Elina Annanperä

MANAGING TECHNOLOGY-BASED SERVICE INNOVATIONS IN EMERGING WELLNESS BUSINESS ECOSYSTEMS
MANAGING TECHNOLOGY-BASED SERVICE INNOVATIONS IN EMERGING WELLNESS BUSINESS ECOSYSTEMS

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Supervised by
Doctor Jouni Markkula
Doctor Kari Liukkunen

Reviewed by
Professor Sami Saarenketo
Associate Professor Mark de Reuver

Opponent
Professor Pauli Kuosmanen


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Abstract

As services are increasingly becoming the main focus in the traditional information communication technology industry, companies are seeking leverage from new types of collaborations, such as business ecosystems that cross industry boundaries. The health and wellness business is one service domain in which advances in technology have created the need for services that integrate technology in novel ways. To advance new service businesses, national research programmes offer funding for organisations to collaborate for developing innovative services. Forming new networks and collaboration between organisations is essential in the new business environment.

Emerging business ecosystems formed in the research programme context are expanding the concept of business ecosystems. When organisations work together for the first time, challenges arise from bringing together different expectations and working styles. Additional challenges arise through issues regarding suitable integrations or in the creation of completely new services.

The need to understand the practical phenomenon of emerging business ecosystems and the service innovation in these ecosystems formed the starting point of this research. The research was conducted in two separate Finnish research programmes in which the researcher actively participated. This led to the adoption of an action research strategy, comprising several activities focusing on the actor dynamics and roles as well as resolving issues arising from the ecosystem formation. In addition, the service innovation-focused research activities were based on the capabilities and domain expertise of the ecosystem companies.

This research produced an understanding of the formation of wellness business ecosystems, identified the main phases of the formation and some challenges. This research found out that successful emerging business ecosystems require strong leadership early in the formation to maintain the stability and vision of the ecosystem, and each organisation should find its role within the ecosystem. The creation of viable services also requires openness between organisations. This research provides practical knowledge of the organisational actions, managerial insights and solutions to issues that are identified when organisations come together to form new ecosystems in a research programme context.

Keywords: action research, emerging business ecosystem, research programmes, service design, service innovation
**Tiivistelmä**


Kun organisaatiot ryhtyvät tekemään tiiviistä yhteistyötä ensimmäistä kertaa yhdessä tarkoituksena tutkimushankkeen yhteydessä, tuovat erilaiset odotukset ja työskentelytapojen yhteensovittaminen myös omat haasteensa yhteistyöhön.

Uusien ekosysteemien muodonmuutosta ja siihen liittyviä käytänteitä on tarvetta ymmärtää aiempaa syvällisemmin. Tämä tunnistettu tarve toimi tämän väitöstitelmän alustana. Tutkimus tavoitettiin kahdessa suurissa tutkimushankkeissa, joihin väitösten tekijä osallistui aktiivisena tutkijana. Tutkimus toteutettiin toimintatutkimukseena, ja siihen sisällytettiin useita tutkimusohjelmia. Tehtävien toteutuksen toteuttaminen oli keskeistä toimijoiden keskinäisesti toimintaverkkojen yhdessä toimintaan ja roolien, ja pyrkii ratkaisemaan ekosysteemiyhteistyöstä syntyviä haasteita. Lisäksi tutkimuksessa keskityttiin ekosysteemiyhteistyön pyrkimykseen synnyttää innovatiivista liiketoimintaa organisaatioiden yhteistyöllä.

Väitösten tuloksena saatiin uutta ymmärrystä hyvinvointialan ekosysteemien muodonmuutosta sekä ekosysteemien yhdessä toimineen muodonmuutosta. Tämä tunnistettu tarve toimi tämän väitöstitelmän alustana. Tutkimus toteutettiin toimintatutkimukseena, ja siihen sisällytettiin useita tutkimusohjelmia. Tehtävien toteutuksen toteuttaminen oli keskeistä toimijoiden keskinäisesti toimintaverkkojen yhdessä toimintaan ja roolien, ja pyrkii ratkaisemaan ekosysteemiyhteistyöstä syntyviä haasteita. Lisäksi tutkimuksessa keskityttiin ekosysteemiyhteistyön pyrkimykseen synnyttää innovatiivista liiketoimintaa organisaatioiden yhteistyöllä.

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For all those with curious minds
Acknowledgements

“It’s good to have an end to journey toward, but it is the journey that matters, in the end.” – Ursula K. Le Guin

It is a cliché but I truly think, that life is a journey, and it is not about the destination, but about the things you learn and the people you meet on the way. When I was still a young university student, I was not planning to take on a dissertation work. It was only after having been a research assistant at our department and working with my supervisor Dr. Jouni Markkula that becoming a doctor one day even seemed like a possible goal. It seems that is when my journey began…

Now the work has been completed, and I feel I have had such an amazing opportunity to learn and challenge myself. I feel I have been lucky to do something I feel proud of, and it has been such an interesting journey, albeit sometimes I have almost lost sight of my goal. For the high times, and the low times, I have many people to thank for support, discussions, criticism and encouragement.

I respectfully thank the pre-examiners, Professor Sami Saarenketo and Associate Professor Mark de Reuver for the feedback and evaluation of my work. I also thank Professor Pauli Kuosmanen for acting as my opponent. I offer my most sincere thanks to my supervisors; Dr. Jouni Markkula for teaching me how to think like a researcher, how to push myself to do better, and for endless encouragement. Dr. Kari Liukkunen for being my mentor in both how to deal with project day-to-day work and managing projects, and for the teaching related discussions.

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Last but not least, I thank my family for all their love and support, for allowing me to grow into who I am. My husband Sauli for all these years together. My mother Terttu and her husband Pekka, for making always feel welcome in their home. My father Arto for supporting me to grow to a strong woman. My brothers Jukka-Pekka and Mikko for the movie nights and not allowing me to take myself too seriously. My in-laws Sirpa and Jouni for the friendship over these years. This is for all the girls out there maybe wanting to be scientists one day: you can do it!

Oulu, 20.4.2017

Elina Annanperä
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<tr>
<td>DIEM</td>
<td>Devices and Interoperability Ecosystem</td>
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<td>DS</td>
<td>Digital Services</td>
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<tr>
<td>ICT</td>
<td>Information and communication technology</td>
</tr>
<tr>
<td>IS</td>
<td>Information Systems</td>
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<tr>
<td>PAR</td>
<td>Participatory action research</td>
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<tr>
<td>R&amp;D</td>
<td>Research and development</td>
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<tr>
<td>SE</td>
<td>Software engineering</td>
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<tr>
<td>SHOK</td>
<td>Strategic Centres for Science, Technology and Innovation</td>
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<tr>
<td>SME</td>
<td>Small and medium-sized enterprise</td>
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List of original publications

This dissertation is based on the following publications, which are referred throughout the text by their Roman numerals:


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1 Introduction

Services have become the main source of economic output in the world over the last few decades. The service industry has garnered increased importance following the rise in standards of living globally. Additionally, traditional manufacturing industries have started to create business models around the services accompanying their products and given room to entirely new branches of services that are built on existing technology.

Services comprise a large part of the post-industrial global economy, making them an important focus for information and communication technology (ICT) and manufacturing technology companies as a point of revenue. Service business has also spread to new areas of industry as technology and digitalisation has spread to all areas of life. The spread of technology and digitalisation challenges companies to create their services in new ways in industries where technology has not been previously self-evident. At the same time, the entire business landscape has changed with the boom of ICT as the enabler for new service business.

Digitalisation has changed the landscape of service business. Companies that were formerly identified as electronics or component manufacturers are now in the service business. This transformation is happening because, in order to thrive in today’s global markets, companies are looking for ways to grow through new ways of doing business.

Companies are also changing their business in the sense that not all expertise regarding the business has to reside within the company (Chesbrough & Spohrer 2006). Initially this meant that production of parts for a machine, for instance, was done in different places, but later, knowledge work, such as programming, also shifted outside the companies. Concepts such as outsourcing and open sourcing have been business strategies for a while now (Enkel et al. 2009). In recent years, the introduction of company collaboration has formed various clusters and networks that enable companies to benefit from working together. Businesses are increasingly forming networks that include other companies, creative individuals, research institutions and governmental bodies. One company may be a part of various networks. In each of these networks, the company might have a different role to play; sometimes it takes a leading position and other times, where another

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1 According to https://www.wto.org/english/res_e/booksp_e/anrep_e/anrep16_e.pdf World Trade Organization (WTO) reports services to be the fastest growing sector in the global economy.
company has taken the lead, it takes a complementary position in a network structure.

One such form of company network is the business ecosystem (Moore 1993). The business ecosystem is defined as an organism of actors of a cross-industry background with various capabilities that contribute to the purpose of the business ecosystem (Heikkilä & Kuivaniemi 2012). According to Moore (1996), the purpose is to benefit the companies and organisations in the ecosystem; by getting involved in business ecosystems, they may survive better in business than by trying to do everything alone. This is because in a business ecosystem, the companies benefit from the expertise of the other actors within the same ecosystem. Together, the organisations are creating greater value for their customers. For instance, a technical platform or device of one manufacturer combines the technology and services of other companies. Increasingly in ICT business ecosystems, the focus of the value creation is moving toward services that are added to the platform or device.

The creation of value in the ICT business ecosystem is based on the value of the technology-based services the ecosystem offers. In business ecosystems value is seen as something that is the outcome of the different capabilities the ecosystem consists of, meaning the different components that are “chained together” (see Moore 1996, 71-72) to capture the value of the ecosystem offering. The value of service in the ICT field is still an issue, as is the understanding of the creation of service value in the ecosystem context. Sometimes much emphasis is placed on the technological innovation in companies, without understanding the needs of the average user. Users tend to place the value of the technology innovation on the service it provides to them.

One of the fields affected by new technology-based service business is that of personal health and wellness technology and its related services. Personal training monitors became popular in the early 2000s, and wearable sensors are the latest trend. The smart handheld devices we own are often used as platforms for measuring personal activity through sensors and mobile applications. As consumers have enthusiastically adopted new technology-based services, businesses have grown in the health and wellbeing field, and personal devices that are used to monitor one’s activity or performance while exercising have been successful products. This has led to the rise of new business and start-ups that target the health and exercise markets. At the same time, some existing companies are expanding their offerings to retain their customers and meet the needs of today’s technology-savvy users.
The problem in such a technology-based field is, however, that the available services are heavily tied to the technology. Oftentimes, the consumers are tied to the first device they buy and its limited services. The companies operating in the health and wellness field are aware of this. For the bigger players in the field, it may work to their advantage, but the smaller ones have begun to try and find solutions that offer greater versatility and added value. In today’s business environment in the health and wellness field, where many new small companies and start-ups are attempting to gain access to the markets, it makes more sense for companies to collaborate with each other. Organising in a business ecosystem to offer a larger set of services and benefits to the consumer is expected to benefit all those that enter the business ecosystem. This research examines the situation in which small companies come together to create new services in the health and wellness industry using technology and digitalisation.

Small companies need to collaborate (with each other) in order to have successful new service or product development or innovations in general (Pullen et al. 2012; Konsti-Laakso et al. 2012). Furthermore, Research and Development (R&D) and collaboration with research organisations can incorporate feedback from scientific research, technical development (Heikkinnen & Still 2008), or sharing resources and exploit research in companies (McKelvey et al. 2015) to benefit the small company business ecosystems. Effective innovation in such collaborations is seen to comprise of companies and research organizations to achieve and share innovation goals (Rampersad et al. 2010). Small companies in need of innovation capacity are relying on the principles of innovation not occurring in closed space; innovation needs knowledge-integration, co-evolution and relationships as well as technological development (Corsaro et al. 2012). What is lacking in the business ecosystem literature is the understanding of small company or SME collaborations. In particularly in research program as an operational environment as the enabler for these SME collaborations, and the specific context dependent aspects need focus. The details of the initial formation process need to be elaborated and the effecting and deciding aspects of the formation of the ecosystems need more focus for these SME collaborations to truly become business ecosystems.

1.1 Research context

In Finland, the Strategic Centres for Science, Technology and Innovation (SHOK) was established in 2008 to direct part of the national funding for innovative
company and research collaboration to create new business opportunities. Consequently, DIGILE was established, as a non-profit organisation, to direct the SHOK in the ICT field, while focusing on the rise of digitalised services and adjacent technology. Other non-profit organisations were also established to direct the national funding in other fields, such as the energy and environment centre, CLEEN, and the health and medical field, SalWe.

SHOK activities are usually research programmes that gather companies and research organisations to arrange their work as projects or, as they were later outlined, ecosystems. In other words, the research programmes create a setting for developing innovative technology-based services to create viable business ecosystems. Traditionally, in a business ecosystem, the leader role exists early in the formation, while other organisations contribute to the company’s vision and needs (see Moore 1996). However, the situation in these nationally funded research programmes is different. The national public funding organisation and DIGILE are seen as stakeholders that initialise and support the development of emerging business ecosystems and call the interested organisations together. The companies and research organisations accepted to the programmes form these ecosystems and develop their visions and operations toward the goals, which may not be exactly clear at the beginning. More precise objectives are formed through the ecosystem formation over time.

Organisations joining these research programmes have the opportunity to benefit from the research and development (R&D) outcomes of other participants in the programme. The DIGILE principle is that companies can stipulate that some part of their pre-existing intellectual property is available to the research programme, for either its duration or afterwards as well (typically via licensing). The research programmes typically span three to four years, and the intellectual property developed during that period is available for licensing by other organisations.

