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Nikita Andrejevs

Sustainable Business Ecosystem Establishment

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Supervisor: Professor Marjo Kauppinen, Aalto University

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ABSTRACT OF THE
MASTER'S THESIS

Author: Nikita Andrejevs

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Supervisor and advisor: Prof. Marjo Kauppinen

The model of ecosystem is widely used both in the research literature as well as in the business environment. However, as the model is different in each domain, the notion of ecosystem has become scattered.

The main goal of this study was to create high-level model based on business ecosystem model that can be applicable in various domains. This thesis has demonstrated advantages for adopting this model in comparison to other network models. In addition, the thesis has provided rationale to use business ecosystem as a base model for other ecosystem types

This thesis has assembled the structure of ecosystem that allows to utilize the model in various domains. This structure defines members, their roles in the ecosystem, and relationships between ecosystem actors. Moreover, this thesis demonstrates practices of using cooperation and coopetition in the model. In addition, it determines an approach to form an economically sustainable ecosystem and to adopt the service-dominant logic in the model. Finally, this study provides the means to consider end users and customers as members of the ecosystem through co-creation.

The result of this thesis provides a high-level ecosystem model as a basis for future studies.

Keywords: business ecosystem model, unified model, sustainability, network structure, service-dominant logic

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1 Introduction

In the modern business world, the ecosystem topic has received considerable attention over the last several decades (Mäkinen and Dedehayir, 2012). The companies in the ecosystems are determined by the business activities, which can be realized in various ways. Business activity[1] is a set of actions devoted to produce products and services, usually it involves commercial, financial, and industrial aspects. In addition, the activity generally includes a collaboration with external stakeholders, since only a few companies take the whole responsibility for providing the business value.

The reluctance of taking the whole responsibility for creating business value has a number of reasons. The most common of them are a resource scarcity, a lack of knowledge and a deviation from the core competence. In general, due to an increasing complexity of contemporary services and goods, companies are networking in order to satisfy the needs. The amount of network participants is increasing with the targeted market size, and the more interconnected parties become, the more they depend on the integrated efforts. Various networked theories have been developed to analyze these interdependencies. Furthermore, the business ecosystem theory provides an effective tool to approach the business network. Nevertheless, an ecosystem provides a singular representation of network collaborations (Majava et al., 2014), however the ecosystem analogy has demonstrated a significant advantage amongst others.

[1]Business Activity, The Free Dictionary, http://www.thefreedictionary.com/business+activity

1.1 Background

At the moment, the business ecosystem has emerged as the most prominent among other ecosystem types. The most prevalent ecosystem types are biological, software, digital and service ecosystems. Although these ecosystems prevail in their own domains, they have significant similarities in structure, dynamics and life cycle. However, in the literature a little or no evidence has been shown to create a unified ecosystem theory which compounds different types of ecosystems. This thesis proposes a conceptual model of consolidated ecosystem that introduces a business ecosystem as core ecosystem, which includes other types as well. This unified model allows researchers and practitioners to imply currently existing methodologies to represent, analyze and influence the business ecosystem.

The ecosystem life cycle has been the focus of growing interest in recent years. In order to adopt the value of ecosystem theory, companies and individuals need to have a solid perception of the theoretical model. Hence, Moore (1993) has developed several stages of the business ecosystem life cycle. This life cycle requires significant attention on each step, however in this thesis the initial stage Birth or Establishment has been explicitly emphasized. In order to successfully establish an ecosystem, companies need to meet certain requirements, which may affect their position in the ecosystem and influence the dynamics of whole ecosystem.

At the moment, the health of business collaboration arouses substantial attention in the literature(Costanza and Mageau, 1999). A sustainable ecosystem allows analysts to correctly forecast the dynamics of network collaboration. Hence, in this thesis the sustainability of business ecosystem has been deliberated. It is important to mention that the sustainability has considered not from ecological but from economic perspective.

A collaboration type between parties is highly important aspect of the business network theory. At the moment, two dominant directions of collaboration are prevailing – cooperation and coopetition (Valença et al., 2014). Coopetition has emerged as a concept of companies with

similar value proposition competing on the same market. Numerous companies (e.g., Amazon) have demonstrated advantage of inheriting the coopetition strategy. Notably, the business ecosystem has exclusively adopted both types, whereas other business networks include only the cooperation type.

In the modern world, the process of value creation is gradually shifting to a user-centric view (Prahalad and Ramaswamy, 2004). The interaction between companies and customers becomes the point of value creation. This interaction results in form of co-creation that assumes active user participation in the business activity of a company. Hence, the unified business ecosystem model, which is presented in this thesis, assumes the user as an active party in the ecosystem in order to emphasize the user participation in the value creation. The user's behavior impacts the dynamic of connected parties and thus affects the sustainability of the whole ecosystem. In order to incorporate users into an ecosystem, a theory of service-dominant logic (firstly presented by Vargo and Lusch (2004*b*)) is considered as an approach to depict the relationship between ecosystem parties.

1.2 Aim of the study

The network collaboration between companies has a significant impact on the performance of companies and on users as well. Hence, one of the goals of this study is to review the current state of the ecosystem model in the literature. The ecosystem model has a number of analogues; thus it is important to justify the choice of using the ecosystem model among other network collaboration types. Moreover, the model has a number of representations in various domains (e.g., business, software, service, etc.), and generally some of these representation might intersect in case modelling. Therefore, another goal of this study is to create a consolidated business ecosystem model based on existing studies. This model has a well defined structure and accurately determines roles of ecosystem stakeholders. Finally, the ecosystem model can be sustainable if actors of the ecosystem meet specific criteria.

1.3 Research questions

Numerous companies are using different models in order to represent other stakeholders on the market: business network, business clusters, hubs, keiretsu, triple helix, ecosystem, etc. However, in many cases, meaning of used model is diluted and the rationale to use a specific model over others is absent. Lately, the concept of ecosystems has become widely mentioned both in the literature and in the business environment. Nevertheless, companies are using the model of ecosystem in various domains and to add distinct features of these domains to the model, which leads to model attenuation. Therefore, this thesis provides an answer to the high-level research question:

Why business ecosystem should be used as a basis network structure model for ecosystem models in various application domains?

This high-level question covers significantly broad topic and in order to answer it, this thesis provides two research questions. The first research question is:

RQ1. What are the advantages of using ecosystem model amongst other network structure models?

This research questions provides rationale to use the ecosystem model over other network models. This research question covers the benefits of the ecosystem model and includes good practices of creating an economically sustainable business ecosystem. In addition, this research questions provides reasoning and methods to consider end-users as actors of the ecosystem. The second research question is:

RQ2. How to use business ecosystem as a basis model for other ecosystem types?

This research question is closely related to the ambiguity of the ecosystem model. Numerous researches have proposed various definitions of the model in different domains. However, in contemporary world, most of the business solutions require more complex approaches, due to the complex nature of the businesses. Therefore, the second

research question provides the means to consider business ecosystem as a unified model for other ecosystem types.

These research questions aim to cover a significant segment of the broad concept. It helps to disclose a part of uncertainty about the ecosystem and create a basis for future research.

1.4 Structure of the thesis

This thesis has following structure. In the Introduction section this thesis provides aim, motivation and background of the study. In addition it defines the research problem and related research questions. Finally, it represents the structure of the thesis.

The section Research methods depicts literature review model and article selection criteria. It describes the approach that is used to find, select and analyze articles and other research works.

The section Analysis provides the report of analysis of selected articles. It is divided into several subsections that cover the research questions. Table 1 shows the links between subsections and research questions.

RQ1	**RQ2**
Network models	Ecosystem types
Collaboration within ecosystem	Ecosystem structure
Sustainability	SDL as interrelationship mechanism

Table 1: Analysis sections answering research questions

2 Research methods

The subject of study is sufficiently extensive and each part of the thesis requires thorough empirical research. Moreover, the scope of the thesis assumes involvement of individuals and numerous companies from various domains (production, retail, software development, public sector and others) and sizes (SMEs, enterprises). Such thorough approach requires significant time investment. Therefore, this thesis provides comprehensive analysis of the research problem based only on the overall literature review. This analysis helps to gather scattered information and comprise different views of the research problem. This thesis provides recommendations for further empirical studies based on the research literature analysis.

This thesis conducts literature review on the research focus, which is presented in the introduction section of this thesis. Analysis section provides the qualitative analysis of the literature review.

2.1 Search method

This thesis follow method presented by David and Han (2004). This thesis study conducted a search strategy to identify major articles that would be relevant and representative using the following steps:

1. The reviewed articles were collected from journals and conferences using major electronic databases including ScienceDirect, IEEE, Harvard, Industrial marketing management, ResearchGate, etc. In particular, this research preferred literature from leading journals and conferences in management, strategic marketing, service research.

2. The search terms were entered in Google Scholar and the relevant articles were selected from page 1 to 10.

3. The titles or the abstracts of the selected articles include one or more keywords in order to ensure correlation.

4. The selected articles focus on ecosystems, business network models, collaboration methods. In addition, this study excluded articles in which the keyword of "sustainability" related to ecological sustainability.

5. Multiple keywords were combined for a comprehensive search and original sources were selected to remove the duplicate articles.

6. The full text of all remaining documents were viewed to ensure that the research themes and research contents were relevant.

7. "Snowballing" was used to track cited articles that were relevant.

2.2 Selection method

This thesis focuses on ecosystem model; therefore, the major search keywords are "ecosystem", "software ecosystem", "biological ecosystem", "service ecosystem", "business network", "business cluster", "network structure", "service-dominant logic", "co-creation", "business collaboration", "cooperation", "coopetition", "ecosystem platform", "economic sustainability". Nonetheless, articles covering ecological sustainability were excluded due to irrelevancy for the research study. In addition, articles that are not concentrating on "ecosystem" model or don't report any challenges were also excluded from the list of literature.

