes as the synthesis of the research contribution form the backbone of the practical implications and the implications are discussed in this chapter following the structure of the framework.

Ecosystem scope and targets

This dissertation presents how the ecosystem governance should begin with defining the scope and targets of it. As customer centric value constellation, the scope and target definition should start with the end customer internal processes and requirements followed by initial value proposal definition as service blueprints. Due to limitations of data, effort and time the focus should be on the customers whose capabilities and motivations to contribute to ecosystem planning is highest. End customer categorization matrix is presented in this research as a practical concept to identify these key end customers who should be involved in the ecosystem planning.

Iterative engagement with the key end customers provide insights for the needed ecosystem joint value proposals that can be used to identify the core service
providers whose capabilities should be involved in the ecosystem planning. Depending on the ecosystem type and related governance mode the core service providers to be involved for the joint value definition have different roles and they establish different types of relationships.

Based on the research findings especially in self-organized ecosystems such as the Taiwanese health and wellbeing ecosystem the scoping and target setting is a very discrete and complex process to control. The central actor needs to find balance in development of a detailed design to convince the core service providers but simultaneously is flexible enough to accommodate emergent preferences. At the same time the central actor needs to recognize the dualistic mode of ecosystem formation where project phase ecosystem actors are different than in the operational phase. This research describes how stakeholder salience model can be used to support governance activities related to this.

The research findings also contribute to the practical challenge of defining a business ecosystem that has no flexible boundaries and is very organic by nature. The scoping of the ecosystem using key customers and their processes and requirements as the baseline describes a flexible yet practical approach to define the ecosystem scope and targets on needed level of detail that enable formation planning in complex and unilinear environment.

The project phase and operational phase ecosystems are different. When planning for a permanent value creation network such as a business ecosystem, the implementing project should include also the operational phase actors. This research presents that sustainable value creation needs to be driven by the end customer and that the end customer is an active and engaged member of the joint value creation.

**System level value proposals and core service providers**

The initial system level value proposals reflect the business ecosystem targets. Based on the value proposals the ecosystem planner can identify the core service providers and their internal and external customer relationships. Modelling the initial joint value creation using customer tier model for customer relationships enable mapping of the basic structure of the operational ecosystem with the most relevant actors that integrate the end customer value and drive the ecosystem formation. These findings support the multifaceted customer role as an ecosystem defining characteristic that should be taken into account in the value proposal planning.
Different types of interdependencies impact how the tiers of the ecosystem customer relationships are formed. Central actors of for example complex built environment projects would benefit from tier model as a project scoping tool in the early phase of the project. Dynamics of both value proposals and involved actors make the tier model a dynamic concept applicable to certain ecosystem phase.

End customer as the central point expands the role of innovations and novel value proposals as the driving forces for business ecosystems. By taking the end customer into the center of the ecosystem planning and modelling the ecosystem joint value and actors from the end customer perspective unveils the ecosystem value integration and control points for the actors planning the ecosystem formation.

**Roles of anchoring and moderating actors in strong relationships**

This dissertation introduces the roles of anchoring and moderator actors and how they are interlinked through the strong relationships forming and hosting the operational ecosystem. Based on the initial scoping of the ecosystem using the customer tier model as the actor role categorization framework, the practitioners can determine the relationships that connect individual business networks as modules of large scale business ecosystem. The relationships that have the biggest number of connected actors in diverse roles can be identified as the strong relationships. Through the strong relationships the ecosystem planners can identify the interdependencies where the impact of governance activities is highest.

The actors who host these relationships are the moderator actors. The central actor of the ecosystem should empower these actors to pursue value creation and integration but control the number of strong relationships. Based on the network modularization this dissertation proposes that in an efficient ecosystem the interactions between network modules should be limited and interactions inside them should be maximized. Number of identified strong relationships between business network modules give also an indication of the phase of the ecosystem enabling the ecosystem planners to estimate how the evolution would continue and what impacts would possible disruptions cause in the ecosystem.

**Ecosystem health assessment**

This dissertation presents sustainability, resilience, renewal capabilities and innovation capabilities as the dimensions where ecosystem health can be defined and introduces a practical framework for ecosystem health assessment in different
life cycle phases. This contribution makes the earlier proposals on business ecosystem health evaluation and definition of key success factors more concrete and applicable in practical complex projects and business environments. Based on this dissertation the actors willing to facilitate ecosystem formation can assess the health status through number or moderator actors, size of anchoring actors’ business network, number of strong relationships and number of weak relationships. These parameters are interconnected, and the health assessment outcome needs to be evaluated in context of the ecosystem size.