The empirical part of this research has been conducted in the setting of two separate research programmes managed by DIGILE. Devices and Interoperability Ecosystem (DIEM), which ran from 2008 to 2012, focused on the (R&D) of smart, interoperable services. The part of programme in which the author of this dissertation participated focused on developing smart technology-based services.
related to exercise and health. Second, from 2012 to 2015, the author participated in the Digital Services (DS) programme, which aimed to form a new type of business ecosystem for small companies in the wellness services sector in Finland. These programmes allowed a longitudinal study approach to be used.

1.2 Research scope

The successful formation of viable emerging business ecosystems in the research programme context was an identified need that formed the starting point for this research. The research programme context offered a special setting for the formation of the business ecosystems, which included funding-instrument-related regulations and expectations, and a degree of artificiality in the formation process in the sense that the actors were coming to work together based on their interest in collaboration. The actors, companies and research organisations varied in size, and a clear leader was not necessarily visible at the beginning.

Therefore, the scope of this research was to understand the practical phenomenon of an emerging business ecosystem. The research programme context offers a new type of setting for emerging business ecosystems, bringing its own challenges and possibilities. An additional challenge is brought by the different motivations and expectations of the actors to participate in the emerging business ecosystem. Collaborative service innovation is an essential part of the successful business ecosystem in the research programme context. Therefore, it was necessary to investigate the ways successful service innovation can be achieved in emerging business ecosystems.

The overall goal of this research is to understand the formation of business ecosystems and their service innovation process. This goal of this research is presented as an overarching research question:

What are the key aspects affecting the formation of business ecosystems in research programs?

The understanding for answering this question is gained through identifying aspects and key practices that affect (1) the formation of a business ecosystem and (2) creation of joined services in the business ecosystems. By identifying the key aspects that affect the business ecosystem formation, it is further possible to identify the challenges and successes in the formation process. It is then possible to understand the needs of small companies collaborating in ecosystems and develop the ways to ease the formation and service innovation.
The phenomenon under investigation in this dissertation is the emerging business ecosystems. The participating organisations in both ecosystems were small and medium-sized enterprises (SMEs) – some start-ups, one big company (in DIEM) and several research organisations – all operating in the health and wellness business domain. This domain affects the research scope. Health and wellness services are more or less personal to their user, which requires understanding from the ecosystem organisations. Moreover, the business landscape is new in Finland for these types of services, although towards the end of the research period, the trend was booming. Service innovation activities were targeted to suit this booming trend.

The context of research programmes and SHOK funding created the operational environment, but this dissertation does not directly investigate or evaluate the success of the funding model or the support provided by DIGILE.

1.3 Overview of research methodology

It was determined that the context in particular called for an active role of a facilitator, that would help the emerging business ecosystem. This need was identified when the participants in the research programmes came together, and organizations were introduced to each other. The participating companies were mostly small and even start-up with little or no experience on collaborating in business ecosystems (or otherwise). Similarly, the research program context was new to most of them. On the other hand, on the research program level, the attempt to create ecosystems was a new target as oppose to the previous closed project working models. It was determined that an explorative approach could be used to see how the emerging business ecosystem would form and how the organizations would respond to such approach.

Aiming to Identify and understand the key aspects of emerging business ecosystems in a research programme context and aiming to facilitate the formation of the ecosystems created an opportunity for the researcher. It was anticipated in the beginning that close collaboration between the researchers and the companies was needed. The duration of the research programmes made it possible to follow and participate in the formation of the business ecosystem and the creation of services closely. This enabled the researcher to obtain a longitudinal view of the emerging business ecosystems.

The selection of suitable research methodology was done to suite the research goals and context. The determining factors in the research context were the
contemporary, on-going phenomenon that was under investigation (Yin 2013). It was seen desirable to collect explanatory and descriptive data of the ecosystem actors and action for the purpose of this research. It was not seen possible to control the emerging business ecosystem in the way that it would require to adapt an experimental research. On the other hand, merely observing the situation without trying to impact was not desired by the context either. The overall research methodology could have been described as merely a case study, but the situation was that the researchers influenced the emerging business ecosystems with their actions quite much. Moreover, this influence and the interventions were seen as needed from the ecosystem actors’ point of view as well as from the research point of view in order to study the effects of the collaboration activities in the ecosystems.

The typical role of the research organisation in the research programme is to provide software or technology-related R&D results for the ecosystem companies. The research organisation also contributes its methodological research expertise to the work of the ecosystems. The need to facilitate the formation process of a business ecosystem was present in both projects. This need for the facilitation and finding suitable solutions for the emerging business ecosystems called for research strategy and methods that allowed the researcher to actively participate in the ecosystem formation process. This research was therefore conducted as action research (see also Reason & Bradbury 2001), specifically participatory action research (PAR) in parts that required considerable presence and interaction between the ecosystem actors and the researcher (following Kemmis & Taggart 2005).

It was anticipated that as a longitudinal research, it would not be possible to anticipate the direction the emerging business ecosystems would take. The planning of the research was therefore based on using guideline for action research as reflective, and participatory research, that would advance in iterations (see Baskerville & Wood-Harper 1998). There were two types of activities planned: those that would contribute to helping the formation of the ecosystem and those that would help in creating the common value of the ecosystem through service innovations activities. Particularly at the beginning of the ecosystem formation the researcher aimed to help the companies to determine the ecosystem’s goals and provided scientific methods to attain these goals as needed.

It was planned that in the run of the research programs the actors would eventually form working collaboration in a level that would allow technical and service level integrations the be tested in real life situations. As is described in this dissertation, this was achieved in the intended level in the DIEM program.
1.4 Structure of the dissertation

When studying the emerging business ecosystems, two facets were identified as relevant for this research: (1) the formation of emerging business ecosystems in practice and (2) the action needed that would lead to the new, collaborative service innovation that the ecosystem offers.

Papers I, II and III, which form the basis of this research, describe the empirical investigation of emerging business ecosystems and service innovations in the presented context. The papers describe the use of action research and performed activities in close collaboration with the companies. Table 1 presents an overview of papers.

Table 1. Article content and methods overview.

<table>
<thead>
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<th>Article</th>
<th>Topic</th>
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<tr>
<td>I</td>
<td>Early phases of the emerging business</td>
<td>Action research</td>
<td>Workshops and interviews</td>
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<td></td>
<td>ecosystem</td>
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<tr>
<td>II</td>
<td>Innovation activities and their effect on</td>
<td>Action research</td>
<td>Workshops, focus groups</td>
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<td>the emerging ecosystem</td>
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<td>III</td>
<td>Service design and the effects on the</td>
<td>Action research</td>
<td>Observation, interviews, survey</td>
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<td>emerging ecosystem</td>
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<td>IV</td>
<td>Applying knowledge management framework</td>
<td>Multiple case</td>
<td>Synthesis and identification of</td>
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<td>for the analysis of the emerging systems</td>
<td>study</td>
<td>management aspects from the data</td>
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<tr>
<td>V</td>
<td>Reviewing existing research on service</td>
<td>Systematic</td>
<td>Analysis and synthesis of literature</td>
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<td>innovations in business ecosystems</td>
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Paper I follows the early phases of an emerging business ecosystem focusing on the developing dynamics of the actors and the way they organise themselves in order to work together to form the business ecosystem and the services they are going to offer. Paper II takes a longitudinal view of the ecosystem formation and the innovation activities performed by the actors over four years. This paper presents an overview of the main innovation activity steps and describes how they contributed to the final technology-based service concept. These steps also triggered changes in the business ecosystem dynamics and the roles of the actors. Paper III examines the finalisation of the service concept. The main contribution of this paper is to present a large-scale technology pilot and describe the comprehensive and detailed planning of the pilot. The research followed the cyclic format of action research. The contribution to the know-how of piloting a service
concept was complemented with the increased understanding of the transition phase at the end of the research programme into the actual commercialisation of the service and the changes that occurred in the original business ecosystem.

Paper IV analyses the data collected and presented in papers I, II and III from a knowledge management viewpoint. In the paper, the knowledge creation spiral (Nonaka & Takeuchi 1995) is used as a framework for analysing the emerging business ecosystem formation and service innovation activities to identify key actions for capturing and converting knowledge inside a business ecosystem in order to create new knowledge. Understanding this process will improve the working practices of emerging business ecosystems.

Paper V focuses on knowledge in existing literature on service innovations in business ecosystems. A literature review was conducted to map out the existing literature that would combine the multi-disciplinary view of service innovations in business ecosystems. Through a systematic mapping study, the current trends of existing research and the key elements identified for creating service innovations in the business ecosystems are analysed. This paper presents an overview of existing research and gives new research directions for future studies in the field.

The remainder of this dissertation is organised as follows. Chapter 2 outlines the theoretical background of this research. The key concepts are the collaboration of companies and other actors as a business ecosystem, and the services developed in these business ecosystems are treated as service innovations, which is further broken down to open innovation and service design. Chapter 3 describes the execution of the research, and the research questions are set based on the overall goal of the research. The questions reflect the explorative and inductive nature of this research and direct the chosen research methodology. Chapter 4 summarises the original contribution by the publications in the dissertation. Each paper summarises the goal of the research, the methods used and the main results. Chapter 5 answers the research questions. The results give an overview of the studied phenomenon and provide a basis for implications of the results. Finally, Chapter 6 presents the conclusions of the results of this work and gives some future research direction.
2 Background and related work

The research programme context brings together various types of organisations and field experts. The business ecosystem paradigm was adopted because it describes the type of cross-industrial and cross-organisational collaboration that research programmes aim toward. The activities and process for actively creating the value in the business ecosystem are essential parts of the collaboration. In this work, open innovation and service design provide the theoretical backbone for the value co-creation in the business ecosystem setting. Here, some of the network types that focus in particular on joined R&D and collaboration with different types of organizations is presented. Next, the business ecosystems are discussed, as well as the reasoning for choosing them as the theoretical background for studying the collaboration in this dissertation presented.

2.1 Organizational networks

Organizational collaboration in business contexts are studied under various types of network types. The types of networks introduced here are inter-organizational collaboration networks, service value networks and R&D networks.

Inter-organizational networks are described to have multiple stakeholders with different knowledge and skills that benefit each other (Lin et al. 2012). They are using a collective process involving actors of the supply chain, governmental institutions, and are dependent of these collaborations (De Martino et al. 2013). This context also recognizes the value delivered through services by the participants of the network (Lin & Hsieh 2014). These networks aim at inter-organizational facilitation of collaborative exchange to create value (Dominguez-Péry et al. 2013). These networks can be temporary (as in goal-oriented) or long-term strategic networks. Interestingly both Dominguez-Péry et al. (2013) and Kutsikos and Kontos (2013) consider the collaborative network as an umbrella term. They consider these long-term networks including business ecosystems, supply chains, clusters etc. The long-term networks are seen as relatively stable with clear definition of member roles and the value-chain. On the other hand, the value co-creation is seen as the key element by both Kutsikos and Kontos (2013) and Snow et al. (2011), where the former emphasizes service creation and the latter innovation.

Service value networks are defined as a set components offered by diverse businesses that create the service (Blau et al. 2009). The composition of these components can be quite complex, including a thinking of infrastructure needed to
deliver a service. Service value networks aim at improved service offering through collaboration (de Reuver & Bouwman 2012). There are also ideas embedded to this type of network of agility in provisioning the service, as if the service is seen as a changing and scalable offering of the involved organizations (Blau et al. 2009). The emphasis is in leveraging the resources, establishing, and maintaining relationships with partners as an organizational relationship capital (Agarwal & Selen 2009). As these networks seem to be complex and large, their biggest issues are in the coordination mechanisms of the services.

R&D networks focus on the joined research and development as well as innovation in networks. In the existing literature, it seems that this type of network is considered in forms of collaboration where different types of organizations, in particularly also research organizations are heavily involved (see for example Löfsten & Lindelöf 2005; Czarnitzki et al. 2007). The identified issues in the literature of R&D networks according to Czarnitzki et al. (2007) can be found in the coordination and information sharing, for instance. These can be seen as joined issues, as it has been noted that collaboration is higher in networks where the innovation spill-over (transfer of knowledge) is high. The research in R&D networks is however in also acknowledging that in order for a successful R&D network to form, the coordination is necessary, and it may be costly (requiring many resources form someone in the network).

Depending on the point of view, and which aspects of collaboration one wishes to stress, all these network theories present relevant points for discussion of collaborative networks.

2.2 Business ecosystems

The collaboration networks related discussion above revealed that business network related research encompasses several conceptualizations, although they share many similar characteristics. The ecosystem analogy for business theory was introduced by Moore in 1996. The term ‘ecosystem’ comes from biology, referring to a living organism and its interactions with the environment. A business ecosystem can be defined as an economic community that consists of interacting organisations and individuals who produce goods and services of value to customers (Moore 1996). The participants in business ecosystems are called actors, of which there can be wide networks. The actors participating directly in business development, such as research organisations, governmental organisations and regulatory bodies, are part of the ecosystem. Business ecosystems do not respect
the boundaries of traditional industries. The organisations typically participate in several business ecosystems, and larger ecosystems consist of smaller ones (Iansiti & Levien 2004).