2.3 Analysis method

Selected articles were thoroughly analysed regarding both research questions. This study reports analysis of articles according to following criteria:

- The article (or relevant study) has contributed to the topic of this thesis. Challenge: numerous of studies provide repetitive concepts without contributing to the relevant research, for example, the concept of "ecosystem" has been mentioned in a significant amount of studies, but the authors of the studies are using the concept as a reference without elaborating or contributing to it.
- The article (or relevant study) provides knowledge regarding focus of research questions. Challenge: the topic of this thesis is significantly extensive, therefore, the report includes analysis of articles that are related to the scope of this study, which is defined by the research problem and research questions.

This study has run several iterations in order to provide more information for the analysis. The sequence of questions that were examined during these iterations is following:

1. How key concepts are defined by various authors? How the members of the ecosystem are defined (actors)? What are the relationships between actors in the ecosystem? What are the roles of ecosystem actors?
2. What network models are used in the research literature? What are the differences? What are the benefits of using ecosystem model among other network structures?
3. What are the types ecosystems? What are the differences? What ecosystem type can be considered as a base ecosystem for unified model?

4. What are the relationships between actors in the ecosystem? What are the collaboration types in the model? How does the ecosystem model support both cooperation and coopetition?

5. What notion helps determine relationships of actors in the ecosystem? How the Service-Dominant Logic can be considered as a relationship mechanism in the model?

6. What is the role of users in the ecosystem? How the user can be considered as an active actor in the ecosystem? How does the co-creation approach can be applicable in the model?

Overall, these questions sufficiently covered the scope of this thesis and provided thorough analysis of the research problem. Table 2 & 3 demonstrates literature works chosen for the analysis. The report of the analysis is presented in the section "Analysis" of this thesis.

RQ1	RQ2
Annanperä et al., 2015	Adner, 2006
Athiyaman, 2009	Anggraeni et al., 2007
Battistella et al., 2013	Bagozzi, 1974
Cheong et al., 2016	Barney, 1991
Gay, 2014	Bengtsson and Kock, 2014
Rodrigues and Melo, 2013	Bharadwaj et al., 1993
Håkansson and Ford, 2002	Bosch, 2009
Varian and Shapiro, 1999	Choi et al., 2001
Suh, 2010	Costanza and Mageau, 1999
Valença et al., 2014	Gawer and Cusumano, 2002
	Dussauge et al., 2000
	Fotrousi et al., 2014
	Goerner et al., 2009
	Greer et al., 2016
	Hagel and Brown, 2005
	Iansiti and Levien, 2002
	Iansiti and Levien, 2004a
	Iansiti and Levien, 2004b
	Jansen and Cusumano, 2013
	Liang et al., 2016
	Lusch and Vargo, 2006
	Lusch et al., 2007
	Lusch and Webster, 2011
	Lusch and Vargo, 2006
	Majava et al., 2013
	Majava et al., 2014
	Mäkinen and Dedehayir, 2012

Table 2: Literature list

RQ1	RQ2
	Malter et al., 2006
	McGuire and Dow, 2009
	Mitleton-Kelly, 2003
	Möller, 2006
	Moore, 1993
	Moore, 1996
	Moore, 1998
	Muegge, 2011
	Muegge, 2013
	Parasuraman et al., 1985
	Payne et al., 2008
	Peltoniemi and Vuori, 2004
	Porter, 2000
	Prahalad and Ramaswamy, 2004
	Ritala et al., 2014
	Ruokolainen et al., 2011
	Sadi et al., 2015
	Tian et al., 2008
	Tiwana et al., 2010
	Vargo and Lusch, 2004*b*
	Vargo and Lusch, 2004*a*
	Vargo and Lusch, 2011
	Weber and Hine, 2015
	Zhong, 2015

Table 3: Literature list (continue)

3 Analysis

This section presents the theoretical background for understanding the essential concepts of the study. In addition, it provides an exhaustive analysis of the assigned problem in the research field. Although findings in this study do not claim to provide a precise guidance for practical framework, they facilitate future studies and present rigorous model of the business ecosystem.

This section is divided into six parts and each subsection provides analysis of different topic related to the research study. These subsections are sorted in specific order. First subsection provides overview of the most common network models in the literature and provides reasoning to concentrate on the ecosystem as the most prominent model. Second subsection covers the most common ecosystem types, their description and provides arguments to consider business ecosystem as promising candidate for base model ecosystem type for the unified model. Third subsection demonstrates analysis of the ecosystem structure, define key concepts and provide theoretical model for the base model. In the fourth subsection this thesis shows possible collaboration types in the ecosystem model. Fifth section covers the Service-Dominant Logic as a suitable mechanism of collaboration between actors in the ecosystem and helps to consider users as active actors in the ecosystem model. Finally, last subsection provides shows the possibility to approach the ecosystem as an economically sustainable model.

3.1 Network models

Over the last decades, a term of business network has been reflected in many articles in the research field. It started to emerge in 1980-s as a concept of collaboration between companies. A network can be determined as an abstract structure where a number of nodes are connected via specific treads. In business network the nodes are depicted as business units (companies, enterprises, individual entrepreneurs, etc.) and the threads are representing a relationship between these entities (Håkansson and Ford, 2002). Networks can be also represented as a set of actors that that control resources and perform activities, which later is going to be considered in the business ecosystem. Companies depend on resources controlled by other parties and in order to gain access to theses resources, companies create a business relationship. Thus, the business network is an abstract structure with actors and reciprocal relationships between them. However, the business network model occurred to be imperfect, thus a number of other network models appeared in the literature.

Business cluster

One of these models is "business cluster", also known as a competitive or industrial cluster (Athiyaman, 2009). Business clusters can be perceived as geographical concentration of interconnected institutions and forms in a specific field. These clusters have a goal to develop their regional competitive advantage. Clusters are known for an ability to enhance economic growth in certain area, increase productivity of stakeholders, drive innovation and stimulate creation of new businesses. The life cycle of the cluster includes birth, evolution and decline (Porter, 2000), which is similar to the business ecosystem life cycle. The business ecosystem in more favorable in comparison to the cluster, because it has a competence to comprehend a larger geographical area and larger business interest zone.

Triple Helix

Another model "Triple Helix" as a matter of fact emerged after 1850s, however it has been labeled as a collaboration of three major entities only in recent years. In contrast to business cluster, the triple helix has three stakeholders: academia, industry and government. In most cases, the common mission is driven by the government. The mission of triple helix is to drive the knowledge-based innovation through active collaboration, and create new organization and institutions (e.g., incubators). Collaboration in the triple helix usually involves R&D, collaborative funding and introducing new products into commerce. Although a triple helix is considered as unstable collaboration model, it demonstrates following outcomes: the coevolution of scientific research and product development; cross-fertilization from the interaction between the different academic disciplines and industries; and public policy, which aims to facilitate technology transfer (Rodrigues and Melo, 2013).

Keiretsu

Second half of the 20th century provided one more network collaboration model called "Keiretsu" has emerged in Japan. As an analogy of business network, keiretsu can be shown as an organization with nodes (actors) and their relationships. Keiretsu is tightly coupled stakeholder network which is divided into two categories: vertical and horizontal. It is based on mutually beneficial cooperation, which provides information sharing, protection from market pressures, access to stable financing, reduced risks and reciprocal assistance. Despite the fact this network model seems promising, usually it is criticized for high borrowing costs, over-investment and poor performance (McGuire and Dow, 2009).

Innovation Hub

Innovation hub as a model appeared in the literature due to recent changes in the business environment. The innovation hub is network involving not only companies, but also individuals, customers, users and others. The purpose of the model is to share knowledge between participants and create new value by utilizing the model of co-creation. In order to successfully enable innovation hubs, three conditions should

be satisfied. First, the required steps of an innovation continuum must exist, including, for example, basic research, idea funneling, "angels" willing to invest, talented people, and capital. Second, the initial size of the innovation hub must exceed the critical size, and the activation barrier for nucleation must be overcome. Third, the nucleation rate must exceed the rate at which talent and ideas diffuse away from the region (Suh, 2010).

Business ecosystem

The definition of business ecosystem is still widely varying in the literature and there is no consensus about the exact definition (Anggraeni et al., 2007). The term "Business Ecosystem" has been firstly introduced by Moore (1993). It has adequately reflected biological ecosystem into the business environment. However, the ecosystem analogy also has been also spread into other than business domains, thus in the literature have appeared industrial, digital, service, software, social and other ecosystem types. The structure of an ecosystem is similar to a business network structure; it is an interconnected system of nodes (actors). However, relationships between participants in ecosystem deviate from those in other network types, because the collaboration of actors involves as cooperation as well as coopetition. Moreover, the ecosystem theory considers not only directly connected parties as actors, but also stakeholders who influence the dynamics of an ecosystem. The life cycle of the model is similar to business network's and it includes four stages: birth, expansion, leadership and death (or self-renewal). The reasons of the model being more preferable that others are based on a few facts. Firstly, the ecosystem model has flexible structure – the number of actors is not regulated and the relationships are defined individually between two actors. Secondly, the dynamics of the ecosystem model is stable, because it is a self-regulated system. Lastly, the model has a mechanism to determine relationships between actors in such a complex network system as ecosystem.

Table 4 summarizes different network models.

Business cluster
Business clusters is a geographical concentration of interconnected institutions and forms in a specific field. The goal is to create regional competitive advantage. Have similar to business ecosystem lifecycle.
Triple Helix
Triple helix has three stakeholders: academia, industry and government. Triple helix is driven by government. The goal is to drive knowledge-based innovation through all stakeholder collaboration.
Keiretsu
Keiretsu is tightly coupled stakeholder network, which is based on mutually beneficial cooperation, which provides information sharing, protection from market pressures, access to stable financing, reduced risks and reciprocal assistance.
Innovation hub
The innovation hub is network involving not only companies, but also individuals, customers and users. The purpose of the model is to share knowledge between participants and create new value by utilizing the model of co-creation.
Ecosystem
Ecosystem is self-regulated interconnected system of actors. The lifecycle has four stages: birth, expansion, leadership and death. Collaboration allows cooperation and coopetition.