Business ecosystem success and health are interlinked and the challenges related to ecosystem success are system level value proposal, architectural interdependencies and managing the relationships between the actors. This dissertation demonstrates with a customer tier model, ecosystem map and strong relationship definition model how these challenges can be approached and ecosystem health can be strengthened.

In project business the recent trend is that the success of the project is determined through value deliverables after the actual project execution has ended. Combining the health assessment model with strong relationship content analysis provides detailed information of the ecosystem dynamics that support the ecosystem formation facilitation. Using the health assessment model the actors who plan a project that is to ramp up an operational ecosystem can align the project targets with the ecosystem goals. This links the two ecosystem formation phases together and enhances the likelihood of the ecosystem to become a healthy value creation entity.

**Governance activity focus on formation phase**

How to apply stakeholder salience assessment to identify actors to focus the governance activities was discussed in this dissertation through Haukipudas school campus. It was considered to be the most condensed and therefore easy to approach business ecosystem where the project business driven stakeholder salience model could be applied. Applying the stakeholder salience model with AHP in a novel context that provides insights how the importance of actors and their impact probability could be analysed in business ecosystem context. Understanding the importance and impact probability enables the ecosystem planners to identify how to involve or inform the different types of actors in the ecosystem formation.

This dissertation presents that assessing the salience and impact probability of the actors provides a visual two dimensional matrix view to evaluate the actors’
role. Modelling an upcoming ecosystem with the planned actors and their salience provides tools to define suitable governance activities already in the ecosystem planning phase. Applying the salience matrix model continuously enables consistent governance activity focus on anchoring and moderator actors. This supports continuous ecosystem steering.

The research contribution emphasizes that the ecosystem formation can be supported with project front-end governance activities like sense-making, scope control and flexible communication and with a complexity logic aligned strategy. The ecosystem formation governance should recognize the realities of uncertain environment and be sufficiently flexible to enable adaptation to changes and to avoid pre-mature concept lock-in. The formation of the ecosystem in this dissertation was driven by the actors’ intent for joint value creation, network benefits following the ecosystem formation mechanisms and network formation conditions. In all of the three case study subjects the formation was led by strong targets to enable sustainable and successful environment as business ecosystem. Therefore the findings underline the importance of joint goal setting, flexible planning and early involvement of key customers and core service providers.

The formation governance framework presented in this research has potential to enhance the ecosystem formation and related planning activities. The model consists of two overlapping phases of front-end and operational ecosystem providing a visual support for planning of the ecosystem formation before the process begins. The model and the elements inside can be used to identify where the anchoring actors would reside, and what would be the connections between actors that need managerial attention to develop as strong relationships. Applying the model to the selection of actors and assessing their salience and impact probability increase the ecosystem success opportunities through improved health status.

4.3 Reliability and validity

This dissertation explores the business ecosystem formation in terms of ecosystem scoping and target setting, joint value proposals, actors, relationships, ecosystem health assessment and stakeholder assessment. The wide research scope builds understanding how business ecosystem as a perspective to analyse complex networks and value delivering entities can be positioned amongst overlapping and complementing theoretical foundations. The concept of ecosystem formation and how the formation can be governed is new in both theoretical and practical views.
Due to the nature of the research multiple single case studies were selected to explore the dynamics of ecosystem formation in both theoretical and empirical approach. When observing the qualitative research validity and reliability following viewpoints should be included (Bryman and Bell 2003): Trustworthiness of the results; validity of the results in different contexts; repeatability of the findings; researcher’s own experience and perception impact to the results.

The trustworthiness of the research comes from the degree of correlation of the results with the real world. The three case study subjects of this dissertation with multiple research methods combined with both theoretical and empirical analysis improve trustworthiness. The case study interviews were conducted in a semi-structured manner, which enabled interaction between the researcher and interviewees, allowing the interviewees to explain the issues as entities. In depth interviews were analysed with experts increasing the correlation of the results with the real world. The results of this dissertation have been impacted by the earlier research on business ecosystems, project business, business and industrial networks, service and customer dominant logics and organizational and strategy research. Multiple theoretical foundations and business ecosystem perspective as the body of knowledge for the ecosystem formation increase the trustworthiness of this research. Hence, the trustworthiness of the research as current state analysis of the case study ecosystems can be considered to be adequate and verified.

Ecosystem research is time and effort consuming and to validate the results the research should be conducted over long period of time. Qualitative research results should be evaluated according to their applicability and validity in another environment (Bryman and Bell 2003, Yin 2003). This dissertation, like most of the research conducted in business ecosystems, is based on qualitative research methods and the creation of the conclusions follow inductive research approach. Small amount of case study subjects and selected research methodology decrease the generalizability of the findings. Validity of the ecosystem formation governance framework would benefit from further research but as the case study subjects presented different ecosystem types, life cycle modes and sociocultural environments, the findings of the dissertation can be seen to be valid in different research context.