The purpose of a business ecosystem is value creation; value lies in the complementarities of the ecosystem and is often enabled by technology (Rao & Jimenez 2011). Both cooperation and competition are needed to create value through innovation (Xiaoren 2014). The need for survival and growth in the markets belongs to the nature of a business ecosystem. The ecosystem must therefore innovate and develop new products or services that are competitive in the markets. The business ecosystems utilise open windows and new opportunities in the socio-technical environment, where innovation and capabilities play a crucial role.

It is important to understand that it takes time to form an ecosystem (Adner 2006). This is partly because of various backgrounds of organizations that lead to for instance difference in used terminology (Dooley & O’Sullivan 2007). A successful ecosystem will experience delays and challenges in the companies’ strategy implementation. In order to find their place in the ecosystem, the organisations must serve the ecosystem’s needs and offer their capabilities that are essential within it. Therefore, different types of organisations have their respective places and roles, which depend on the valuable contributions they can provide. Business ecosystems evolve over time and have a life cycle. The first stage of the evolution is defined by Moore (1996) as a pioneering phase, during which the ecosystem and the business model develop. Innovation is the focus; its development is a key activity of the organisations within the ecosystem.

The following stages in business ecosystem evolution include the expansion, which can be after the pioneering phase or when the ecosystem is in need of new resources (Moore 1996). When the ecosystem reaches stability in the common architecture, the ecosystem has reached the authority stage, which is the peak of its evolution. Finally, to avoid dissolution, the ecosystem needs to renew itself through continuous innovation.

Roles identified among the actors of the business ecosystems are one of the key characteristics of the ecosystem. Iansiti and Levien (2004) describe the leaders of the ecosystems as ‘keystones’ – the organisations that have a central driving impact on the business ecosystem. Keystones are essentially the organisations that define the essence of the business ecosystem; they need to lead the vision and purpose of the business ecosystem. Business ecosystems might have actors that aim to take a stronger role and even wish to be the ecosystem leader (Iansiti & Levien
2004). These ‘dominators’ aim to challenge the keystones; however, this is not necessarily an undesirable situation from an evolutionary viewpoint because they may bring a new vision to the business ecosystem. Other actors take a complementary role in the business ecosystem, such as ‘niche players’. These actors take a supporting role in the ecosystem and are often the most innovative and value creating actors (Mäkinen & Dedehayir 2012). ‘Hub landlords’ offer resources to the ecosystem. The dominators and the hub landlords are considered to operate out of their own interests and not necessarily reciprocally (Peltoniemi 2006), whereas niche players see the advantages of exchanging knowledge and innovations.

As discussed above, the evolutionary nature is essential in business ecosystems. The process of change in time in the business ecosystem is called co-evolution (Moore 1993). This is also called the fate of the ecosystem (Battistella et al. 2013). The evolution of the business ecosystem is a recognized part of the change dynamics and has implication to strategy and leadership (Mäkinen & Dedehayir 2012; Xiaoren et al. 2014). Change is mostly induced by the actors’ changing capabilities and roles, and aligning themselves with common directions. Each actor in the change process also influences the other actors in the business ecosystem. The leadership role is important throughout evolution, and a key characteristic to the keystone is to learn how to manage evolution (Gawer & Cusumano 2014). Leaders also need to learn to understand evolution as a dynamic aspect for growth (Rong et al. 2010) and to identify the affecting external factors: social, economic and technology changes (Mäkinen & Dedehayir 2012).

All these roles are important for the overall success of business ecosystems. The organisations participating in the ecosystem jointly form the vision of the future and work together to make it emerge. They need methods to coordinate their vision and realise their plans. They also require R&D activities, along with supporting methods and tools, to align their activities with their future goals.

The defining features in the ecosystems can be seen in the emphasis different studies place on the defining phenomenon. Harland and Wüst (2012) emphasise the ecosystem with a strong leading company that leads a platform and a strong brand. In Rao and Jimenez (2011) and Battistella et al. (2013) the roles and participants in the ecosystems are emphasized. Business ecosystem is seen as a huge network of actors such as distributors, manufacturers, customers and products, services and technologies. Overall, the actors or members of the ecosystem can be enterprises, institutions or individuals (Ruokolainen et al. 2011), also legal bodies (Qu et al. 2010).
The distinguishing features are found in the strategic goals, the key actors (e.g., leader, keystone, platform owner), and their role and responsibility in managing the network. The business ecosystems research seems to emphasize the role of a strong leader, and the need for a diverse set of actors with loose but dynamic connections, which are seen as antecedents to service innovation.

Value co-creation, collaboration, knowledge sharing, and ecosystem-wide knowledge generation are seen as both success factors and major challenges in service innovation ecosystems. These challenges are present during the lifecycle of the ecosystem, in its formation and coevolution. Successful ecosystem management requires facilitation of collaboration, strategic decision making, and efficient sharing of knowledge among the ecosystem actors. The relevant aspects of technology or platform, the combination of the resources in order to create and innovative outcome are some of the key considerations that ecosystem decision making needs to include.

Structured decision-making based on knowledge and data analytics in ecosystem management and joint service innovation poses a challenge to ecosystems that encompass various organizations with different cultures, roles, interests, and resources in the ecosystem. In the stages of service innovation in the ecosystem, different resources and expertise are needed. These need to be recognized and managed through communication and knowledge sharing. The actors in the ecosystem understand their respective roles, for instance, customer insight, technology knowledge, and market knowledge to innovate and create services in knowledge-intensive fields. The management of the ecosystem requires combining the actors’ expertise with a common vision and shared knowledge.

### 2.3 Service innovation

Innovation is the introduction of a service, product or process that is novel or significantly improved for its intended use (Omachonu & Einspruch 2010). Innovations can be generated by individuals and organisations by scientific research or other means of incremental improvement.

In the organisational context, innovation is a result of a purposeful activity to create something new and improved to the markets. Traditionally, innovation-related activities have taken place in a single company, for instance, within a large R&D department of a mobile manufacturer company (Lichtenthaler 2008). The same larger phenomenon of the companies wanting to collaborate in networks and business ecosystems has extended the understanding of how new services can be
created through innovations that involve outside resources. Similarities between different approaches to developing service innovations can be found. In this dissertation, service innovations and their part in business ecosystems as value creation outputs are examined from two perspectives: open innovation and service design. Both perspectives consider that using external resources is not only beneficial, but actually integral to the creation of value through services in businesses. Furthermore, when addressing service innovation as a means for value creation, this study takes the view that value is a desired effect from the customer’s or user’s viewpoint of meeting the customer needs (see Edvardsson et al. 2012).

2.3.1 Open innovation

The idea that R&D and innovation processes could be opened to companies’ external resources is presented in the open innovation paradigm (Chesbrough et al. 2006). The resources used to benefit from open innovation can range from using patents and licences to using ideas and design input from other organisations and individuals, customers or even competitors. The knowledge available in the world can be captured and novel innovations distributed across organisational boundaries.

Individual organisations can find it difficult to access markets, new services or technologies alone, but open innovation eases these connections (Almirall & Casadesus-Masanell 2010), particularly if the business ecosystem setting is included. Open innovation also enforces the ideas that external channels can be used to access markets and external knowledge can be included in the companies’ value creation process through patents and licences.

The business ecosystem paradigm also shares similar viewpoints to open innovation. However, here, open innovation is included to emphasise the innovation aspects of service innovation (see Chesbrough 2012). Open innovation as a theoretical perspective is added to explore the open innovation activities in practice in the business ecosystems. This refers to opening the service innovation activities in the emerging business ecosystem to outside actors such as potential customers and otherwise visionary individuals that could bring benefits to the service innovation in the ecosystems.

Managing open innovation or participation in innovation networks has some identified challenges. In an emerging ecosystem, where the roles may not have been fully set, the issue of leading innovation activities becomes an issue. In open innovation literature, the roles of actors have been discussed, for instance, in Gemünden et al. (2007). While one actor might overlook the hierarchical resources
and retain the power structure in the process, another actor might have an interest in the technical expertise know-how, and another actor’s interests might be in retaining the inter-organisational know-how. Another actor who might be interested in the ties to other actors or organisations outside this particular organisation is seen as a promoter of relationships. Innovations research typically attaches these roles to individuals, whereas in business ecosystems research, the organisations have the describing roles. Further challenges may arise from the various backgrounds of the actors involved, as reflected in the interests of the actors and the roles they assume with regard to open innovation, especially if these interests conflict with the expectations placed on the emerging business ecosystem.

### 2.3.2 Service design

The fundamental principle of service design research is the inclusion of the value perspective and more specifically the customer viewpoint of the design process as a whole. For instance, Hakanen and Jaakkola (2012) state that companies should focus on solving their customers’ needs through their service design actions. Many service design processes presented in the service design literature emphasise the inclusion of customer involvement in the design process (see Alam 2002; Alam & Perry 2002). However, the inclusion of the customer viewpoint is often complex and time-consuming. Nevertheless, the literature often points out that companies should not define the service value without the customer’s input (Evanschitzky et al. 2011).

The traditional service design process includes several steps in which the customer can be included in the design process. These steps range from collecting ideas for new or improved services to involving customers to evaluate service ideas, test new services or otherwise give feedback of ready or almost ready services (Alam 2002). Interaction with the customers is the main point in each of these processes (Ramaswamy 2009).

In business ecosystems, service design may help the companies to align the needed capabilities and combination of preferred services, maximise the value potential and include the customer’s perspective in the emergence of the business ecosystem. Making visible the service solutions that can be found in the business ecosystem helps to identify the value of the ecosystem. The combination of needed services or elements that produce the needed result from the customer’s viewpoint can be found within the ecosystem, or the missing and desirable additions to the ecosystem actors can be identified.
For a successful service design, the companies need to know their market in-depth. The advantage here can be that companies can combine their knowledge of the markets and different existing customer bases to gain a comprehensive insight into the markets and needs of customers. When creating new business within the business ecosystem, service logic may be the base to which technological resources are added.

2.4 Knowledge management in business ecosystems

Challenges presented in both business ecosystem management and service innovation process management can be considered management problems that knowledge management can alleviate. To understand the process for generating and managing knowledge in a setting that involves multiple actors with varied motivations, such as the emerging business ecosystem, we can learn from the classical knowledge management research. Knowledge management traditionally contextualises knowledge creation, capture and sharing in the context of an organisation (Dalkir 2005). As a larger perspective, the organisations create business ecosystems, where the same principles apply, but on cross-organisational and cross-individual scales. However, the multi-organisational viewpoint adds complexity to the knowledge management.

In knowledge management tradition, individuals in an organisation are the knowledge-base for the organisational potential and source of skills, competences and innovations (Dalkir 2005). Similarly, organisations forming a business ecosystem bring their capabilities, expertise and resources to the business ecosystem to benefit from the collaboration and from the other organisations’ capabilities and skills.

Nonaka and Takeuchi (1995) describe knowledge management as a process which captures, structures, manages and disseminates knowledge in a systematic way. This enables the organisation to work faster and better by reusing best practices and ultimately reducing work. Over time, the collective collaboration and decision-making should become more fluent and flowing.

The approach of Nonaka and Takeuchi (1995) in the knowledge conversion model and the knowledge spiral can be adapted to the business ecosystem knowledge management (see Figure 1). As can be seen at an organisational level, knowledge sharing is a continuous process between individuals that expands to the organisational level. The same principles can be applied to ecosystems, as the organisations and the individuals are the actors in the ecosystem. Notably, as the
organisations are typically involved in several ecosystems, the relevance of shared knowledge varies depending on the context.

![Knowledge spiral (adapted from Nonaka & Takeuchi 1995).](image)

Knowledge creation starts in Nonaka and Takeuchi’s (1995) concept by sharing knowledge through social interaction or socialisation of tacit knowledge, with the aim of generating new ideas or forming apprenticeship-type relationships. In the externalisation process, the knowledge is changed from tacit to explicit. This part of knowledge creation is described by the articulation and concretisation of knowledge. The combination of knowledge means the synthesising of knowledge, where new knowledge is created by recombining existing knowledge. Last, the internalisation of knowledge makes the explicit knowledge tacit by a process that takes the shared experiences and knowledge, making it used and useful at the individual level.

### 2.5 Service innovation and business ecosystem management

Research on service innovation and business ecosystems has similarities. These fields address the companies’ service business and creation of innovative services from a different perspective; however, the attempt to understand the improvement of business and company collaborations is related to services. In this study, creating service innovations through company collaboration, and the intention to form a viable business ecosystem, is considered an emerging business ecosystem.
The important aspects in the emergence phase are largely related to management of the ecosystem. In the management of a business ecosystem, the understanding of the dynamic structure of ecosystems is important (Adner 2006; Mercan & Göktas 2011). In the emerging phase, the ecosystem roles are not necessarily stable and the service innovation process may change these dynamics before the services reach the market. In this study, the business ecosystems were emerging in a way that is not usually addressed in the literature. The early phases of how the keystone sets its role in the ecosystem while the roles are not really set and how the decisions are made are not much reported. In an emerging business ecosystem, there is need for the actors to develop the antecedents for mutual collaboration and to get to know each other’s capabilities and expertise. A knowledge management perspective of collaboration and capturing, sharing and creating new relevant knowledge for the business ecosystem organisations can help in the formation process. In the business ecosystem context, the organisations complement each other by collaborating and contributing to the common interest, thus the creation innovative services can improve the understanding of the process from a knowledge management perspective as well.