Table 4: Ecosystem structure definitions

3.2 Ecosystem types

A number of authors have utilized the biological ecosystem metaphor to describe the network structure in different domains. This subsection considers the most used ecosystem types. One of the prevailing ecosystem types is a software or digital ecosystem which introduces very important topic of platform. Much less attention in the literature is devoted to social, service, entrepreneurial and industrial ecosystem types. Lastly, this thesis suggests arguments to exploit the business ecosystem as a basis for the collective ecosystem model.

Software ecosystem

Over the last decades, the complexity of software solutions has been significantly growing. In many cases the value of a software product increases with more complementary products and services, and more users. However, development of the whole product line within one company requires a considerable effort and resources. Thus, companies allow other companies and individuals to contribute to the product by utilizing existing resources of the owner company. The product line architecture and shared components determines a platform (Bosch, 2009). In addition, Gawer and Cusumano (2002) defines the platform as "a foundation technology or set of components used beyond a single firm and that brings multiple parties together for a common purpose or to solve a common problem". The platform owner establishes the extent of access to the platform resources for other parties and degree of freedom for value creation of which the controlling entity receives a minor part.

Once the platform owner decides to open boundaries, the company transitions from software product line to a software ecosystem. Jansen and Cusumano (2013) provides following definition: "A software ecosystem is a set of actors functioning as a unit and interacting with a shared market for software and services, together with the relationships among them. These relationships are frequently underpinned by a common technological platform or market and operate through the exchange of information, resources and artifacts." The adoption of the software ecosystem model provides several benefits for companies. Members of

the ecosystem share the cost of production; more efficiently identify and satisfy demands of end users by providing diverse services; inherit expertise from various stakeholders to develop domain-specific applications; force the growth of innovation; confront competitors (Sadi et al., 2015). Nevertheless, the crucial factor of success in the ecosystem is the number of supporting products and services. Thus, the keystone actors in the ecosystem need to drive the expansion of collaboration within ecosystem to attract more external stakeholders to join the ecosystem. On the other hand, the benefits for external companies to affiliate the software ecosystem is the opportunity to join new markets that were established by the ecosystem (Valença et al., 2014) and possible joint sales to customers.

The overall purpose of adopting ecosystem analogy is to use the network pattern. The software and business ecosystem have obvious similarities like structure, relationships with other members and an independent set of activities. Moreover, roles of the software ecosystem are corresponding to roles in the business ecosystem. According to Gawer and Cusumano (2002) one of the crucial roles is played by "platform leader" which can be referred as a keystone player in the business ecosystem. Another role in the description is "wannabe" – an actor with incentives to take the leadership position in the software ecosystem. Wannabes are behaving similarly to dominators in the business ecosystem. Lastly, in the software ecosystem there are "complementors" that are playing same role as niche players. Therefore, this similarity can lead to conclusion that these ecosystems pretend to act correspondingly.

Service ecosystem

Many companies are moving towards the service-centric business models and effective use of digital services. Digital or electronic services take various forms of information sharing and social networking. According to Ruokolainen et al. (2011), the services are handled by service-centric businesses in the service ecosystem. The authors define service ecosystem as "a socio-technical, complex adaptive system. Its technical aspects support contract-governed composition of software agents, i.e. computational services, where the services can be provided by independent ecosystem members." However, this definition

doesn't reveal the unambiguity of the concept of service ecosystem but creates controversial claims, e.g., "adaptive" means being able to adjust oneself to different conditions (that definition fits self-regulation principle of the ecosystem) whereas the service ecosystem is governed by members according to Ruokolainen et al. (2011). Further analysis demonstrates that the service ecosystem in this cases is presented as specific case of software ecosystem with dominant digital services components. Moreover, other patterns of software or business ecosystem are totally applicable to the service ecosystem.

Industrial ecosystem

The ecosystem metaphor has been used by scientists not only as a metaphor to model the network structure of entities, but also as a means utilize the benefits of biological ecosystems. The primary intention of industrial ecosystem is environmental protection by the means of nature (Peltoniemi and Vuori, 2004). The idea of industrial ecosystem has been implemented in the ecological sustainability principles, where all material is recycled and reused more efficiently. One of the strategic principles of the ecosystem model is a cooperation of members, where members use each other's waste material as resources. This model is hardly attained in any industrial operations due to the need of habits change of both manufacturers and consumers. Moreover, ideas of the model are more appropriately utilized by the sustainability-focused communities and organizations. However, the industrial ecosystem has no effective contribution to the neutral ecosystem proposed in this thesis.

Innovation ecosystem

Many studies have been adopting ecosystem metaphor similarly to the industrial ecosystem approach. The model of innovation ecosystem can be described as a behavior or dynamics of business ecosystem, rather that an independent network structure. Adner (2006) defines innovation ecosystem as "the collaborative arrangements through which firms combine their individual offerings into a coherent, customer-facing solution" and Annanperä et al. (2015) claims that organizations joining a business ecosystem to create new services can be called innovation ecosystems. In both cases this ecosystem means collaboration of

several firms in order to foster innovation or create new services. This model is considered as a high-risk and high-reward strategy. The innovation ecosystems face three types of risks: initiative risks—the familiar uncertainties of managing a project; interdependence risks—the uncertainties of coordinating with complementary innovators; and integration risks—the uncertainties presented by the adoption process across the value chain. However, the success in innovation might expand or create new markets and increase common value created in the ecosystem. The risks are mitigated through the nature of ecosystem where the risks are distributed among participants. Nevertheless, the innovation is important aspect of the business ecosystem evolution stage, thus it is a crucial part of the ecosystem. This thesis suggests to avoid using the innovation ecosystem model separately to the business ecosystem model due to incomplete view of the whole picture of the ecosystem and various stakeholders' connections.

Social ecosystem

Another type of ecosystem is social. The definition states that social ecosystem is a consolidation of all related businesses, customers, suppliers, consumers, and economic, cultural, and legal institutions. An important aspect of the ecosystem is the interdependence of actors – each actor influences and is influences by all stakeholders in the ecosystem (Mitleton-Kelly, 2003). However, Bosch (2009) determines the social ecosystem differently – it "consist of users, their social connections and the exchanges of various forms of information." Although both of these definitions propose different interpretation of the ecosystem, key factors of ecosystem exist, e.g., actors and relationships between them. A distinctive feature of the social ecosystem is co-evolution of the interconnected actors, which describes similar process of biological ecosystem and business ecosystem as well. Similar to innovation ecosystem, the social model reveals and describes one of the aspects of business ecosystem. The social ecosystem can be considered separately, however more value can be extracted from the model, if considered together with business ecosystem as a solid model.

Business ecosystem

An increase of the complexity in business network structure and a growth of interconnected members in the business system has attracted considerable attention in business ecosystem model development. In the previous section, this thesis has broadly introduced the model of ecosystem. This section considers the additional details of the business ecosystem model taking into consideration already provided descriptions of other types.

The business ecosystem is a complex self-adapting (i.e., self-regulating) network system with actors performing in various domains. In the literature, the ecosystem has been examined from various perspectives Muegge (2013). Firstly, the business ecosystem has been viewed as an industry structure around a technology platform, which implies the essence of earlier described model of software ecosystem. It is obvious, that some keystone companies in the structure might operate in the technology field and offer an opportunity to collaborate with other parties as platform providers. Secondly, the ecosystem can be seen as a context conductive to open innovation. Thirdly, as an innovation community that extends membership to organizations as well as individual. Lastly, as an innovation network of ties and relationships between firms.

Choi et al. (2001) uses complex network theory to depict some of the business ecosystem processes and he claims that networks progressively evolve from random set of business entities to more structured communities that involve interdependent stakeholders in an endless reciprocal structure. Nevertheless, an important and vital phase of any ecosystem is a co-evolution of its members which is possible through innovations. The innovation ecosystem model might be considered as a vital stage of business ecosystem evolution. This stage leads to inevitable reshaping of the whole structure and to the last stage in the life cycle of ecosystem – death or self-renewal, depending on the success of innovation process. Thus, organizations and individuals might benefit from developing reciprocal and open relationships with each other (Majava et al., 2013). However, some issues occur while developing open interactions: a lack of trust to other parties, which can be mitigated through loose coupled interactions; companies have a

limited amount of resources and thus they likely cannot interact with all external stakeholders, and therefore prioritization is needed. In addition, the behavior and evolution processes of the business ecosystem are affected not only by its directly interacted members, but also by regulatory authorities, media outlets, social environment and other stakeholders. the relationships amongst the constituent elements may change the ecosystem structure (Iansiti and Levien, 2004b). Analyzing the business ecosystem model means not only depicting the shape and relationships amongst the constituent entities in a certain moment in time, but grasping how it changes by monitoring evolutionary trends. It is important for actors to monitor their ecosystem, both from the static and dynamic point of view, and identify the real and potential impact of relationships to their own businesses (Battistella et al., 2013). Therefore, it is more reliable to evaluate the degree of interaction among different actors and view the relationships level and type of interaction (e.g., licensing agreements, technology or knowledge sharing, market relationships, etc.).

One of the goals of this thesis is development of a consolidated ecosystem model. Thus, in this section are provided following reasons to consider business ecosystem as a basis for the model. Reviewing all ecosystem types, it is obvious that most of them have decently similar foundation, but they focus different domains. Among all ecosystem types, the software ecosystem has the most effective adaptation of the ecosystem model. Nevertheless, it is possible to consider the software ecosystem as business ecosystem. Peltoniemi and Vuori (2004) has risen the topic of digital business ecosystem, which is a European Union funded environment where software coded by European SMEs can act like organisms in an ecosystem. In the DBE "business services and the software components are supported by a pervasive software environment, which shows an evolutionary and self-organizing behavior". On the other hand, the software providers can be considered as business entities and the solutions they provide as business activities, which in turn allow to view the software ecosystem from business perspective and use corresponding principles. However, other types of ecosystem might be acknowledged as a part of business ecosystem structure or behavior, e.g., the innovation ecosystem implies same principles as the evolution process of business ecosystem, the core of social ecosystem

illustrates relationships between actors. Therefore, this thesis suggests to use the business ecosystem and its dynamics as a basis for the unified ecosystem model.

The Figure 1 shows the scheme of the network models and ecosystem types.