The repeatability of the research evaluates if similar results could be achieved regardless of the researcher (Yin 1994). The other research approach, the selection of more homogenous or stable ecosystems as case study subjects and a larger number of actors, could result different observations. The repeatability of the findings specifically on the same research context can be challenging due to the
organic and evolving nature of business ecosystems. The qualitative and interactive interviews provide case specific and observation driven results. Especially the interdependencies between the ecosystem actors that define the roles and types of relationships change over time making it difficult to repeat the research. However as the selected methodology and methods are proven in different founding research streams, from that perspective the research framework can be considered as repeatable.

The perception and own impact of the researcher may challenge the objectiveness in qualitative research projects (Yin 1994). Naturally the previous experience of the researcher and the personal background have impact to how he perceives and conducts the research possibly impacting the case study analysis. With involvement of experts into results analysis and validating the results with the interviewees and other researchers during the research, this personal impact has been attempted to be minimized.

When the qualitative research is conducted as semi-structured interviews and workshops, the objectiveness of the interviewees can be questioned as well. This phenomenon was realized in all of the case study subjects but especially in Taiwanese health and wellbeing ecosystem research where the interviews were translated from Chinese to English the objectiveness of the results need to be addressed carefully. In order to avoid the subjectivity of both the researchers and the interviewees, the semi-structured questionnaire was attempted to be made as accurate as possible and the interviews followed the similar order in terms of questions. Interviews were recorded and the results were reviewed with experts and the interviewees. Also, the researcher has done his best to be as objective as possible when analysing the results.

4.4 Recommendations for further research

This dissertation presents a governance framework to support healthy ecosystem formation. The research illustrates how business ecosystem scope and targets can be defined, recognizes the roles of anchor and moderator actors and presents the strong relationships as the joint value delivery channel of the ecosystem. The research could be complemented by analyzing in more detail the weak relationships that were identified but only partly discussed in this research. Weak relationships are temporal by nature and more formal bringing innovativeness into the business ecosystem. They serve as the gates for new entrants for the ecosystem and act as
exits. The role of weak relationships as catalysts for ecosystem emergence and evolution could be studied further based on the results of this dissertation.

Three types of interdependencies have been introduced by Pinho and Fisk (2014) to be present in the relationships between ecosystem actors: dynamic role interdependency (roles change over time), temporal interdependency (interactions occur sequentially) and self-interdependency (value proposal is based on actor’s own actions). This dissertation recognizes that interdependencies of the actors especially in the strong relationships form the ecosystem structure. The types of interdependencies in business ecosystem would benefit from a more long term research to build a more coherent understanding about how the actors depend over time on each other.

The roles of anchor and moderator actors are novel in business ecosystem literature. Additional research in different types of business ecosystems could sharpen the description of these role and increase the validity of the roles as important actors in the ecosystem formation. Analysing the behavioural patterns of the actors (e.g. Anggraeni et al., 2007) would build the knowledge about specifics of the governance actions that could be applied in ecosystem formation planning.

The health status assessment model complements the academic knowledge on ecosystem success factors, development mechanisms and governance models. The created model serves as an example of how to define “a compass for ecosystem health guidance” and it enhances the usability of the ecosystem success parameters. Applying the health assessment model in different business ecosystems and in different life-cycle stages would provide an interesting source of information to compare ecosystems as further application of this dissertation. The health assessment model is a novel concept defined through a single case study in Taiwan and likelihood for modifications needed exists. The concept should be reapplied in suitable research set-ups to test its validity and to define needed adjustments to the model.

In self-organized ecosystems trust is an essential enabler for healthy ecosystem. Distribution of trust amongst the ecosystem members is a critical component for the ecosystem relationships and the structure of ecosystem as a whole (Mc Evily et al. 2003; Provan and Kenis, 2008; DeFilippi and Sydow 2016). How the trust is defined, how anchoring actors build trust as part of the strong relationship and how trust is distributed in a business ecosystem would complement the ecosystem health assessment model and be worthy of further research.

This dissertation presents in total five different elements addressed through different research questions that aim to improve healthy ecosystem formation. The
events that trigger the ecosystem formation, being those internal or external events
or deliberate actions, provides an interesting field of further research to build
understanding in both academic and practical fields about how the evolution of
complex networks could be steered using business ecosystem as the perspective to
approach the phenomenon.
List of references


Original Publications


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Original publications are not included in the electronic version of the dissertation.


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