A closely related aspect in the management of emerging business ecosystem is the creation of the offering of the ecosystem. When the business ecosystem is emerging in a research programme context, it is not often clear to actors involved what the most appealing and viable service offering might be. Moreover, if the actors are looking for innovative solutions together, they may not have a clear vision of the outcome. This dissertation offers new insights in to the creation of new services in the emerging business ecosystem using service innovation methods and tools. Additionally, the actor’s capabilities, visions and target setting are affected by the innovation activities, and those effects were made visible in this study. The inner workings of the ecosystems require a longitudinal look to understand the perspective and track the activities and decisions made.
3 Research process and methodology

The overarching research question specified earlier in this dissertation, directs the research approach in this study towards creating understanding of the chosen phenomenon, and aiming to ease the identified needs coming from the research setting and context. The main research approaches applied in this study are exploratory and on the other hand, inductive. Exploratory approach in research is used to gain better understanding of the phenomenon under study in an unclear or unfocused situation, and where better understanding needs to be gained (Collis & Hussey 2009).

Qualitative research paradigm refers to the purpose of gaining understanding of a question or an issue (Stringer 2007). Moreover, according to Stringer (2007) in action research, the posed research questions in the beginning of the research are typically broadly defined, and become more focused as the studied phenomenon becomes more clarified. In this type of research, generalized solutions may not be fitting to the situation of emerging business ecosystems in research program context.

The knowledge creation process in the context of this research commenced by investigating the practical phenomenon of emerging business ecosystems and participating in the practical work for the creation of service innovations. The research context greatly influenced the chosen methods for the research. The author of this dissertation took an explorative approach to the research context and scope, and first focused on increasing the understanding of the practical phenomenon by using action research as the main research strategy to carry out the research within the research programmes.

3.1 Research questions

The formation of the business ecosystems and the creation of services are integrated processes. In this particular context, building the relationships between the organisations precedes the successful collaboration for the innovative services to integrate or realise. Therefore, the relationships of the organisations and the service innovation activities are in the focus in this research to form the big picture of ecosystem formation in the research programme context. The overall research goal guided the researcher to adopt an inductive, explorative approach, and the chosen action research methodology, directed by the aim to understand the practical phenomenon from the beginning of the research. This allowed the research questions to become more focused as the research process advanced. In action
research, the focus of the research is to find out how things happen, instead of focusing on the why things happen (Stringer 2007). With the explorative approach in mind, the following research questions were set:

Research Question 1 (RQ1): How can an emerging business ecosystem be formed in the research program context?

While the research programme context was identified as a type of business ecosystem, the existing literature on business ecosystems provides few guidelines for this type of context. The main distinction is that the business ecosystems in the research programmes are intentionally formed, as opposed to traditional ecosystems in the literature (cf. Moore 1996). The practical process of forming a business ecosystem in a research programme setting was the first step towards understanding the emerging business ecosystems and their evolutionary process; the actors were not clearly positioned in their roles at the start of collaboration, and there was a need to facilitate the formation process.

This question is expected to make visible the dynamics of organisations, the issues caused by the early formation of the ecosystem and possible solutions. This question also aims to obtain knowledge about the facilitation of the formation and emergence process and clarify the business ecosystem evolution in practice.

Research Question 2 (RQ2): How can the service innovation process for creating new services in the emerging business ecosystem be described?

The service innovation process is included in the entire emerging business ecosystem formation, and therefore given specific focus. The service innovations are seen in the context of this study as one influencing part of the the overall emergence process, although the emergence process is expected to have an impact on the service innovation process as well as outcome. So they can be seen as interwoven and simultaneous processes. It is seen in this study, that understanding the service innovation process and the relationship it has to the formation of business ecosystems and actions will increase the value of the service innovations offered by the ecosystem.

This question investigates the ways in which the service innovation process can be done in an emerging business ecosystem in the context of research programmes. The companies in these emerging business ecosystems aim to create the purpose of the ecosystem and the services together, and several aspects need to be considered during their collaboration. Utilising open innovation and service design knowledge, the researcher is able to offer tools for the ecosystem
organisations to create new services. Experiences of using different tools in the service innovation process are expected to contribute to further understanding of the ways to facilitate and improve the tools used in service innovation in similar contexts. Based on the findings to the two questions above, it was identified that a more specific view of the knowledge creations and management in the emerging business ecosystems was needed.

Research Question 3 (RQ3): How knowledge management viewpoint can be used to analyse the management aspects in emerging business ecosystems?

This question indicates that aspects of a managerial nature were identified in service innovation in emerging business ecosystems that could be improved to ease similar ecosystems in the future. This question was therefore set to help combine the understanding of the management of a business ecosystem and the service innovation activities formed through RQ1 and RQ2. Practical experience collected from the research programmes needed to be analysed further, and it was recognised during the research process that the management issues could be treated as knowledge management issues in these emerging business ecosystems. This question brought the knowledge management viewpoint to an emerging business ecosystem and aimed to identify the relevant aspects from the knowledge managerial viewpoint. Through analysing earlier identified processes in the ecosystems, knowledge of the key aspects that affect the emerging business ecosystems management are obtained, and future improvement points found.

Research Question 4 (RQ4): What is known about the multi-disciplinary nature of service design in business ecosystems?

The practical knowledge of forming business ecosystems and the service innovation in business ecosystems were studied with RQs 1, 2 and 3. Since the research process started out as explorative research, and the ecosystem formation and service innovation as intertwined processes were studied from the practical point of view. The results found in the empirical research were in need of confirmation or contradiction from the existing literature. This research question also investigates the positioning of the research in this dissertation in the multidisciplinary field of the service innovations in business ecosystems, by looking into a specific multidisciplinary literature that combines these aspects. The aim is to find out where the practical research fits into the existing body of knowledge and where it can provide complementary knowledge or add new knowledge to this field.
3.2 Research process and phasing

The overall research process was designed to start by building a new understanding through the practical development of emerging business ecosystems and the service innovation process, and to tie the practical knowledge from empirical research setting to existing research later on. To reach the goals set for the research and to answer the research questions, enough empirical data had to be collected and processed, and relevant theoretical knowledge needed to be systematically collected and analysed.

The research conducted in this dissertation took place between 2012 and 2016. The main activities for the empirical data collection took place between 2012 and 2014, when the research programmes DIEM and DS were active. While further analysis, theoretical framework building and publishing of the results were partly done during that timeframe, most of this work was conducted afterwards.

In these two research programmes, the general themes were determined at the programme level, and focused projects were formed to direct that theme to a certain domain. The domain of these two projects was health and wellness. Participating organisations could be large enterprises, SMEs or very small companies, and each programme had one or more research organisation. The research organisations provided the scientific expertise that can be applied to practical development purposes in the companies. Since the interests of this research were in the formation of business ecosystems in the research programme context, and the organisational collaboration in value creation, these projects and participation in them suited the purposes of this research well.

Creation of new knowledge on emerging business ecosystems and the service innovation in these ecosystems was done by conducting research activities that aimed at helping the formation of the business ecosystems. This was done by analysing the effects of the activities to the overall processes of both emergence of ecosystems and service innovation. By comparing them to existing literature on formation of business ecosystems, key issues in managing the service innovation process and emerging business ecosystems were identified. Further analysis of the results of these processes was conducted by adding the knowledge management framework to create new understanding. Figure 2 depicts the overall research process phasing.
The first empirical parts of this research focused on following the actual emergence of the business ecosystems. Action research methodology is used as the overall strategy throughout the empirical research in this dissertation. The author followed the formation of the business ecosystems in a situation where the organisations’ roles were not fixed from the beginning, but the number of active actors in the ecosystem setting was fluctuating or the roles were significantly changing over time. The researcher followed and facilitated the evolutionary process to help the business ecosystems find direction and purpose for their common endeavour.

This study examined two separate long-term research settings of emergent business ecosystems. First, Phase I closely examined the first activities to form a wellness service business ecosystem. Here, the organisations started to work together to form as comprehensive a service offering as possible consisting of the organisations’ expertise. The phases involving finding the building blocks for
collaboration and suitable solutions for joint services were conducted over two years. This research was done in the DS programme and resulted in Paper I.

Phase II investigated the context of a health and exercise service innovation development. The study followed an emerging ecosystem of four companies and one research organisation. This research and its original publications focused first on the four-year period of the overall ecosystem evolution process that aimed at understanding and describing the overall service innovation steps identified from the process. The aim was to identify the innovation ecosystem evolution process and related service innovation activities and evaluate the tools and methods used in the service innovation steps.

The end stages of the service innovation and design process in the health-exercise ecosystem. This part of the empirical research focused on piloting the designed technology-based service. The aim of this research was to elaborate on the particular point in emerging business ecosystem evolution where the service concept was ready to be tested through piloting and what it meant for the emerging business ecosystem. The purpose was to find out the how to conduct a pilot study of a technology-based service concept in the business ecosystem context. This research was conducted in the DIEM programme and resulted in both papers II and III.

Phase III and subsequent Paper IV reflects the empirical findings of a new theoretical framework. To further understand the dynamics and evolution of business ecosystems, a need was identified to introduce an additional viewpoint of knowledge management. The entire process of ecosystem evolution presented in earlier papers and conducted in DS and DIEM was analysed using the knowledge management theoretical base. The study used the classical framework ‘knowledge spiral’ by Nonaka and Takeuchi (1995). The study aimed to add to the understanding of the business ecosystem formation process in a research programme context, ascertain whether the phases of knowledge creation can be compared to business ecosystem emergence in the research programme context and establish what can be learned from the management of ecosystems.

To connect the research to the theoretical basis used throughout this dissertation, Phase IV employed a mapping study literature review method to investigate the existing research in the field. The aim of the mapping study was to investigate the trends of existing literature on business ecosystem research, open innovation and service design. The study was designed to find the existing unifying papers of these areas. The perspective of the mapping study maintained that there needed to be either an explicitly named (business) ecosystem or a network of
businesses and other actors that could be considered a business ecosystem-like setting; this was determined in the mapping study through an inclusion of the search term ‘business network’. This research phase was reported in Paper V.

Table 2 summarises the primary focus of each paper.

Table 2. Paper content in relation to research questions.

<table>
<thead>
<tr>
<th>Paper</th>
<th>Primary Focus</th>
<th>RQ</th>
</tr>
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<tbody>
<tr>
<td>I</td>
<td>Follow ecosystem evolution, identify challenges and possibilities and understand the ecosystem decision-making.</td>
<td>1</td>
</tr>
<tr>
<td>II</td>
<td>Follow service innovation process and effects in an emerging business ecosystem; evaluate the suitability of tools and methods to facilitate innovation.</td>
<td>1,2</td>
</tr>
<tr>
<td>III</td>
<td>Activities in the emerging business ecosystem during the piloting of a ready service concept in a large-scale public setting.</td>
<td>2</td>
</tr>
<tr>
<td>IV</td>
<td>Understand the knowledge creation and conversion in emerging business ecosystems.</td>
<td>3</td>
</tr>
<tr>
<td>V</td>
<td>Mapping of existing research in the multidisciplinary nature of business ecosystems and service innovation.</td>
<td>4</td>
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Papers I, II and III investigate the practical phenomenon of emerging business ecosystems in the research programme context. These provide answers to RQ1 and RQ2. Further analysis of the phenomenon of emerging business ecosystems combining the practical research process into knowledge management theory of knowledge creation provides answers to RQ3 in paper IV. It was necessary to compare the empirical work to the existing theoretical body of knowledge in this multidisciplinary field of research, thus paper V provides the answer to RQ4.

3.3 Research methodology

This work uses action research as the research strategy. Action research is traditionally a social research process that aims to introduce and study a change process in a social phenomenon (Reason & Bradbury 2001). It is also applied in organisational settings in the fields of Information Systems (IS) and Business Studies (Baskerville 1999). Further analysis to the collected data was performed by applying an additional knowledge management framework to improve the understanding of the formation and service innovations of emerging business ecosystems. A systematic approach to study the existing literature base was used to complement the empirical study and connect the existing research of business ecosystems service innovations.
3.3.1 Action research

In general, the process of an action research study is a cyclical interplay of identifying real world problems to be solved, devising a plan to solve them, acting according to the plan (implementing the research actions), and analysing and reflecting upon the results. These activities can lead to the identification of a need for a new plan, thus starting the action research loop. The action research activities can be repeated until a desired outcome has been reached.

Action research is described as critical research or inquiry, meaning the researcher adopting this approach aims to see the studied phenomenon as it is in terms of the actions and interactions of the social setting being studied rather than relying only on informants’ perspectives and opinions of the situation (see Gummesson 2000; Herr & Anderson 2015). The action researcher attends the social situation to introduce possible actions that aim to solve identified problems by participating in the activities in way possible for the researcher. The business ecosystem setting allows the researcher in this study to locate ‘inside’ the business ecosystem and facilitate the change and formation of the ecosystem while being a productive part as well as an observer of the formation process. In action research, the participants of the research are not seen as subjects of research, but they work in collaboration with the facilitator to rigorously explore and reflect the common situation together (see Stringer 2007).

There are varying views of the position of a researcher as an ‘insider’ or an ‘outsider’ in terms of the closeness to the other participants in action research (see Herr & Anderson 2015, 40-41). Role of researcher in action research is to nurture the leaders of the community and help them lead the new ways of working after the researcher has left the research domain. In many situations were action research is used in organizations, the action researchers role has been to merely facilitate dialogue in organization and “help out” in transformation processes by fostering reflective analysis (Stringer 2007).