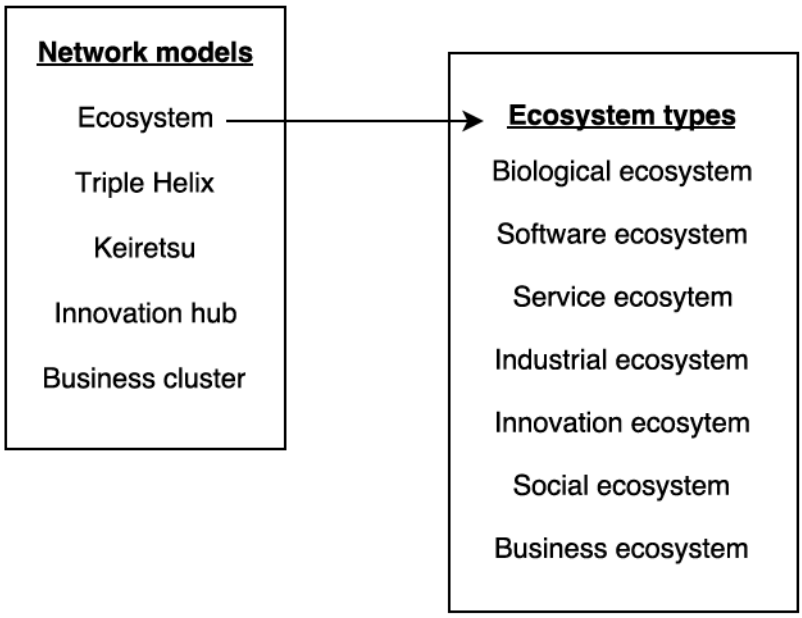

Figure 1: Representation of network models and ecosystem types

3.3 Ecosystem structure

In the past years, much effort has been directed towards modeling the ecosystem model structure. A number of different descriptions of ecosystem stakeholders exist in the literature. Authors have proposed their own interpretation of the model, thus there is a significant variety of definitions. This thesis focuses on the refinement of presented definitions and proposes a sole solution for the unified ecosystem model.

Moore

The definition of biological ecosystem states that "ecosystems are not just assemblages of species, they are systems combined of organic and inorganic matter and natural forces that interact and change" (Peltoniemi and Vuori, 2004). Although this definition does not provide clear picture of the ecosystem, it represents inhabitants (species) and relationships (natural forces). Moore (1993) has transferred the biological ecosystem metaphor into the business environment. The author defines ecosystem as "an economic community supported by a foundation of interacting organizations and individuals – the organisms of the business world." So the analogy with biological system is obvious, the species are represented as organizations and individuals.

In another article, Moore (1998) expand initial definition: business ecosystem is "extended system of mutually supportive organizations; communities of customers, suppliers, lead producers, and other stakeholders, financing, trade associations, standard bodies, labor unions, governmental and quasigovernmental institutions, and other interested parties. These communities come together in a partially intentional, highly self-organizing, and even somewhat accidental manner." The former definition emphasizes the interconnection between parties, while the latter point to the self-organization and decentralized decision making of the community. However, Moore haven't introduced any specific terminology, but uses biological ecosystem taxonomy, thus the stakeholders in business ecosystem are referred as species. Moreover, Moore haven't profoundly described activities of parties or relationships between them. So, following works of different authors have completed these gaps.

Peltoniemi and Vuori

Much effort has been devoted to obtaining unambiguous definition of business ecosystem by Peltoniemi and Vuori (2004). The authors has agreed with Moore that biological ecosystem can be interpreted as a suitable analogy for the business environment. The business ecosystem is considered as a complex adaptive system and the authors define it as a "dynamic structure which consists of an interconnected population of organizations." This population is includes enterprises, small and medium firms, universities, research centers and public sector companies. Thus, the inhabitants of an ecosystem are referred as organizations, however a little attention has been brought to the interdependence of parties.

Weber

Another attempt of creating a solid definition of business ecosystem has been proposed by Weber and Hine (2015). The definition identifies business ecosystem as "an adaptive system positioned around a platform encompassing the totality of co-evolved interactions between technospecies and other inhabitants, required to design, improve, produce, deliver, or market a product or service." The techospecies are considered as inhabitants of the ecosystem. Technospecies are defined as an organization form comprising different set of routines (equivalent of DNA in biological systems) that are exchanged with other technospecies. Although, the major business activities (e.g., production, distribution and market of good or service) in the business ecosystem might be considerably similar, the interactions between entities are different. This author has brought attention to valuable notion of activities of organizations and interaction within ecosystem.

Bosch

Bosch (2009) has also contributed to the structure of business ecosystem. Although this work is devoted to another ecosystem type (software ecosystem), it presents interpretation of the business ecosystem. The author distinguishes human ecosystems that are including as social as well as commercial aspects. The commercial ecosystem generalizes the business ecosystem with actors as inhabitants. The

actors are businesses, suppliers, customers with certain activities that characterize these actors. In addition, the nodes in the ecosystem are connected via transactions, which in commercial ecosystem are stated as financial transactions. This description clearly outlines different components of the ecosystem and worth noticing during the composition of the collective ecosystem model.

Iansiti and Levien

Considerable progress has been achieved in the development of business ecosystem model by Iansiti and Levien (2002), which later impacted works of other researchers on the topic. Iansiti and Levien have concluded that network approach provides more effective results. They outline that breaking things up into large number of interconnected parts has more impact on solving difficult problems. The business ecosystem is considered as a network structure with loosely connected members. Some of the members are considered as hubs or "keystone" species. According to Iansiti and Levien (2004a), this hub structure provides more stable network structure and affects the health of the whole ecosystem, which is described in another section in this thesis. This hub structure has been adapted to the ecosystem model thus some members are recognized as "keystones" and others as "dominators". In addition, there are species in the ecosystem who are connected with only one member, which means they can not be considered as hubs. These sole members are represented as "niche players". This structure brings a compelling factor of the ecosystem structure – a role that each member is playing. The roles help to illustrate the position of stakeholders in the model.

Roles of actors by Iansiti and Levien (2004a)

Keystones. Keystones are ecosystem actors that provide a critical service to related ecosystem members. In most cases, keystones are vital for the health of the whole network, because they are providing important resources to other stakeholders, who can't successfully function without provided nutrition. As soon as the ecosystem partially represents a hub structure, the keystones are playing role of hubs in the ecosystem. Although, the ecosystem is considered as self-adaptive and self-sustained, keystones are playing crucial role, by regulating close

connections, thus influencing the behaviour of other actors. Another factor concerning keystones is creating new niches, attracting and supporting existing actors that are dependent on keystone's resources. Moreover, the keystones usually enhance productivity by simplifying tasks of connecting ecosystem members to each other, and making creation of new products by niche players more efficient. Furthermore, they incline robustness of the ecosystem by consistently investing in and assimilate innovations, and by providing an interface structure for other actors.

Dominators. Similar to keystones, dominators are representing hubs in the ecosystem. However, unlike keystones, dominators tend to proactively take over bigger part of the ecosystem. They eliminate closest actors by pushing them out of the market or conducting merge and acquisition. In most cases dominators harm to the health of their ecosystems by decreasing diversity, remove competition, limiting users' choices and stifling innovation. One of the examples of typical dominator types is a cartel, which suffocates new businesses in the ecosystem and rigidly controlling the market.

Niche players. Niche player is an organization or individual that represents small players in the market, and exist mostly by connecting to keystones or other niche players. Although the niche players seem like to be least influential, it is not true in the case of ecosystem. Firstly, they represent the most numerous actors in the ecosystem, and create critical mass that can make impact on the behaviour of the whole ecosystem. Secondly, they are innovation adopters. It is well-known fact that most of new products and services are being pursued and developed in small but flexible companies, e.g., startups. Thirdly, niche players are integrating resources of keystones thus allowing them to successfully function and utilize activities. Fourthly, as soon as most of the innovations are held by niche players, they expand existing market and create new ones, thus expanding borders of the whole ecosystem. Finally, the unique nature of niche players suppose diversity in the market, so it helps to broaden the value proposition to users and other actors. However, regarding the health of the whole ecosystem, it is important to the players to be self-sustained, deliver the value proposition to related actors, improve their productivity and efficiency in the market. Eventually, a niche player can evolve to a keystone,

which represents natural evolution stage of the ecosystem.

Ecosystem structure summary

The literature analysis has demonstrated a significant number of works where authors have reviewed the structure of the business ecosystem. However, most of these works are based on the articles presented in this subsection. Therefore, this thesis is focused on the same set of research works. The unified model suggested in this thesis considers original works in order to avoid collisions with later studies. The first aspect that requires thorough attention is the definition of members in the ecosystem. Adner (2006) has concluded that each ecosystem potentially might contain several types of stakeholders such as suppliers, focal firms, complementors and customers. In most cases customers are not considered as a part of the ecosystem, but in the collective model they are presented as important members. Majava et al. (2013) adds to the stakeholders list also communities, partners, competitors, universities, research institutes, government, regulators, and capital providers. This list includes all major members of the ecosystem and it clear that inhabitants are not only companies, but also unrelated organizations and individuals. Although the biological term "species" allows to outline the inhabitants of the biological ecosystem, it doesn't represent the essence of any other types of ecosystem. Moreover, the Iansiti's role description implies certain concerns to the term "species", thus this thesis considers other options. The term "technospecies" (Weber and Hine, 2015) create ambiguity of the definition and doesn't reveal the basis of ecosystem's inhabitants. As a result, the term "actors" has several advantages. Firstly, this term is widely used in the literature, e.g., market actors. Secondly, it matches to the "role" system, i.e., actor is playing a role in the ecosystem. Therefore, this thesis suggests to use the term "actor" meaning a stakeholder of the ecosystem. The second important aspect is the characteristics of the members. Actors in the ecosystem have a number of types and in order to correctly identify them in the model, it is required to specify the definition of their actions. In the literature, the companies are defined by their routines (Weber and Hine, 2015) or activities (Bosch, 2009). This thesis suggests to inherit the term "activities", because it is also applicable to actors who are not viewed as organizations, e.g., customers. The last aspect is the definition of relationships between actors. Most

of the researchers haven't characterized the relationships due to the possible ambiguity, because each contact requires certain specification, e.g., information exchange, financial exchange, etc. However, the term "transaction" used by Bosch (2009) is relevant in various domains: in business environment it concerns financial exchange, knowledge sharing, inquiries, pre- and post-sales contacts; in the software ecosystem, which is described in the previous section, it represents information exchange; in human ecosystem it concerns physical and non-physical connections. Therefore, in the common ecosystem model the relationships are defined as transactions. To sum up, the business ecosystem consists of actors that are characterized by certain activities. These actors are playing one of the following roles in the ecosystem – keystone, dominator or niche player. The relationship or connection between actors are defined as transaction and it takes different factors, depending on the type of actor and its activities, e.g., financial transaction, information sharing and etc. Figure 2 demonstrates the ecosystem structure and the Table 5 provides summary of the ecosystem structure.