In emerging business ecosystems, in the context of research programmes, the researcher can be seen as an insider; however, as the goal of those ecosystems is that the ecosystems continue in the commercial world after the programme ends, the research organisation’s role can be very limited. Nevertheless, there is the reciprocal nature of give and take between the companies and the research organisations, and researchers are seen as part of the ecosystem during the programmes.
More specifically, the parts of the research process that required active interaction with various different actors (such as ecosystem organisations and users) were planned and executed following the PAR (see Kemmis & McTaggart 2005; Whyte 1989). The key aspects of PAR are the reciprocal nature of interaction between the researcher and the participants. PAR is traditionally used when research is conducted in a social environment where the participants may have conflicting interests (Herr & Anderson 2015). The setting of an extended business ecosystem with several actors can have such conflicts.

3.3.2 Data collection and analysis

The empirical part, the research conducted in the programme contexts, consists of the action research activities. The principle aims for the action research activities relate to the overall formation of the two business ecosystems and the subsequent creation of innovative or integrated services (Figure 3). The principles of action research were applied to the collaboration of organisations within the emerging business ecosystems in both research programmes. The activities were planned according to the goals set for the change process investigated in the business ecosystem. Here, the typical action research terminology of PLAN, ACT, OBSERVE and REFLECT have been used to describe the cyclic process.
The data collection and analysis in the research setting was conducted as follows. The study in the DS programme consisted of setting the targets and building the joint service offering of an emerging wellness business ecosystem. The wellness business ecosystem consisted of six companies and five universities (11 organisations). The companies were: (1) a service and technical platform for well-being and recreational service payment system, (2) a wellness activity monitoring service and platform, (3) a personal medical and wellness information database-based service, (4) an activity sensor manufacturer, (5) a scorecard-type organisational wellness measurement solution and (6) a meal planning mobile application. The university partners’ research focus areas were (a) technical sensor analysis, (b) user interface testing and data mining, (c) organisational wellness management and leadership research and (d) ecosystem building and service design research.

The phase I of the research was conducted in the DS, and reported in Paper I. The research consisted basically a series of workshops that were designed to incrementally build on existing knowledge and what was achieved, following the action research cycle. Workshops deepened the understanding of the management and service design of an emerging ecosystem. Four workshop cycles were
performed, which were backed up by a round of interviews. In the DS context, the action research interventions were the workshops: in the Table 3 activities DS A1, DS A2, DS 3 and DS A5. An auxiliary round of interviews, DS A4 was conducted to help in the process of reflecting the effects of the interventions in that point of the research process.

All sessions were partly recorded (presentations and summary discussions at the end, at least) and all the participants were from these ecosystem organisations.

Activity DS1, a workshop, was the starting place for the ecosystem, which included persons from 12 organisations (one dropped out after the workshop). After an introduction round, the workshop participants were organised into small groups of three to five people and asked to draw or write down a vision of the wellness ecosystem that could be the result of the research programme. The results were presented to other participants and discussed at the end. From the first workshop, the collected themes coming from the participants were mainly of the overall vision of the ecosystem, and the concerns they felt about the collaboration. The results were collected and disseminated to the ecosystem members; this was done by the author of this dissertation. The main results also served as a starting point for planning the next activity.

In activity DS2, the work continued by focusing on the potential integrations at both the service and technology levels. This was done by discussing freely about

<table>
<thead>
<tr>
<th>Business ecosystem Activity</th>
<th>Methods in Activity</th>
<th>Participants</th>
<th>Aims</th>
</tr>
</thead>
<tbody>
<tr>
<td>DS A1 Workshop teams formed targets</td>
<td>Workshop teams formed targets</td>
<td>18 persons from 12 organisations</td>
<td>Introductions, target setting</td>
</tr>
<tr>
<td>DS A2 Workshop, visualisation of ecosystem integrations</td>
<td>Workshop, visualisation of ecosystem integrations</td>
<td>9 persons from 7 organisations</td>
<td>Potential integrations</td>
</tr>
<tr>
<td>DS A3 Workshop, visualisation of needs and expertise</td>
<td>Workshop, visualisation of needs and expertise</td>
<td>11 persons from 8 organisations</td>
<td>Resource allocation, expertise recognition, problems</td>
</tr>
<tr>
<td>DS A4 Interviews</td>
<td>Interviews</td>
<td>11 persons from 10 organisations</td>
<td>Organisational expertise, expectations, service alignment solutions</td>
</tr>
<tr>
<td>DS A5 Workshop, two teams formed to work on cooperation and visibility beyond the current state</td>
<td>Workshop, two teams formed to work on cooperation and visibility beyond the current state</td>
<td>10 persons from 9 organisations</td>
<td>Finalise integrations, user identification, expand the ecosystem</td>
</tr>
</tbody>
</table>
the perceived integrations, and how the participants saw the integrations from their point of view. It was agreed that the researchers would prepare a sketch of the different level integrations to the other organizations to comment based on the discussion. This visualisation was prepared by two researchers in different organizations, one being the author of this dissertation. The perceived role of the organizations and their products or services in the ecosystem were derived from the discussion. The results were visualised as a tentative drawing that portrayed the technology and service layers and the actors in each layer.

The aim of activity DS3 was to make visible the expertise and interests from each research organisation and to help companies match this expertise with their current needs in their development work. This was done by each company listing the needs they had, that researchers might help solve on a board. Similarly, researchers listed their expertise and interests towards collaboration as well. New connections could be made between researchers and companies by matchmaking the needs and expertise on the spot. Furthermore, this resulted in forming a so-called research expert pool and making more detailed planning of researcher led actions in the future. The researchers present in the workshop (four including the author of this dissertation) were each responsible for taking their own responsibility of the needed actions with the companies.

Activity DS4 was a round of interviews. The researcher wanted to deepen the collaboration of the ecosystem by focusing on each organisation’s individual situation. The interviews focused on the situation in the development of each organisation and their expectations and worries for the ecosystem, and included themes taken from the coevolution stages in the business ecosystems according to Moore (1996). Ten organisations were interviewed, and one person from each organisation participated in the interview, except for one organisation, where there were two participants. The interviews were recorded and analysed. Analysis was done by extracting the emerging themes from the conversation. The themes revolved around the ecosystem’s service offering, business logic, key markets, customer segments and general issues regarding ecosystem collaboration and expansion.

Activity DS5 was the final activity of the emerging wellness business ecosystem facilitation activity reported in this research. The aim of this workshop was to find new ways of working inside the ecosystem and prepare for customer inclusion in the ecosystem. The group was divided into two and, after holding discussions, both groups started working on this same theme. Both sides then presented ideas and practices that could be used in the ecosystem. Some future steps
were agreed at the end of the workshop, and responsible persons (organisations) were named to start the work.

To ensure that the business ecosystem organizations got their opportunity to continue together with a joined mind-set, a feedback session was arranged. For the final discussion after the activity DS5, the author of this dissertation prepared material based on the final activities, mainly DS4 and DS5 and presented an overview of what the ecosystem members had expressed in regards to the ecosystem collaboration. This session was purely a feedback and reflection session that served to draw conclusions of the emerging business ecosystem in the DS program so far, and give the organizations possibility to verify that the researchers had interpreted the events in the ecosystem correctly. Mostly, the next steps and future activities were left up to formed collaborations between the organizations. This activity concludes the action research cycles in the DS research program, and phase I of this research, resulting in Paper I.

In the DIEM ecosystem, the organisations were looking for new business opportunities based on future health and exercise technology. They were interested in innovative solutions and ideas that could be utilised as a basis for developing new innovative services. The organisations involved were (1) a heart rate monitor manufacturer, (2) a rehabilitation service provider, (3) a health club offering personal training services, (4) an exercise gym manufacturer and (5) a university partner.

In DIEM, the action research strategy was visible in data collection so that each performed research activity contributed to incrementally increasing the knowledge-base. The following research activities were based on a reflection of the achieved results in each activity and what was still needed for the final service innovation to be designed. The entire research process consisted of five main activities: four workshops on varying data collection methods and one large scale service pilot. This pilot was treated as a separate activity because it was lengthy and consisted of several activities.

In DIEM, there were two main uses for the action research. The process of focusing the emerging business ecosystems goals and service innovation actions in workshops, meaning that interventions were the activities in DIEM A1, A2, A3 and A4 in this respect. The other action research cycle consisted of the piloting of the common R&D outcome of the first research outcome. The pilot included itself three iterative action research rounds, that were visible as the changes in the environment and included in turn auxiliary data collection methods to help the reflection of each change plan iteration put into action.
Overall, the workshops and activities produced a large amount of data including mind-map types of collaborated drawings, notes from the participants, and collages and business model canvases filled with information. Recorded audio was obtained from the presentations and discussions, and pictures were taken from the events. The innovation competitions and other activities in DIEM (DIEM1 and DIEM2) were planned and facilitated by researchers other than the author of this dissertation (Järvillehto et al. 2010; Tulppo et al. 2012); however, the data available from those workshops were used to analyse the relevant information for this research. The data were reused to find out how these workshops served in terms of service innovation and how they affected the dynamics of actors in the emerging ecosystem in DIEM. The author participated in and co-facilitated the remaining activities in DIEM (3, 4 and 5).

The research phase II took place in the DIEM program. The early stages of the ecosystem formation was heavily focused on the innovation capabilities through technology, and the iterative workshops were planned to serve the service innovation; however, they also had the side effect of forming the dynamics of the companies in the process. Table 4 shows a summary of the collected data in this phase of research and summarises the general aims of each method.

<table>
<thead>
<tr>
<th>Business ecosystem activity</th>
<th>Methods in Activity</th>
<th>Participants</th>
<th>Aims</th>
</tr>
</thead>
<tbody>
<tr>
<td>DIEM A1</td>
<td>Innovation competitions &amp; Focus group</td>
<td>9 persons</td>
<td>Find radical new ideas for exercise</td>
</tr>
<tr>
<td></td>
<td>Focus group</td>
<td>10 persons</td>
<td></td>
</tr>
<tr>
<td>DIEM A2</td>
<td>Innovation competitions, User diaries &amp; Focus group</td>
<td>12 persons</td>
<td>Understand potential users’ needs for the health-exercise concept</td>
</tr>
<tr>
<td></td>
<td></td>
<td>12 persons</td>
<td></td>
</tr>
<tr>
<td>DIEM A3</td>
<td>Short innovation competition</td>
<td>15 persons</td>
<td>Health-exercise concept design</td>
</tr>
<tr>
<td>DIEM A4</td>
<td>Workshop with business model tools</td>
<td>7 persons</td>
<td>Business model development based on the concept</td>
</tr>
</tbody>
</table>

The DIEM1 activity was used for gathering radical innovations through two separate methods: innovation competition and focus groups. Participants in the innovation competition were a mix of employees from the emerging business ecosystem companies and potential users found through advertisements. The innovation competition lasted two days, and resulted in scenarios of future gym services expressed using visual clues, notes and drawings on large paper canvases.
The focus group included some of the same persons but also new potential users. The participants used heart rate monitors (wrist worn exercise computers), for a week as inspiration and insight for filling out a diary to make notes on needs and ideas for the focus group discussion. The ideas were collected in recorded discussion after the week. Data from the competition and focus group were thematically analysed and combined, resulting in a visual view of suggested new concepts. Most of the emerging themes were found in both groups, but as a result, 160 themes and sub-themes were extracted. The results grounded the work for advanced exercise service. The results gave the companies ideas to start the technology development. The data collected through these innovation activities were to serve as background information for the ecosystem companies on where to direct their interests, following the principles of open innovation.

In activity DIEM2, the innovation competition was used again in a different setting with a new potential user base comprising customers of the rehabilitation institute. The arrangements and carrying out the innovation competition were similar than in previous step. To obtain comprehensive data, a focus group was also arranged to facilitate user diaries and group interviews. Participants in those activities were (a different set) customers of the rehabilitation institute. The focus group was organized by first arranging a group interviews to participants, with the discussion revolving around topics of how technology could help produce services to improve the rehabilitation and general exercise motivation from the customers’ point of view. The diary similar to previous step was also used for this group, as the participants were again gathered together to share the ideas from the diaries after three days of keeping them. The outcomes of this activity were analysed thematically, and again combined. The ecosystem learned from this was that users saw the technology potentially offering a variety of possibilities to improve the exercise motivation and monitoring the health of an individual.

Activity DIEM3 used a simplified, shorter version of the innovation competition format. This time the innovation competition was combined with a business model canvas (see Osterwalder 2008). The innovation aspect was directed to make the participants think about the business perspectives of the new exercise services. This activity comprised employees of the ecosystem companies complemented by persons regarded as ‘domain experts’ in the field. Altogether there were 15 persons. The results of this activity were combined as two different service scenarios and concepts, extracting the ideas coming from the competitions and the canvases. This step helped the ecosystem to recognise the key partners for
the future service. It would help them to expand the ecosystem and stabilize the roles to turn the ideas and R&D endeavours into business.

Activity DIEM4 used only the business model canvas to finalise the service business model and concept selected by the ecosystem. Experts were invited to participate alongside key company personnel from the ecosystem, forming seven people in total. Two separate models were created in line with the canvas format. However, based on the concluding discussion at the end of the session, and then extracting the information from the canvases, one clarified and detailed concept for the future exercise service based business model was made by the author of this dissertation. Paper II is based on the research conducted in this phase.

In addition in research phase II, a specific focus on the research process was given to the piloting of the DIEM service innovation (Table 5). This activity DIEM5, being such a large scale public pilot and about a year in duration, was planned and conducted as a separate action research activity (Paper III).