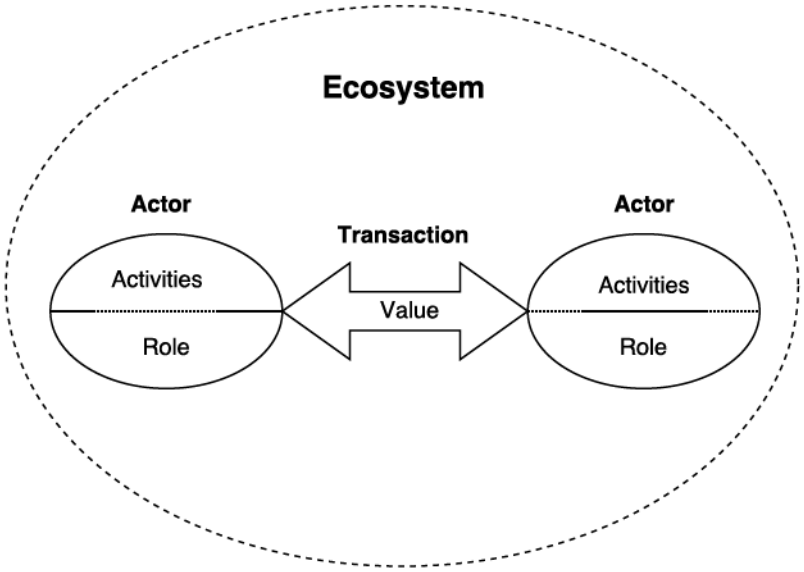

Figure 2: Business ecosystem structure

Actors
Active members of the business ecosystem. Related terms: stakeholders, members, participants, species, technospecies.
Activities
Routines or actions devoted to produce products or capability to participate in the service exchange, usually it involves commercial, financial, and industrial aspects. It determines the functions of actors in the ecosystem.
Transactions
Relationships between actors in the ecosystem. Depending on domain, it concerns financial exchange, knowledge sharing, inquiries, pre- and post-sales contacts, information exchange, physical and non-physical connections.
Roles
Defines position and behavioural pattern (dynamic of the actor) in the ecosystem. Actors can perform three different roles: keystone, dominator and niche player.
Value
The result of collaboration between actors. Transactions determine relationships between actors and the mutual value is co-created in the process of service exchange.

Table 5: Ecosystem structure definitions

3.4 Collaboration within ecosystem

Traditionally, new products are considered as the result of continuous effort, acceptable execution, and innovation process within a single organization. This approach has demonstrated positive results within traditional businesses in many years and it is worth for companies to cultivate their own specializations to create differentiated value. However, the most innovative outcome, especially in ICT field, is a result of collaboration among different actors in various stages if the innovation and development processes. One of the most popular forms of collaboration is a cooperation with allies, in other words creating strategic alliances or regional clusters in order to satisfy common goals refine the value and supply chain (Annanperä et al., 2015). However, there is another collaboration type called coopetition, which is applicable for ecosystems and is considered in the section.

Cooperation

The process of cooperation is natural to the behaviour of ecosystem members. This process defines relationships between actors and provide general reasons of affiliating and creating an ecosystem. In most cases organizations and individuals collaborate with each other for several reasons: the necessity to use complementary capabilities; sharing resources; supply chain management; protection or support of the product in the market; product innovation and commercialization; and customer relationship management. Nevertheless, all actors directly and indirectly influence the dynamics of the ecosystem. However, while building coalition or alliance, it is important to offer reciprocal interconnection or compatibility (Varian and Shapiro, 1999). But it should be done in terms that indicate one's strengths and suitable restrictions so that companies don't lose position in the ecosystem. Moreover, in some cases alliances serve as means of preventing conflicts. There are several ways of negotiating difficult situations between rivals. First, both sides decide to refuse alliance and continue conflict, becoming competitors, which might be beneficial for customer who are looking for variety of products in the market. Second, companies realize they are better off cutting a deal that entering into a fight. Lastly, one of

the sides is stronger and have better position in the market, thus it can dictate the terms to a losing side.

There are several factors indicating the size and position of an actor: contemporary market position, technical capabilities, amount of resources, and the strength of control over intellectual property. Depending on the criteria, actors can dictate certain propositions and demands in the ecosystem, and find compromise with other actors. Gawer and Cusumano (2002) proposes several useful strategies of strong players in the ecosystem. First, keystone actors are leveraging the scope – the amount of innovation the company is performing by own resources and capabilities, before starting to collaborate with other parties. Actors should weigh whether to develop in-house extensive solution with all following components, allow other actors to create complements or find a middle road. Second strategy is more applicable to software ecosystems however it can be adapted to others as well. The strategy is a product technology where owner should decide what is the architecture of the product or service. Key factors are modularity, amount of open interfaces and the amount of disclosed information for other actors. Third strategy is the relationship with external complementors. Keystones must have explicit vision of bounded complementors and acting competitors. Former complementors at some point might turn to competitors and platform leaders should mitigate these situations. However, there are a few scenarios that affect the switch decision: lock-in scenario and consideration of coopetition collaboration type, which is discussed later in this section.

Researchers indicate to the existing disadvantages of collaborating with platform-type companies. One of the risks is a lock-in scenario mentioned by Varian and Shapiro (1999). This situation occurs when customers or partners decide to switch to another resource provider and realize that the switching cost is immensely high. Thus, actors have to decide whether stay with the same platform and extract additional resources to collaborate with other supplier, or to withdraw all resources from the initial platform and move to another, which is extremely risky and might lead to loosing position in the market. However, the lock-in scenario might be mitigated through adopting open standards in the ecosystem. Truly open standards reduce the risk faced by consumers. Although open standards reduce the scope of differentiation and result

in less variety, they reduce compatibility issues and shift the competition from features towards price, because many features become common across competing products. On the other hand, open standards also face two essential threats: the need to specify the direction of development and defining actor responsible for investing into the standard to make improvements. Therefore, all actors must take weighed decision on the choice of fitting development strategy and suitable partners in the ecosystem.

Coopetition

Over the last decade, growing interest in research field has been directed toward development of the coopetition collaboration type. Researchers and practitioners have considered that two companies can be involved in and benefit from both cooperation and competition simultaneously (Zhong, 2015). This sophisticated relationship emerges when two organizations decide to cooperate in some activities, e.g., creating a strategic alliance, and compete with each other in the other activities in the same market (Annanperä et al., 2015). In most cases, competing actors are already indirectly connected through the same customers. These connections affect the whole ecosystem dynamics and its evolution. An actor becomes one's competitor when mutual customer values one's product or service less than actor's product. However, inheriting the coopetition model allows competitors to collaborate and gain benefits that they could not achieve alone. As in the case with cooperation, the coopetition results in several outcomes: risk and cost sharing; distribution channel sharing; co-marketing; and even collaborative innovation (Bengtsson and Kock, 2000). In addition, the ecosystem model is the only network type that adopts coopetition type and thus creates extra benefits for practitioners.

The generic relationship between competitors in game theory can be considered as a "zero-sum game", whereas the coopetition allows to utilize the "positive-sum game". Ritala et al. (2014) provides four rationales behind using the coopetition strategy in the ecosystem.

First, coopetition helps to increase market size. In most cases competitors operate in the same market and provide relatively similar type of offerings (products or services) to common users. Nevertheless,

they are likely to use distinguish, unique resources and capabilities in looking for benefits from coopetition. Coopetition is innate driver that allows competing companies to leverage their strong abilities and unique resources in market expansion efforts. Moreover, due to the similarity in their competence and knowledge in the market, combined effort can increase "relative absorptive capacity" (Dussauge et al., 2000).

Second, coopetition-based business models often result in creation of new markets. Competing companies in this way can create completely new value over which to compete, generating new possibilities for value capture for each actor involved. As soon as companies operate in similar domains, they also prompt radical innovations and identify new market where the innovation is applicable. As the matter of fact, in high-growth industries actors might not be able to completely capture all the value created in the market. Thus, due to the competitive context, it is an opportunity for actors to fill the gaps and create competitive and appealing end market from users point of view. Moreover, coopetition helps to the creation of new industries and offerings where network externalities occur. Network externalities are connected to offerings where the users value increases with the growth of number of users utilizing the same or a similar offering (Bengtsson and Kock, 2014). In addition, innovation and new offerings frequently require an increasing amount of costs, that can be shared using the coopetition model.

Third, the coopetition model benefits in efficiency of resource utilization. Some of the collaborative type decisions are targeted to cost reduction and quality assurance within existing activities. Most of these activities are distant from customer area and focusing more the production phase in the value chain, where the operations are linked with logistics, manufacturing and other functions that benefit from scale advantages. It has been proposed by Dussauge et al. (2000) to batch similar or supplementary resources in the cooperation "scale alliance" in order to gain efficiency benefits and cost sharing.

Four, an actor utilizing the coopetition model can improve the competitive position in the ecosystem. As a matter of fact, coopeting actors might shift the locus of competition towards network-against-

network competition. These companies create alliance in which they still compete among each other, but perform much intensely against other networks or collaborations that tend to act in the same market. Therefore, by combining efforts, supplementary and complementary resources, competing actors might radically shift their position in the market even more competing against the rest. However, the same strategy may indicate the creation of cartel organizations, which in most countries is prohibited and regulated by law.