Table 5. Empirical research activities phase II, service pilot.

<table>
<thead>
<tr>
<th>Business ecosystem Activity</th>
<th>Methods in Activity</th>
<th>Participants</th>
<th>Aims</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constructing</td>
<td>Observation, short interviews</td>
<td>N/A</td>
<td>Create an inviting and functional Lounge</td>
</tr>
<tr>
<td>Adjusting</td>
<td>Thematic interviews</td>
<td>24 persons</td>
<td>Ease of independent use of Lounge</td>
</tr>
<tr>
<td>Finalising</td>
<td>Survey</td>
<td>545 responses</td>
<td>Renewing Lounge and systematic data collection.</td>
</tr>
</tbody>
</table>

DIEM5 research was conducted in three action research cycles. Each cycle aimed to improve the pilot area, Exercise Corner and Lounge by fixing problem and introducing new items. At the same time, the data collection was systematised. The collected data involved observation and thematic user interviews, which were used to extract users’ views and suggest alternatives to the space. Additionally, survey data were collected electronically in the pilot environment. Appropriate data analysis methods were used to produce the information that the companies needed about the users’ views and experiences of the space; the interviews were analysed thematically and statistical analysis software was used for the survey data analysis. As a final activity in the DIEM program, the pilot finalized the service innovation activities and produces a new exercise service to be taken into production as a program result.
In the phase III in this research, the empirically collected data described above were subjected to further analysis. The results of this research phase are reported in Paper IV. For the purpose of understanding the management issues and offering tools for further research of the service innovation in emerging business ecosystems, the knowledge management framework presented in Section 2.3 was used. The knowledge management view was utilised by adapting the knowledge spiral (Nonaka & Takeuchi 1995) to see whether the corresponding phases of knowledge creation, as presented in the spiral, existed in the phases identified for the emerging business ecosystems in the already analysed parts of the study, as described above.

The reuse of the data was treated as two cases to analyse the phases and actions that occurred, the recognised key decisions that took place and how these affected the management of the ecosystem and the service innovation outcome. These aspects were treated as the ‘knowledge’ relevant to the organisations from the viewpoint of the emerging business ecosystems. The cases were compared in their evolutionary life cycle thus far, making this approach a multiple case study (Yin, 2013).

In research phase IV, the research scope was widened to look at the existing literature and positioning of the research in this dissertation. For a clearer picture of the existing research on service innovations in business ecosystems, this dissertation included a mapping study approach to investigate a cross-section of the existing literature. The mapping study is reported in Paper V. This was done to reflect the empirical findings of the existing body of knowledge. A systematic mapping study as a literature review method enables the examination of relevant literature in a field that may be either scattered or new, and a traditional systematic literature review might be too extensive or restricting (Kitchenham et al. 2011; Petersen et al. 2008).

A systematic literature review has become an increasingly used research method in IS and software engineering (SE) for cutting edge research areas. The systematic literature review tradition that originated in the medical sciences has gained popularity in SE research, following strict guidelines and search strategies that were adapted to the SE research tradition by Kitchenham et al. (2011). A systematic mapping study as a form of a systematic literature review allows the researcher to map a broader subject domain, and could be used to study new emerging research areas where relevant, high-quality primary studies that are scarce, or to provide a more general overview of the subject (Kitchenham et al. 2011; Petersen et al. 2008). This tradition provides a clear protocol for the execution of the systematic mapping study and guidelines for analysis and
reporting. The mapping study examined the research that combines existing service design research or open innovation research in the context of business ecosystems or ecosystem-like settings. In the planning and execution of the study, the objective and search strategy were determined first. The used search string was in the form of "("service design" AND "business ecosystem") OR ("service design" AND "open innovation") OR ("open innovation" AND "business ecosystem") OR ("service design" AND "business network") OR ("open innovation" AND "business network"). The search string was adjusted to fit the syntax of each database, and to search in the titles, abstracts, and keywords.

The databases that were included were those that were considered relevant IS and SE research, and including management and marketing or other business studies domains. The selected databases were Scopus, Academic Search Premier (EBSCO), ACM Digital Library, IEEE Xplore, Springer Lecture Notes in Computer Science, Science Direct, Web of Science, and Wiley Online Library. Time restrictions for the searches were defined so that all papers up to the end of 2015 were included. Figure 4 shows the process for selecting the final data set.
Initially, 788 potential papers were obtained from selected databases. Through exclusion criteria and three rounds performed by two researchers, the primary dataset of 38 papers was used for analysis. By identifying and analysing the relevant literature, it was possible to develop conclusions on the challenges of managing service innovation in ecosystems. Identifying the relevant issues in terms of data and knowledge management should aid decision-making in the creation of innovative services within the ecosystem context.

The primary studies were subjected to data extraction. Papers were classified using a data extraction template, and continued working with it to extract needed metadata, classification data, and descriptive data, that would help answer the set research goals for the mapping study. The extracted data included: the year and type of publication and the citation count, the identified research area (business ecosystem, other business networks, service design, and open innovation) was based on the description found in the paper. Similarly, the terminology the authors used for the type of network they had studied was extracted, along with the passages explaining the relationship of the study to services or innovation and the other
frameworks or theories that were named and used in the study. This content from the papers was inserted into large tables to see the relevant data and use it to compose the results.
4 Original contributions

The original publications included in this doctoral dissertation correspond with the phasing of the research. Papers I, II and III present the results of longitudinal work following the formation of two business ecosystems in the technology-based health and wellness domain that analyse the overall formation, management and value-creations process. Paper IV presents a combined analysis of the empirical research and adds the perspective of knowledge management to the analysis. In paper V, the phenomenon studied in papers I, II and III of this dissertation provides the basis for conducting a literature review that allows the researcher reflect her work in light of existing literature. Paper V was based on a study conducted as a systematic mapping study. The author contribution for each paper is elaborated in each section.

4.1 Paper I: Service design and coevolution of an emerging SME wellness ecosystem

A detailed view of the early phases of an emergent wellness business ecosystem was gained through the DS project reported in paper I. The study in the paper follows the two years of a wellness business ecosystem formed by 11 small companies and research organisations. The aim was to follow the business ecosystem evolution, help the organisations by identifying challenges and possibilities, and understand the decision and directions made in the emerging business ecosystem.

The study was conducted as action research. The researchers organised face-to-face workshops that brought actors together and were themed around getting to know each other, collecting the needs of the companies, and finding and matching the capabilities of the actors across the ecosystem. Workshops were designed to help build trust and openness within the ecosystem when clear leadership had yet to take place. The role of the researcher was to act as a facilitator and help the ecosystem to get started.

Several possible solutions were presented to find a common service design vision. When the companies came together to find synergies in an emerging wellness business ecosystem, the services or service concepts existed in their catalogue. Possibilities for creating joint services formed of components of the ecosystem companies were offered as a solution. There was no need for all the companies in the ecosystem to try and fit their service together, but the consensus
was that logical, complementing package solutions based on identified user needs would be the best course of action.

The author of this dissertation planned and facilitated the workshops used for data collection in this paper in collaboration with the co-author. The author planned the interviews with the help of her supervisor (not a co-author) and conducted them alone. The author also designed and performed all of the data analysis. The content and format of the results were verified via discussions with the co-author. As the corresponding author, the author of this dissertation was responsible for writing the paper. The co-author supported by presenting the results and structuring the paper.

4.2 Paper II: Innovation in evolving business ecosystem: A case study of information technology-based future health and exercise service

The goal of the research in this paper was to examine the practical process of an emerging innovation ecosystem. The study aimed to understand the innovation process and decisions that lead to new technology-based services in an ecosystem. As the ecosystem actors were new to each other in this collaboration, there was a need to analyse the effect of the service innovation process to the ecosystem evolution. The goal of the innovation ecosystem was to develop a new technology-based health exercise service together.

A four-year longitudinal study was conducted as action research in which the researchers followed a case of an evolving innovation ecosystem. Throughout the research, the interplay of actions intersected the development work of companies by first innovation inducing and later service conceptualising activities. Four main activities proceeded the service innovation process. Within these activities, several methods were used to collect data suitable for the stage and participants of the innovation process. The methods ranged from innovation competitions to user diaries and from group interviews to workshops.

From the research data, the authors of the paper extracted an innovation process for the ecosystem. The innovation process followed in principle the process of open innovation (Chesbrough 2003). The identified steps in the case of a new health and exercise service were from technology and customer driven ideation steps to business focused steps. The first two steps in the service innovation process produced many ideas, which were refined within the ecosystem. The most suitable
ideas were moved into business development by focusing the innovation activities around a single, focused concept.

It was observed that a level of openness was needed in each step relating the ecosystem to its surrounding world of potential customers and stakeholders. In the first steps, there was a need for the flow of different ideas and visions of a new type of service. For this purpose, different types of groups were invited to participate in the innovation activities. As the idea became more focused, the ecosystem became more closed, and only some actors, deemed experts with valuable insight, were invited to participate in finalising the concept.

However, the evaluated methods gave some insight into the practical benefits and challenges in the service innovation management of a business ecosystem. To collect more ideas, the innovation competition format was useful, although compared to user diaries and focus groups, it failed to produce radically more advanced ideas. The innovation methods were unable to produce an estimate of the actual market value of the ideas that were left for the ecosystem central actors – the companies – to evaluate.

Resources are a key aspect in arranging the innovation activities: the more open they are, including gathering more people in a face-to-face situation, the more resources are required for planning, executing and analysing the activities. In a setting where researchers conduct the study, this is possible, as is often the case in ecosystem settings.

The author of this dissertation contributed by defining the research topic of this paper. The author chose to use data previously collected by other researchers from the emerging business ecosystems. The first two research activities were planned and executed before the author joined the programme. The author participated in the two later research activities. The plan and facilitation of activity 3 was performed by another researcher in the research team, and the author participated in collecting and analysing the results. The author was responsible for planning and facilitating activity 4 and for planning and analysing the collected data. The formulation of the results was done in collaboration with the co-authors, who supported organising the paper, presenting the results and participating in the writing process.
4.3 Paper III: Managing business ecosystem in the piloting of a technology-based health-exercise service

As a continuation of the innovation steps presented in Paper II, the piloting of the health and exercise concept (Exercise Corner) was a closer focus of the research. Including users to obtain the user’s viewpoint during the final stages of the concept development gave valuable feedback for finalising the concept.

The approach used for this study was action research. The PAR approach was used because of the intensive nature of researcher participation for the pilot planning and data collection on-site as well as introducing interventions to the pilot. There were three action cycles: constructing, adjusting and making the final changes to the pilot. Each cycle followed the PAR process of making a plan for the cycle, acting and observing at the pilot site and reflecting on the data before making plans for altering the situation. The action cycles included further methods to collect the data. Those cycles were designed so that in the beginning of the explorative research, qualitative methods such as interviews and observation were used. Towards the end of research, automated survey tools and monitoring of pilot space were the primary sources of user data.

In a technology-based service that is targeted for independent use, there are challenges that only testing in a real life situation will reveal. That is particularly true for a service that is targeted for use in a public location. Users need sufficient guidance for any phases of the use of the service that might be unclear. It was found that in a public location, the people need to be convinced to come to the pilot location, and the purpose of the equipment and the available services need to be made clear.

User experience of the service in a public space is in the core a service design issue. The space where the service is offered needs to be inviting and the required aspects of the use of the service and accompanying technology need to be clearly communicated. It took three iterations of the action research process to satisfy the level of the business ecosystem. The researchers used various methods to obtain the required data from the users to analyse the challenges and successes of the pilot. First, the active involvement of the researchers was required as they were observing and interviewing the users of the service. This helped for a more detailed view of the needed data collection. Final data to analyse the preferred aspects and challenges, as well as the potential customer base and markets were obtained using an electronic survey tool. Complementary data from the exercise equipment and devices at the location allowed evaluation of the usability and frequency of use.
The benefits for the ecosystem members can be summarised from the aspects that they contributed to the piloted service concept. Each of the technology developers also obtained feedback for their new versions of equipment developed for the pilot, such as the smart card operated gym equipment and measuring device. The service companies obtained data regarding the appeal of the concept, its issues and preferred features. The feedback helped to fine tune the content of the service and the information that had to be conveyed to the users. Additionally, some estimations of the market potential were gained.

The author of this dissertation planned the overall approach for the study described in this paper. The data collection was planned and done in collaboration with other researchers. While the author of this dissertation was responsible for planning and analysing the observations and interviews, the data collection was a shared responsibility. The survey questions were planned by three researchers, and the implementation of the survey and the results analysis was the responsibility of another researcher. When writing this paper, the author of this dissertation went through the data again from the viewpoint of the aim of this study. The author of this dissertation served as the corresponding author and had the main responsibility for writing the paper. The co-authors participated in structuring the results.

4.4 Paper IV: Managing emerging business ecosystems – a knowledge management viewpoint

Papers I, II and III studied the emerging business ecosystem and the innovation and service design activities. Paper IV analyses the entire process of service innovations in emerging business ecosystems from the viewpoint of managing the knowledge and related working practices in the ecosystems. The aim of the paper was to further analyse the aspects of an emerging business ecosystem and identify current practices and needs for further research.

This study used the existing data of the two research programmes and compared the data as two cases to form the analysis. The identified processes and used methods and tools were re-analysed from the viewpoint of knowledge capture, linking with existing knowledge and the creation of new knowledge used in the business ecosystems jointly and in the separate organisations. The analysis of these processes, methods and tools were fitted into the knowledge spiral of Nonaka and Takeuchi (1995).

By analysing the activities in the research programmes, the ecosystem formation and service innovation processes were identified. Some of the activities
in these processes seemed to match the knowledge spiral. These activities were associated with the phases of knowledge creation where knowledge residing inside a single organisation is externalised for the use of other organization. In addition, the capabilities in the emerging business ecosystem were combined by linking some of the existing knowledge, identifying new service opportunities among the business ecosystem actors, and internalising the knowledge by realising those identified opportunities and creating a new business together. The evolutionary dynamics and the change in the organisations was also observed, suggesting that participating in business ecosystems needs further research to avoid the problems organisations face during collaboration; by addressing these problems as knowledge management issues, they may be solved using knowledge from this established field.

The author of this dissertation was responsible for setting the research question and approach for this paper and for planning the use, re-analysis and combining of the pre-existing data (collected for papers I, II, III), and for forming the results. The co-authors supported the formation of the analysis framework for the data. The author of this dissertation served as the corresponding author and was responsible for the writing process.

4.5 Paper V: Service innovation in business ecosystems research – a multi-disciplinary mapping study

The aim of this paper was to find the overlap among existing research on service innovation in the context of business ecosystems or networks similar to business ecosystems. The author identified during the dissertation research process that the research on service innovation in business ecosystems is multidisciplinary; the related research around the phenomenon could be found coming from several aspects and traditions. There was a need to understand the topic as a whole to identify its current state and identify gaps in existing research and future research directions. Therefore, the fields of business ecosystems, service design and open innovation were included in the mapping study to find the unifying research existing in these areas.

This part of research was conducted as a systematic mapping study following the guidelines of Kitchenham at al. (2011) and Petersen et al. (2008). The research protocol was devised to map out scientific databases relevant to the IS, SE and business studies fields and to search for relevant studies. The identified papers were placed under a review process with exclusion/inclusion criteria to determine the
relevant dataset that would answer the research questions. Finally, out of 737 searched papers, 38 were identified as relevant and formed the dataset used for analysis.

The primary study dataset confirmed that most of the relevant research on the topic resides in the IS and business fields. Most of the identified studies were from the past 10 years. From the three different aspects included in the study, innovation and ecosystems seemed to have some overlap, while research on service development in ecosystems was less frequent.

Managing the business ecosystem is a central issue in the successful service innovation process. After the initial formation, the ecosystem requires facilitation for networking and knowledge sharing. The leader’s role is to coordinate the relations and resources, establish requirements for the strategy and brand or platform and coordinate the collaboration. Other roles in the ecosystem bring in innovative capabilities increasing the R&D efficiency, but they need to have clear tasks and roles.

Service innovation in the ecosystem context is essentially the process of value creation within the ecosystem. Similar aspects are seen as key factors in the creation of value, as in the ecosystem management in general. First, the ecosystem needs to have a fundamental understanding of what in the ecosystem creates the value and what the ecosystem offers. The other important consideration is the role of the customer, or end-user, since they ultimately determine the value of the ecosystem.

The author of this dissertation was responsible for constructing the search strategy, conducting the searches, retrieving the data and storing the data in a suitable format. Together, the co-authors went through the study inclusion/exclusion rounds to arrive at the dataset of acceptable papers. The author of this dissertation was responsible for analysing the dataset, while the co-author supported in designing the analysis and structuring the results. The author was responsible for writing the paper and served as the corresponding author.
5 Findings

The emerging business ecosystems have great potential when they form in a supporting environment, such as that offered by the research programmes. The defining characteristic of the emerging business ecosystems studied in this dissertation is that they are intentionally formed, which creates the need for facilitation, and even a degree of turmoil, before the actors, especially the needed leader, find their roles and the keystone stabilises. The need to understand the business ecosystems emergence in this specific context (research programmes) motivated this research, and it became evident during the course of this work that the formation of a new business ecosystem and the services created or designed within the ecosystem are processes that influence each other greatly. For the purpose of this study, these processes are addressed separately, but the author examines them with the reality in mind that one influences the other. Both the emergence of a business ecosystem and the service innovation process are regarded as management issues, where solutions are often based in open communication and clear practices. To improve the management of an emerging business ecosystem and accelerate the collaboration, this study also offers a foundation for developing management practices. Creating common working knowledge by making the relevant knowledge and working practices from organisations visible and transferable to other organisations in the ecosystem improves the collaboration.

5.1 Formation of the emerging business ecosystem in the research programme context

Research Question 1: How can an emerging business ecosystem be formed in the research programme context?

The formation of an emerging business ecosystem can be seen as a process of interaction between the organisations that leads to building mutual interest and trust between the organisational actors. Additionally, by exposing the capabilities in the emerging business ecosystem, the vision can be made clear. Most importantly, leadership in the ecosystem in the research programme context is vital: a leader needs to emerge to take responsibility for aligning the ecosystem.

In this research, the two emerging business ecosystems had different starting points and objectives in the beginning, which led them to different paths and
different outcomes. The overall process of an emerging business ecosystem formed in a research programme context was identified as follows.

In the first meeting of the companies in the DS wellness business ecosystem, it was visible that the companies had a positive, even idealistic view of what could be accomplished by collaborating in an ecosystem. However, the organisational actors needed to get to know each other first, and this was facilitated by arranging a workshop with all the participants. The organisations worked in groups to express their overall goals and concerns for the ecosystem. They quickly identified some potential collaborations and complementarities among each other’s services and products, suggesting an easy first stage of collaborations and thus indicating that some collaboration started right away. The companies also had the interest to come up with some kind of unified service model that could cover all the companies in some respect.

Next, the companies started to notice that they had some conflicting interests and expectations of each other and of the whole outcome, the unified service. This became visible when the possible technological and service integrations were outlined in the following workshop. The problems emerged partly because some of the companies were recent start-ups with few resources and their product was still in the development phase. There were also different views of who the leader of the ecosystem should be, since there was no clear leader company. The companies could not decide who should lead between a wellness platform developer and a company which offers analysis tools for managing the aggregated data that was going to be produced by the devices in the ecosystem. The emerging business ecosystem tried to solve these issues in workshops with support from the researchers. Additionally, the conducted interviews aimed to collect the expectations, needs and solution suggestions from all the organisations separately. The issues and suggested solutions were finally discussed and the next steps to find solutions identified. After the wellness mobile platform developer took the leading position in the ecosystem, the services started to align. The role of the researchers and facilitators diminished and instead became their focus area experts.

In the DIEM health-exercise ecosystem, the companies were already familiar with each other, and there were fewer companies than in the DS ecosystem. They also had the idea of creating something completely new together. In the beginning of the ecosystem formation, the leadership was considered to be with an electronics manufacturing company that made wearable exercise computers. This company was already considered well-established in the exercise domain and had a good global market position. The collaborative work to identify an interesting and
investment-worthy service innovation began to take form through collaboration with stakeholders and potential customers. In the middle of the development and design process, when the technology and user-based approaches were complete and the business concept design began, the ecosystem experienced a change in leadership. The service concept started to develop in a direction in which the wearable exercise computer manufacturer was not interested in investing or leading. As the new service concept needed a stronger ownership, the health club took the lead in the design of the concept. After the end of the programme, the ecosystem split into two parts, and both parts took the development advances made during the programme, but they continued to develop the technology-based services in separate directions. The health club, which now owned the service concept that was piloted and finalised during the programme, started to gather new actors to its ecosystem to expand the service and prepare to launch it.

In both cases, the emerging business ecosystem started by setting the common goals for the ecosystem. Some required activities were identified for the decision-making process. While a positive attitude towards the collaboration is vital for the ecosystem to start its work together, the formation of a concrete outcome took time. Without clear leadership, the challenges can become disrupting and, as can be seen in the case of the wellness ecosystem, some companies started to lose interest in the common vision. Eventually, the wellness mobile platform developer took the lead, continued to foster the vision that was set in the beginning and streamlined it to create a more coherent wellness business ecosystem and services around their own platform. In the health-exercise ecosystem, the leadership needed to change in the middle of the process to ensure continuation of the development process. Figure 5 combines the key phases in both emerging business ecosystems into one view of an identified formation process.
During the initial ecosystem formation process, the key management aspects are building trust among the actors, establishing the actors’ capabilities and setting the overall vision for the business ecosystem. Reflecting the phases of ecosystem formation in this research to Moore’s evolutionary phases, it seems that the both the business ecosystems during the timeline of this research, did not go beyond the first pioneering stage. The ecosystems were focusing in innovation and design, and only at the end of this study, we were able to get to the business model development. Therefore, this research zooms in on the first phase of ecosystem formation. Once the targets are set and the resources are accounted for, the concretisation of the goals and the service innovation and design begins. Here, the management issues involve ensuring openness within the ecosystem, integrating the technical platform and designing the services together. This is in line with previous research with ecosystem coordination and management research presented in this dissertation earlier, such as Gaver and Cusumano (2014). Particularly the establishing of the leadership is the strongest indication that the ecosystem has started to build on the foundation it was started in.

When the ecosystem starts to gain its form as it is getting ready to enter the markets, it is important to stabilise the roles in the ecosystem; pilot the service and technology or test the integrations, whichever is relevant to the setting; and finalise the business logic. Overall, the evolution process does not stop with the end of the research programme; as the ecosystem enters the markets, other actors might join and old ones might leave, and the ecosystem leader needs to stay constantly aware of the relevance and the value of the business ecosystem. It can be identified that as in Iansiti and Levien’s (2004) characterisation of different roles in the ecosystems, in the DIEM context, the initial ‘keystone’ was indeed replaced by the competing ‘dominator’.
Some of the earlier research identified business ecosystems through their stability and long-term goal setting (Domínguez-Péry et al. 2013); however, the ecosystems studied in this research had not reached such phase yet in their evolution, but rather were in the very early phase.

5.2 Service innovation process in the emerging business ecosystem

Research Question 2 (RQ2): How can the service innovation process for creating new services in the emerging business ecosystem be described?

The service innovation process in emerging business ecosystems focused on two aspects: finding new innovative ideas for a novel service and integrating existing services together in a meaningful way. The process can be seen to move from open innovation to closed service innovation and service design, and the process opens again for open evaluation of the integrated technology-based services.

In the DIEM health-exercise ecosystem, the organisations decided to start the design process from the search of innovative ideas through principles of open innovation and innovation competition. Through innovation activities, this emerging business ecosystem got many different outspoken desires of possible new services; they chose the most interesting ideas based on the organisations’ existing interests and capabilities, and the overall vision. Those ideas that seemed possible to design were taken further in the service design process.

The service concept started to come into focus as a new type of health-exercise using smart technology that would assist the user to perform a small daily exercise on two or three gym machines and receive feedback based on the activity. Investigating the commercial potential and success of the service design choices was part of the service design process that was performed using service design methods and tools. The ecosystem core actors performed two iterations of working together with additional actors that the ecosystem companies regarded relevant, such as other health industry professionals and business development experts. The reflections of these workshops and the status of the technology development lead to the preparation of a large scale pilot, where the new technological integrations and the health-exercise concept were tested. Table 6 summarises the main results from the innovation activities in the health-exercise ecosystem.
Table 6 Summary of innovation activity outcomes in a health exercise ecosystem.

<table>
<thead>
<tr>
<th>Steps</th>
<th>Aim</th>
<th>Methods</th>
<th>Main results</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>New visions for technology-based services</td>
<td>Innovation competitions, focus group</td>
<td>Scenarios of future services with technology features</td>
</tr>
<tr>
<td>2</td>
<td>User perspectives for future services</td>
<td>Innovation competitions, focus groups, user diaries</td>
<td>Three different scenarios new service</td>
</tr>
<tr>
<td>3</td>
<td>Conceptualising the future service in the exercise context</td>
<td>Simplified innovation competition and Business model canvas workshop</td>
<td>One concept designed to fit ecosystem leader brand</td>
</tr>
<tr>
<td>4</td>
<td>Business model for the exercise concept</td>
<td>Business model canvas workshop</td>
<td>Business model for the exercise corner</td>
</tr>
<tr>
<td>5</td>
<td>Pilot for the exercise concept</td>
<td>Real-scale pilot of technology and service in public space</td>
<td>Finalised concept and user feedback</td>
</tr>
</tbody>
</table>

The DS wellness ecosystem planned to integrate the different existing technology-based services to create a service ‘catalogue’ that is either served on a technical platform or otherwise clearly linked together. The ecosystem agreed on a target for their collaborative service design effort: to enhance the wellbeing of an individual and prolong their working health in particular. To test the appeal of the overall concept and the potential business logic, the ecosystem needed to test the service with customers. The companies agreed to start by negotiating one occupational healthcare actor as the main distribution channel and contacting selected companies directly. The research programme tested the wellness mobile platform, some attached devices and the reporting of the wellbeing of the workplace community. The designs were finalised and the service portfolio and platform could then be taken to commercialisation. Figure 6 summarises and unifies the open innovation and service design phases as service innovation phases in the emerging business ecosystems.
In terms of service innovation and design, the challenges in the emerging business ecosystems varied depending on the intended outcome and target state. Using open innovation principles and innovation competitions can be demanding in terms of not being able to predict the outcome at the start of the process. Still, the open innovation methods were used, because the DIEM ecosystem wanted to collect new ideas based on the actual needs of the potential customers. The innovation activities in DIEM in particular, followed the open innovation principles in the beginning of the process. The innovation process as a whole seemed to follow common funnel-ideas of innovation processes (Chesbrough 2012). These innovation and design activities were quite resource consuming, as the researchers were responsible for planning, executing and analysing the results. The researchers supported the ecosystem companies focusing on the concept and supported the leaders as required, but the leaders of the both ecosystems were in charge of the overall vision.