In order to demonstrate the implication of coopetition in the business environment, this section provides two cases of successful coopetition. These cases provide as platform as well as non-platform collaboration types.

First case is a Tesla Motors collaboration with its competitors Daimler and Toyota. Tesla Motors is company car manufacturing company focusing on electronic vehicles, whereas Toyota's and Daimler's have originally been known as car manufacturing companies producing fuel-engine vehicles. The consumers of all these companies are car buyers and holders, which makes these companies to compete in the market. Daimler and Toyota have been cooperating with Tesla, which possesses the key technology of low-cost and efficient powertrain parts (Cheong et al., 2016). Therefore, the collaboration helps to share resources and learn about and implement the technology in the EV market and develop more sophisticated powertrain prototypes together with Tesla thereafter. This coopetition results in three benefits: Tesla offers high-tech powertrain components to high-marginal-cost competitors; Daimler and Toyota have significant market shares but with this can collaboration can expand to the EV market; and lastly, this coalition is competing with outsiders and can improve current competitive situation in the EV market.

Second case is platform type collaboration between Amazon, the online retailer, and third-party sellers. Amazon has provided the Amazon Marketplace where every one who can sell their goods using Amazon's resources. Amazon decided, instead of multiplying and competing directly with other online retailers, to offer a platform to third-parties. Thus, companies are using the platform to sell their products but have to provide information and pay extra fee for using

the platform. On the other hand, Amazon provides resources but still have control over the market by dictating dictating rules to the marketplace actors and as well get additional source of revenue from the third-parties. However, this strategy creates a lock-in scenario for niche players, because the switching cost might be high. Nevertheless, this coopetition is a perfect example of symbiosis of actors in the business ecosystem.

In the business ecosystem actors are dependent on the dynamics of the market, which is the main source of energy that can directly or directly influence all the actors. The cooperative and coopetitive collaborations, strategic alliances, partnerships with suppliers and customers can cope with financial, time, knowledge and other resource constraints (Valença et al., 2014). However, new actors entering the existing ecosystem should explore the position in the ecosystem and decide who are the competitors and collaborators. After that, these actors can provide own capabilities to other keystones or niche players to create partnership and utilize the benefits of collaboration within the ecosystem.

3.5 SDL as interrelationship mechanism

This section covers an emerging topic of service-dominant logic (here and after SDL) in service science and its implications in the business ecosystem model. The subject of SDL has been initially presented in the work of Lusch and Vargo (2006), albeit the premises for the concept were developed during the 20th century. The SDL reflects appearing way of thinking that is based on service science. Although the SDL is considered more as philosophy and has a little appearance in practice, it is worth to use as an abstract approach to develop new models and consider it as a trending direction in the research field.

Over the last centuries, the goods-dominant logic (here and after GDL) has been prevailing in the economic world. This logic is specified by producer-consumer behaviour, which was developed in the ancient times, when one party produced goods for another party that consumed the goods in exchange for indirect benefit (e.g., money). This behaviour even more deviated with the industrialization in the 18th century, when companies focused on producing specialized goods and distributing through independent third-parties, e.g., merchants. Moreover, this logic is a part of foundation for neoclassical economic theory which is based on equilibrium of supply and demand moderated by price. The neoclassical model has been playing a major role in economics during the 20th century, it is represented by goods or products, embedded with value, as the focus of economic exchange – as Vargo and Lusch (2008) have referred to as GDL.

In the literature, the GDL has been considered as a natural approach in the business network systems. Although this approach is well-adapted in many fields in economics, it still has certain limitations when applying to such abstract model as the business ecosystem. Thus, this thesis considers the SDL as a suitable substitution for the GDL. The SDL provides more holistic view on the relationships between actors of an ecosystem – it shifts focus from the producer-consumer relationships towards value co-creation. Moreover, it demonstrates a connection mechanism between parties. Finally, the SDL proposes one

of the possible options to consider end-user as an active stakeholder in the business ecosystem. Nonetheless, the SDL is a considerably wide topic, and it is rather a philosophy (Lusch et al., 2007) than well-established and practiced methodology, so this thesis considers the best outcomes of the SDL and implies to the unified business ecosystem model.

Significant effort has been devoted to creation of the theoretical conceptualization of the SDL by Vargo and Lusch (2004*a*). The main idea of SDL is to move the locus from the obsolete notion of "exchange of goods" towards "exchange of services", thus one of the main tenets of the SDL postulates "it's all about services". In addition, Malter et al. (2006) considers the exchange of service for service means that all actors (organizations and individuals) need to exchange their ability to serve other actors, and the goods involved in the transaction are just mechanisms for service provision. Moreover, business-marketing scholars have devoted much effort to the shift from understanding exchange in terms of goods to concepts of value and spreading the sources of value creation to networks and relationships between actors. In GDL the value of a product is considered as a property that is added in the manufacturing process (value-in-exchange). Although the SDL recognized the need to obtain monetary value in the process of exchange, it asserts that the value is not created (or added) in the production process, but rather is co-created with the user.

This viewpoint helped Vargo and Lusch (2011) to make a vital step away from the producer-consumer concept, which has been referred as irrational in the SDL. The reason behind this assumption is based on the problem of misconceptual association of 'producer', as creator of value, versus 'consumer', as a destroyer of the value, which has been demonstrated in the literature for the last century. One of the general ideas of SDL is "service – the application of resources for the benefit of another party — is exchanged for service" (Vargo and Lusch, 2004*b*). The view depicts the basic role of resources, so the authors propose a following tenet: "all social and economic actors are resource integrators". Bagozzi (1974) has stated that all actors are active participants of the exchange system – "a set of social actors, their relationships to each other, and the endogenous and exogenous variables affecting the behaviour of the social actors in those relationships". Moreover,

the SDL assumes that all actors are operating in the B2B domain, however in the business ecosystem model it is more relevant to refer the domain as A2A (actor to actor). In addition, in the A2A domain, by definition, there is no endogenous consumer, which perfectly correlated with the concept of the SDL. Overall, the A2A is an appropriate level of abstraction, all actors are essentially providing similar functions – service provision and resource integration through co-creation.

In the SDL all actors are resource integrators and Vargo and Lusch (2008) recognize different types of resources. First, operand – resources that require some action to be performed to provide value, for example, natural resources. Second, operant – resources that are used to act, for example, knowledge and skills. The service provision, as one of the activities of actors, require a combination (in most cases) of both resource types. The authors claim that resource integration provides opportunities for new potential resources that can be used in another service exchange and the cycle continues. The value of any potential resource is balanced by the availability of the resource from other sources, the beneficiary's ability to utilize the resource, and the resistance to resource integration. Vargo and Lusch (2008) states "FP10: value is always uniquely and phenomenologically determined by the beneficiary." Therefore, the logic resonates with the model of business ecosystem, for example, that even rival actors can efficiently co-exist in the same ecosystem.

Traditionally, the the concept of marketing assumes the company-centric behavior of actors and customers (or users) are not considered as a source of value creation (Prahalad and Ramaswamy, 2004). Primary functions of the market are value extraction and exchange, which is disconnected from the value creation process. Needless to say, the customers are being persuaded to favor certain firm in the market, which in turn implies one-sided connection. However, with the technology development together with the growth of value supply on the market, the customers now seek to influence companies in every part of the business system. Payne et al. (2008) has demonstrated the opportunity of suppliers (firms) and customers to to create value through customized, co-produced offerings. The business ecosystem model allows companies to identify the impact of the complex network mechanism on customers. Moreover, the customer-to-customer communication provides more

options of alternative sources of information and perspective on the offered value. The customers have an opportunity to make more sophisticated decision on the company they want to build relationships with, which is based on their own view about the ways of creating value. Therefore, the SDL assumes symmetry in the relationships between stakeholders (Lusch and Webster, 2011), which allows to considers users as sterling actors in the business ecosystem model.

Significant attention has to be devoted to the mechanism of building relationships between actors in the business ecosystem. One of the possible solutions is described by Hagel and Brown (2005), who suggested to use loose coupling mechanism for process management in companies with modular approach. He assumes that loose coupling focuses on creating relatively independent modules with certain responsibilities and each module is accountable for own performance. The mechanism concentrated on establishing the performance level in each that each entity should meet at the interfaces connecting with other modules. This approach has several advantages: easy scalability; extensive number of specialized participants; it effectively suits the need to coordinate across nodes that desire to preserve the integrity and autonomy of their own activities; and it enhances flexibility. Although the business ecosystem comprehends considerably wider scope, it still can be applied as a method of connecting actors, especially with the principles of the SDL, where actors are actively participating the value exchange. Moreover, Iansiti and Levien (2004b) consider the business ecosystem as a loosely coupled system, where actors are independent participants with adaptable relationships. In addition, Greer et al. (2016) affirms that even the service ecosystems are relatively self-contained and self-adjusted, they are naturally flexible and loosely coupled. Thus the the relationships might be adjusted according to the needs or type of connection, whether the connection type is company-company or company-user or user-user. Overall, the approach allows actors to effectively communicate with other ecosystem members and individually determine the quality of relationships.

Overall, the SDL demonstrates auspicious aptitude to become a suitable instrument for the business ecosystem model. Greer et al. (2016) have elected four axioms, which in previous works of Vargo and Lusch were mentioned as tenets, that extensively describe the SDL.

First axiom claims that service is the fundamental basis of exchange. By the SDL definition, "service is the application of resources (primarily knowledge and skills) for the benefit of another individual or organization (the beneficiary)." This definition implies the following: goods are considered as appliances for service provision, all businesses are service businesses, and all economies are service economies. The second axiom alleges that the value is co-created with the customer through the interaction of actors. This logic shifts the focus away from the GDL and proposes different perspective of interaction between actors. The third axiom is related to the actors, who are considered as resource integrators. Moreover, any actor can be a resource integrator, which enables to consider the user as a part of the ecosystem. Finally, the fourth axiom states that value is always uniquely and phenomenologically determined by the beneficiary. Each actor perceives offering and integrates them with other resources differently, so the value is experiential and it is uniquely identified by the user. This thesis proposes to take into consideration these axioms as a functional mechanism for the unified business ecosystem model.

Table 6 summarizes application of the SDL in the business ecosystem model.

The service-dominant logic
The business ecosystem model is considered as a loosely coupled actor-to-actor system, where each actor is accountable for own performance. The SDL provides more holistic view on the relationships between actors of an ecosystem – it shifts focus from the producer-consumer relationships towards value co-creation. The exchange of service for service means that all actors (organizations and individuals) need to exchange their ability to serve other actors, and the goods involved in the transaction are just mechanisms for service provision. The value is not created (or added) in the production process, but rather is co-created with the user. All actors are essentially providing similar functions – service provision and resource integration through co-creation

Table 6: The service-dominant logic in the business ecosystem model

3.6 Sustainability

This section of the thesis is devoted to an important topic of ecosystem's sustainability. Over the last decades, the meaning of word "sustainability" has been diluted. On the one hand, the term has been widely used in environmental science and ecology, assuming that sustainability is the property of biological systems to remain diverse and productive indefinitely. Researchers in this area are emphasizing the need to impact on the environmentally-friendly production, distribution and consumption of goods. On the other hand, the sustainability also has meaning related to economic environment. This thesis considers the economic sustainability aspect of the business ecosystem.

Numerous studies have been addressed the issue of sustainability of network systems such as ecosystem. However, in the literature the term ecosystem sustainability has not been explicitly defined. One point of view has been presented by Ruokolainen et al. (2011) where he claims that the sustainability means capability of an ecosystem to support continued viability. The viability is an uncertain measure of the actors' ability to provide business-supporting capabilities to related members of the ecosystem. Moreover, the author says that the ecosystem should provide capabilities for efficient utilization of core competences, strategic and adjustable business networking, dynamic business environments, and valuable business decision making. Muegge (2013) complements the definition by stating "Sustainability or growth of this system requires operation of each node and each segment of the resource cycle between nodes".

Extensive effort has been devoted to the dispute about the sustainability of company in a network by Barney (1991). The author notes that sustainability is related to the business competitive advantage. The work provides essential requirements for skills/resource for a company to be a source of sustainable competitive advantage: it should be valuable; it have to be unique or rare among competitors; it should be imperfectly imitable; and it shouldn't have any strategically equivalent substitutes for this resource or skills. In addition, Bharadwaj et al. (1993) also confirms the logic of the proposed argument: "Sustain-

ability is achieved when the advantages resist erosion by competitor behavior. In other words, the skills and resources underlying a business's competitive advantage must resist duplication by other firms". Moreover, researchers differentiate the source of competitive advantage – deviating capabilities (skills) and unique assets (resources). Notably that both of the propositions are generally compatible with mentioned works in the previous paragraph (Ruokolainen et al., 2011; Muegge, 2013).

The researchers studying business ecosystem have borrowed some principles of the biological ecosystem and same approach is also applicable in consideration of the sustainability. Costanza and Mageau (1999) in his work claims that sustainability is the ability to maintain ecosystem's structure (organization) and function (vigor) over time while facing external disturbance (resilience). In order to be healthy and sustainable, the ecosystem should maintain its metabolic activity level and as well its internal structure, which is tightly connected with the diversity of actors. In addition, a sustainable ecosystem possesses adequate resilience to survive different small-scale perturbations. Another researcher Goerner et al. (2009) supplements this theory by adding two structure-related attributes that helps to maintain the vitality of an ecosystem. One of the attributes is efficiency: "the network's capacity to perform in a sufficiently organized and efficient manner as to maintain its integrity over time" and the other one is resilience: "its reserve of flexible fall-back positions and diversity of actions that can be used to meet the exigencies of novel disturbances and the novelty needed for on-going development and evolution". These attributes are related to the diversity and connectivity in the ecosystem. Generally, resilience and efficiency have reverse relationship – greater resilience leans to less efficiency, and, conversely, greater efficiency leads to less resilience. Nevertheless, this helps to measure ecosystem's sustainability by determining its place in the continuum from brittle (insufficiently diverse) to stagnant (insufficiently efficient). Notably that much research has demonstrated the efficiency of diversity of species in the ecological field, for example the work of Liang et al. (2016), which later might be evaluated also in the business environment.

One of the fundamental works in business ecosystem filed by Iansiti and Levien (2004b) has evolved three important aspects of ecosystem's

sustainability: robustness, productivity and niche creation. Firstly, measuring robustness allows actors to examine survival rates in a given ecosystem. There are presented several metrics regarding robustness: survival rates; persistence of ecosystem structure; predictability (adjustment in ecosystem structure is not only comprised; it is also predictably localized); limited obsolescence (existing activities in the ecosystem are resilient to radical innovations); and continuity of use experience and use cases (users in the ecosystem have a period of adaptation to changes). In general, researches claim that hub structure and diversity of actors in ecosystem have significant premises to indicate robustness of an ecosystem. Secondly, productivity of an ecosystem is analogous to the competitive advantage of actors. It is not enough to be robust in the ecosystem, because companies constantly subject new conditions: new members, new markets, new technologies, new processes, etc. Actors must have ability to adapt to changes by demonstrating effectiveness in converting the raw materials of innovation into lowered costs and new products and functions. Three following metrics are indicating productivity of ecosystem members: total factor productivity (generally, using traditional economic productivity metrics); productivity improvement over time (evaluating the progressive factor of productivity among ecosystem actors), and delivery of innovation (evaluating the process of innovation and spread of new technologies and ideas to all stakeholders in the ecosystem). Lastly, there is a niche creation, which indicates the capacity of an ecosystem to create new valuable niches. It happens due to the factors related with collaboration within ecosystem, which is discussed the corresponding section in this thesis. Niche creation has two suitable metrics: variety (the number of emerging services, products, technologies, categories and other values in the ecosystem over time); and value creation (the overall value of the options created). Provided metrics allow to estimate the sustainability of the ecosystem and as well demonstrate the current position and evolution stage of business ecosystem.

The open business models have demonstrated a positive impact on the overall ecosystem health (Gay, 2014). Companies are more effective in producing as well as capturing value in the ecosystem. Moreover, open business models also contribute to establishment of productive collaboration between actors. Actors provide more efficient

ways to leverage other companies' resources, products, technologies, or organizational capabilities, and as well help to leverage their assets. Studies of network structures have shown that value is co-created with other actors and business model of a single actor should not be seen in isolation nor should be considered static. Open relationships allow rapid access to valued innovation in the ecosystem while decreasing operating costs and reducing supply chain dependencies. On the other hand, the open business model might become dangerous due to the trust issues among actors.

Complementary approach to measure the performance and sustainability of the ecosystem has been proposed by Fotrousi et al. (2014). The author provides KPI to evaluate software ecosystems, however this thesis has already stated that the principles of other ecosystem types are also applicable to the business ecosystem. These KPI have several objectives: improve businesses; improve interconnectedness between actors; stimulate the growth of the ecosystem; improve quality of products and services within the ecosystem; and enable sustainability. First indicator is business improvement. The performance of ecosystem is related to the performance of each actor, its encouragement to collaborate in the ecosystem, and the transaction volume. In addition, there are commercial (sales) success, innovativeness and competiveness of actors. Second indicator is interconnectedness improvement. Mostly, it demonstrates supplier availability, discovery, ranking, and selection; the overall resulting connectivity, evaluation of interaction, and the impact of the interaction on connected actors in the ecosystem. Third indicator shows the overall growth and stability of the ecosystem. In the growth or evolution stage, actors should maintain flexibility and controllability. On the other hand, in the stagnation phase, actors must focus on continuous co-revolution. Last indicator is quality improvement. It is important to consider following aspects: performance, usability, security, data reliability, extendibility, transparency, trustworthiness, and quality-in-use. Quality management spurs growth and co-evolution, improve business performance and maintain sustainability in the ecosystem. These KPI can be adopted by keystones in order to help relating actors and increase overall value of the ecosystem.

4 Discussion

This section summarizes the results of the thesis by reflecting them into the research questions which were stated in the corresponding section. Also the reliability and the validity of the study is discussed in this section.

4.1 Answering the First Research Question

RQ1. What are the advantages of using ecosystem model amongst other network structure models?

Advantages
The ecosystem model has more flexible structure than other network models, for example, number of actors is not controlled by other actors but by market fluctuations. Due to the the self-regulatory pattern, dynamics of the model is more stable. Moreover, using the SDL for interrelationship mechanism, the model adequately depicts relationships between various actors in the ecosystem. Another key advantage of the business ecosystem is variety of collaboration types: it allows to adopt both cooperation and coopetition relationships between actors. In addition, the ecosystem supports creation of economically sustainable collaboration network. Finally, the model considers users as actors in the ecosystem.

Table 7: Advantages of the business ecosystem model

In general, the business ecosystem is a high-level abstract model which can be applicable in various domains. The model has been naturally evolved from network structure and contains all the good practices of the network collaboration. Although companies might not be using intentionally the model, they still can be involved in the ecosystem and other stakeholders can benefit from adopting the model.

The model provides several advantages and one of them is explicit view of the market. Firstly, emerging companies can identify other actors in the ecosystem. The actors in the ecosystem have a few types: keystones, dominators, and niche players. This information helps new actors to determine their position in the ecosystem and perform the strategy management process. Moreover, this information allows companies to consider existing competitors, potential partners, and their role in the ecosystem. Later, the actors may build relationships with close stakeholders: cooperate with appropriate partners, and decide the benefit from coopeting with competitors. For example, an extensive analysis may provide early startups a valuable opportunity

to join the market, more precisely identify position on the market, and provide valuable information to mentors, investors, and other actors.

On the other hand, existing actors in the ecosystem are able to efficiently monitor contemporary situation on the market. Keystone actors set up the development direction, thus other stakeholders, that are bounded with keystones, can adapt to upcoming changes. Therefore, the transparency and reaction speed helps all stakeholders to appropriately respond to any changes on the market. Moreover, actors in the ecosystem may build long-term relationships with other actors, and such system may help actors to rank companies according to their reliability. Although the model of trust between companies is an ambiguous factor, many stakeholders are implicitly using it, and the ecosystem model is suitable for indicating that factor.

The network structure of the business ecosystem assumes another major benefit of resource sharing. As soon as the model follows the SDL, the parties are considered as resource integrators, thus all stakeholders to some extent are sharing and exchanging resources. This logic allows new actors to fulfil the resource insufficiency from more "experienced" actors (such as keystones). One the other hand, keystones are helping to create niches (expanding existing or creating new markets) and utilize their resources there. This approach provides an opportunity for companies to focus on their strong activities and rely on other actors, when the complementary actions are required. One of the examples is cross-marketing, which allows to acquire new users through partners and provide complementary value. Overall, the structure simplifies connection with other parties and allows more flexibly design and implement efficient communication.

The business ecosystem perspective also aids business leaders recognize that organizational performance is generally a firm-centric and it captures performance from the perspective of the organization. An extensive view is that the organization might be displayed from the viewpoint of the larger network of stakeholders that affiliate the ecosystem. This ecosystem encompasses the interdependent network structure where the company is a single node connected with other actors. This broader picture provides a significant outside-in perspective that helps actors to identify the relevancy of other parties who are involved in

relationships with the organization. The view defines and perceives the performance of actors, and affects the value proposition of firms and mutual value created by them.

Another crucial benefit of the business ecosystem model is consideration of users as members of the business ecosystem. Regarding the SDL, the user can be acknowledged as an active actor in the ecosystem, as soon as it serves same functions as some of business entities and even more important that the user has a significant impact of businesses. The collaboration with user can be achieved successfully through co-creation and other co-activities. This rationale is clearly evident in the latest tendency in the IT-world, where companies are providing a platform and users are the resource of content creation, e.g., Facebook, Airbnb, Amazon, etc. Moreover, the user as an actor can be defined as an entity with specific role, activities and capabilities to make transactions with other actors, that in turn helps other ecosystem stakeholders to account on users as active members. In addition, users are also actors with social activities and the resulting network value creates a powerful effect on the business and social environment. Therefore, the business ecosystem model enhances as business entities as well as individuals (users, customers, etc.).

The literature analysis has provided overall answer to the first research question. However, in order to investigate the adequate diversity between certain network models and the ecosystem model, empirical research methods are required. This thesis suggests to conduct a sequence of research to compare each model with the ecosystem model.

4.2 Answering the Second Research Question

RQ2. How to use business ecosystem as a basis model for other ecosystem types?

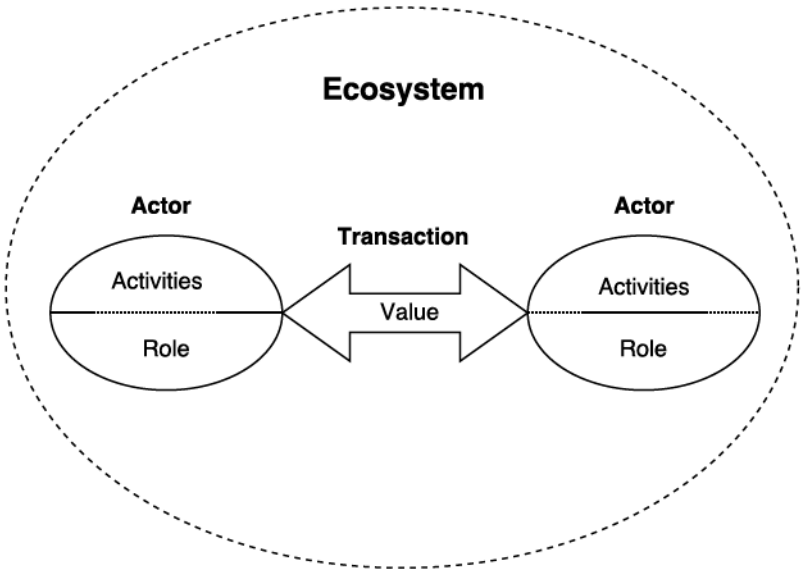

Figure 3: Business ecosystem structure

In the last decades the ecosystem model has been widely used in the literature and it has been adopted in various domains. The most prominent ecosystem types are software ecosystem, service ecosystem (well-known in the SDL) and social ecosystem. Innovation, industrial and other minor ecosystem types have significantly less attention in the literature, but they are still mentioned in discussions in the business environment. Moreover, these minor types are mostly included in major ecosystem types and further deviation may lead to diffusion of the model. However, all the variety of ecosystem types has common root – a biological ecosystem, which in turn has provided a common behavior pattern, structure and lifecycle to all other ecosystems.

In general, the ecosystem is considered as a high-level model, which has attributes of the biological ecosystem such as structure, lifecycle and behavior pattern. Moreover, depending on the implementation of ecosystem in certain domain, it maintains different interfaces. Therefore, this thesis considers the business ecosystem as a base ecosystem type. Firstly, it demonstrates a promising capability to link all other

types, which are related to human and business interaction. Secondly, as soon as the business ecosystem has network structure, it shows shares functionality and objectives with other ecosystem types. Thirdly, the business ecosystem with the SDL helps to consider all entities as a service providers and service integrators, thus theoretically allowing to collaborate with stakeholders from different domains. In general, the business ecosystem comprises or relates to the majority of activities that appertain to other ecosystem types.

Actors
Active members of the business ecosystem. Related terms: stakeholders, members, participants, species, technospecies.
Activities
Routines or actions devoted to produce products or capability to participate in the service exchange, usually it involves commercial, financial, and industrial aspects. It determines the functions of actors in the ecosystem.
Transactions
Relationships between actors in the ecosystem. Depending on domain, it concerns financial exchange, knowledge sharing, inquiries, pre- and post-sales contacts, information exchange, physical and non-physical connections.
Roles
Defines position and behavioural pattern (dynamic of the actor) in the ecosystem. Actors can perform three different roles: keystone, dominator and niche player.
Value
The result of collaboration between actors. Transactions determine relationships between actors and the mutual value is co-created in the process of service exchange.

Table 8: Ecosystem structure definitions

The business ecosystem model has predetermined structure, which is demonstrated in Figure 3 and defined in the Table 8, that is inherited from biological ecosystem and modified to support functionality of business environment.

Firstly, it is assumed that the size of ecosystem is less or equal to

the market size. However, there are exceptions, for example, if the ecosystem contains entities that are serving mutual market and another not related market. Nonetheless, such exception case might lead to one of the position outcomes – market expansion.

Secondly, all ecosystem actors are considered as actors, similar to market actors. Each actor has certain role: keystone, dominator or niche player. These roles help to identify the position of actor in the ecosystem and its behavior, which in turn aids new actors to see the overall picture of the ecosystem and enables every actor to build a strategy based on the information.

Thirdly, each actor must have innate activities that determine the actor in the ecosystem and create competitive advantage among other players. This is critical every actor to have capability of providing relevant value to other actors, because the sustainability of the whole ecosystem depends on productivity of its members. This condition is a key principle of economic sustainability of the business ecosystem, where each actor should be self-assured and provide guaranteed value proposition.

Fourthly, the interface of each connection and the nature of transactions is defined uniquely in each case on the grounds as the relationships depend on a plenty of factors such as trust, reliability, policies and many other. Thus, each relationship is determined individually by related actors. The principle of relationships between actors in the ecosystem model is following the SDL, which assumes that all stakeholders as resource integrators and the transaction in every case is a service exchange. The value is co-created during the service exchange regardless of the actors involved in the transaction, because the ecosystem is considered as Actor-to-actor system. Therefore, this logic allows to use the base model in various domains and consider users as actors.

Fifthly, the ecosystem model has a unique differentiation from other network structure types – it enables two types of collaborations: cooperation, which is expected behavior of partnership, and coopetition, which allows to collaborate with competitors in the same ecosystem and benefit from the connection. The coopetition concept has evolved from the standard opposition between rivals towards mutual benefits

through joint effort to create value for direct customers and users. A good example of one of the outcomes is education of the user, which utilizes resources of the competitors, and the user helps to expand or create new markets for the competitive actors.

This thesis has provided a broad answer to the second research question. It has demonstrated a possibility to use the business ecosystem model as an abstract high-level model that can be used in other domains. However, this logic assumes that different domains has own ecosystem types, which requires thorough analysis to prove the statement. Overall, the ecosystem model constructed in the thesis has potential to be used as a basis for more complex models used in various domains.

5 Conclusions

The purpose of the thesis was to investigate the reasons and approach to use business ecosystem model in various domains. This thesis is based on the literature review, which has provided overall picture of the problem. However, due to limitations of the research method, a few question hasn't been answered and more questions has aroused.

Firstly, the thesis depicts common network structure models used in the literature and in the practice. Secondly, it demonstrates advantages of using the ecosystem model in comparison to other network structure models. Thirdly, the this study has shown the various types of ecosystems and provided argumentation to use business ecosystem as a basis for other ecosystem types. Finally, this thesis establishes a structure of the ecosystem model, which can be used as a basis model in various domains.

Despite the fact the business ecosystem is auspicious model, it still has numerous obstacles, which could be referred and solved in further studies. Firstly, this model provides only high-level overview on the actual circumstances, so it doesn't provide solutions for various in-depth problems inside companies and it doesn't determine interfaces and the process of communication between actors, e.g., the notion of trust as a human factor is crucial in the business environment and stakeholders should invest in the process of building transparent and mutually beneficial relationships with other actors. Another issue is closely connected to the ecosystem's network structure – it is critical to loss of key actors in the ecosystem. This thesis proposes to study mechanisms of robustness and resilience in case of restructuration of such systems. This issue is related to the obligation of actors to constantly react and adapt to changes in the ecosystem, for example, arrival of new actors, change to policies, political and social adjustments and other factors. Yet, this issue is common in any networked structure and the ecosystem approach provides suitable basis to create mechanisms solving it. Finally, this thesis proposes to conduct thorough empirical research with practitioners in order to identify concerns and investigate the practical application of the business ecosystem model.

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