In the alignment of different services that all had the same overall target of promoting their users’ wellbeing, the challenges were twofold. First, service packaging, targeting and revenue logic need to be planned. Second, the target customer base proved to be a challenge. The working wellness or occupational wellness promotion concepts were new at the time, and finding the distribution channels and customers in immature markets in Finland was difficult. This meant that working with potential customers to enhance the customer service experience and investigate the real customer needs was challenging. When a new service is being designed, the interest of the leading company is needed. Once the leader in both ecosystems took a clear role, these challenges became easier to solve, since the leaders set the rules for the revenue logic and distribution channels, among other things. It could be concluded, that had the target customer base identified in earlier phase of in the ecosystem, and had one of the companies started as leader earlier in
the formation process, there might have been a better success with identifying and defining the service value. This perspective adds to the importance of not trying to define the value in the co-creation process without the clear customer perspective, as is stressed throughout the service design literature (Edvardsson et al. 2012; Evanschitzky et al. 2011).

5.3 Management aspects of emerging business ecosystems in the research programme context

Research Question 3 (RQ3): How knowledge management viewpoint can be used to analyse the management aspects in emerging business ecosystems?

The emerging business ecosystem requires managerial activities that enable the members of the ecosystem to build trust, establish roles within the ecosystem, identify capabilities and set the vision for the ecosystem, as recognised in sections 5.1 and 5.2. Analysing the emerging business ecosystems from the knowledge management viewpoint, some aspects can be identified for improvement. The knowledge within the ecosystem needs to be made visible through interactions between the organisations. The linking of knowledge requires support to enable the organisations to start work on integrating the technologies and services. It can be expected that as the integrations become more concrete, the business aspects become relevant and both the value of the services and the business models need to be identified.

The emerging business ecosystem knowledge creation, capture and sharing process was analysed using the knowledge spiral (Nonaka & Takeuchi 1995). The required action and decision-making can be identified from the emerging business ecosystems’ evolutionary process. Figure 7 shows the key aspects of each identified phase in the knowledge conversion.
Externalising knowledge was seen as the start for the knowledge conversion in the emerging business ecosystem in the research programme context, which means that the relevant knowledge within each organisation needs to be elaborated to others, and the knowledge is explicated. In the wellness ecosystem, this meant bringing the actors together for the first time, making the introductions and having them think about the visions and targets for the ecosystem together. These actions were identified as the key actions that started the knowledge conversion. The type of knowledge they shared was the domain expertise and technical know-how that existed in each organisation, which more specifically means the expertise available for the ecosystem.

In the health-exercise ecosystem, the situation was different in the sense that the organisations were already familiar with each other, and the wearable exercise manufacturer was the leader organisation. They recognised the need for external knowledge and for making that part of their goal setting. The innovation activities in the beginning of the formation process brought in new knowledge directly from outside the ecosystem; however, the ecosystem’s existing interests, capabilities and vision directed the process in the background.

The potential for value creation through service innovation in these ecosystems was linked to the combination of knowledge. In the wellness ecosystem, it was seen as the pooling of knowledge that enabled possible integrations to be made visible to the ecosystem at both technical and service levels. This occurred during and after the second workshop. Making the potential integrations visible also
highlighted some problems in the ecosystem as well. The early positivity was replaced by the realisation of some conflicting interests and differences of opinion among the leadership. These needed to be overcome for the emerging business ecosystem to continue and for the true ecosystem to form.

In the health-exercise ecosystem, the service concept started to form after completing early technology integrations and internal testing, which were done based on a decision made after the early open innovation steps. The service concept had taken the early form of the health-exercise concept at this point, and the companies started to investigate the commercial potential of the concept while benefiting from the knowledge of some chosen business domain experts, which they brought into the ecosystem.

**Internalisation of knowledge** in both ecosystems can be linked with, or rather solve, leadership issues. For example, the researchers in the wellness ecosystem decided to make their support known to the entire ecosystem so that the companies knew what they could get from the researchers from different institutions. To further clarify each organisation’s status and needs, the interviews were conducted, and the companies expressed their desire to resolve things together. The wellness mobile platform developer then took a more visible role that after a while led to clear leadership in the wellness ecosystem. This enabled the ecosystem to make the technical and service level integrations and set the target customer base.

In the health-exercise ecosystem, the service concept had started to take form. However, for the customer testing and commercialisation to begin, the leadership of that ecosystem also had to change. The health club took the lead by taking the concept into public testing and finalisation. This led to the earlier leader (wearable computer manufacturer) to withdraw from the ecosystem, as they saw that the new concept no longer fitted their vision and portfolio.

It is assumed that **knowledge socialisation** occurs more frequently between the individuals in each organisation than at the ecosystem level and that it is more difficult to point out those linkages at the ecosystem level. For example, those persons that work together to create the technical integrations are possibly transferring the tacit knowledge of other organisations to their organisations. However, this aspect needs further investigation, as this was not clearly recognisable in the way this research was conducted.

Analysing the knowledge conversion in these ecosystems concretised the transfer of knowledge and the phases in the formation of the business ecosystem as well as in the service innovation that had the defining effect for these ecosystems. Those phases and decisions that had the most effect were in the strategic vision and
target becoming clear to the ecosystems and the identified need for certain expertise, furthermore matching the expertise inside the ecosystem and identifying the possible synergies. Starting to make new combinations of knowledge through service and technology level integrations and forming solid leadership that took lead of the business development were the final defining factors for the organisations to remain in (or leave) the ecosystem.

5.4 Existing research in the context of service innovation in business ecosystems

Research Question 4 (RQ4): What is known about the multi-disciplinary nature of service innovation in the business ecosystems?

The relevant body of knowledge in service innovation in business ecosystems resides mainly in business and ICT-related research. Business ecosystems and open innovation seem to be a natural combination of research topics in this area, and the research typically focuses on the management of innovation networks, of which business ecosystems are an example. Almost equal parts of identified relevant research come from either IS or SE field publications or from management and business studies forums. This supports the positioning of the work in this dissertation as well, as it is positioned to the information systems research field, with influences form the business management research field. Antecedents for service innovation were identified, such as practices for ecosystem actor involvement; however, it was identified that more focus is needed on the practical tools and methods for service innovations in business ecosystems.

Research on service innovation in business ecosystems has gained popularity in recent years. According to this research, the trend seems to be diversifying in terms of interest areas on business ecosystems, which could indicate that the field is maturing. On the other hand, the results from Paper V show that the related research in this field is focused on understanding how to strategically organise and make decisions in the business ecosystem regarding the service and innovation aspects of value creation. It is the view of this dissertation as well, that these are the key effecting aspects, as there will always be new organizations and new people forming ecosystems. Interest in understanding and further improving the antecedents of different types of ecosystem environments is important.

Nevertheless, when examining the focus of research around the theme, there is a clear link between business ecosystems and innovations research, and less
research on service design. It becomes evident that research specifically on open innovation and business ecosystems deals with similar issues: developing new innovations with the optimal set of actors and their capabilities. Understanding the network and actor roles and leading the organisations have been identified as key challenges in both innovation networks and business ecosystems. The research in this dissertation is also focusing and contributing to adding to this understanding.

The interaction between the business ecosystem actors, in terms of collaboration or contributing to the ecosystem, is a management issue that was also identified as a challenge. The main principles related to managing service innovations in ecosystems and the ecosystem formation can be seen as the management of a relationship by recognising the actor’s capabilities, creating the joint vision of the ecosystem and building mutual trust between actors. The coordination of ecosystems, consequently, should not be too rigid, thus allowing new collaborations and innovation to be formed. It was identified in this dissertation, that analysing the interaction and activities form knowledge management perspective, we can identify further research needs and possibilities to further the understanding of business ecosystems.

In terms of the service perspective in the ecosystem context, services are seen as the value creation outcome of the ecosystem. The ecosystem should thus include customer viewpoints to value creation in service creation and innovation. Customers are considered integral to the ecosystem for it to truly create the value. Very few papers have studied leveraging customer insight in ecosystems; they considered it a challenge to include customers in the innovation process for a novel service design because customers may lack an insight into the possibilities of new technologies. If the need for customer involvement is clear to the ecosystem, it is easier to include them, as was also stated in the mapping study results. The customer involvement can also be seen as part of the larger strategic and management issues of successful ecosystem. The actors, but especially the leaders need to know how and when the inclusion of customers should be done. In this dissertation, the customer inclusions were used in different phases of the ecosystem formation and service innovation. Therefore, this dissertation offers some insight on involvement strategies in different stages, as well as experiences of used tools.

The challenges found in existing research correspond partly with the challenges found in the empirical research conducted in this dissertation. The key issues in the management of service innovation in emerging business ecosystems are similar to the management issues identified in existing research. Nevertheless, some good management practices were identified in both the existing and the
empirical research. These practices include ensuring openness and communication in the ecosystem, making the existing knowledge and capabilities visible within the ecosystem and seeking help from researchers and other outside domain experts to gain R&D and process expertise.

5.5 Validity discussion

The validity aspects discussed here relate to the chosen method: the action research. To add to the validity discussion, the empirical phases of this research are discussed. This part of research will consider the main validity threats used in case study research (Yin 2013; Runeson & Höst 2009), as this will add to the action research perspective, and the evaluation of the overall qualitative nature of the research.

The validity of action research can be considered the quality of the following aspects: the outcome validity, democratic validity, process validity, catalytic validity and dialogical validity (Reason & Bradbury 2001; Ozanne & Saatcioglu 2008). Outcome validity refers to the successful resolution of the research problems set for the research, and the aspect of who benefits from the research is considered democratic validity. This research was conducted in two separate, but similar, research programmes that were treated as separate cases for the research. The need to adopt a researcher-led style of working, and inductive, explorative research approach with close collaboration with the other organisations was recognised at the beginning of the research. The aim was to fulfil the success of the research by first understanding the research setting and the needs of the setting. It was found that all the organisations involved in the ecosystems benefited either by being part of the ecosystems and having their expertise implemented in them, or by taking away new expertise. As far as democratic validity is concerned, the context of a research programme influences the emerging business ecosystems and enables small companies to use their resources for starting collaborations that may be crucial for them. It does not, however, limit the research conducted in the setting or influence the results. It also allows other collaborations during the programme and inclusions of other parties (experts and customers) in the ecosystems. The research programme acts as funding for this research; thus, future research programmes can take advantage of the results of this research.

The ability of the action research to develop abilities and collaboration skills in the research setting refers to process validity (Reason & Bradbury 2001). In addition, the action researcher needs to learn from the research and improve the
processes used. Ozanne and Saatcioglu (2008) exemplify this by stating that relationships between researchers and participants improve over time as trust develops. In both ecosystems, the organisations trusted the researchers more as time passed (not just the author of this dissertation, but others as well). The workshop-style research activities endorsed open discussions, and the companies approached the researcher for possible solutions to their problems. The research process became increasingly focused as the phenomena became more familiar to the researcher, and she was able to direct companies to focus their work within the ecosystem. These outcomes reflect the building of trust in the ecosystem.

Catalytic validity of action research refers to the ability to bring change to the investigated setting (Reason & Bradbury 2001). In this study, the change of the organisations to become part of a business ecosystem is the process that can be evaluated for this validity. The actions imposed by the researcher were intended to support this change, give grounds for decision-making and role setting, and prepare the ecosystems from the research programmes for the markets. Big changes occurred in both ecosystems towards the end of the research programmes, which is essential for the business ecosystem to survive.

Dialogic validity aims for the improved quality of research through a peer-review process, sharing the research results with the peers to raise discussion. This research has been phased so that the results have been disseminated in full in five research articles. The articles have been published in relevant peer reviewed venues. The challenge, as always in research, is that the research is published after the longitudinal research processes have ended, and thus the dialogue with peers is unable to influence the on-going research process. Nevertheless, the dialogic validity can be considered to cover the internal review process in the research programmes. Within in the ecosystems, the results of the main phases were reported to the ecosystem organisations and, when possible, reviewed together regularly in internal programme reviews, thus validating the researchers interpretation of the data.

Dealing with the concern of reliability in research in contexts with more than one active researcher, there is a need to make sure the data collection and analysis is consistent and reliable. In DIEM it was in particularly necessary to ensure that the use and reuse of data would not lead to misinterpretations. Going through the analysis again with at least one other researcher who was involved in those research processes was the practice when writing both Paper II and Paper III. The problem however remains, that in retrospect to analyse the activities again for Paper IV, some misinterpretations could have been made, even with another researcher who
had been there. Additionally, to avoid the risks of misinterpretations of DS actions (Paper I) and their effects, the researcher went through her interpretations of the workshops and the interviews with the companies and other researchers. This ensured that the bias of regarding one statement or opinion from one participant over the others would be avoided.

Internal validity, i.e. the concern with causal relationships in the research can be seen a difficult concern in action research, where the effects of actions that the researchers’ initiate are meant to have effects in the studied context. Facilitating change that would help the participants in the emerging business ecosystems to form successful collaboration was the purpose anyway. Thus, in this context the internal validity may be addressed by examining the actions that were made in both contexts, and what they resulted in in those ecosystems. The purpose was to form business ecosystems, but realistically, it would not have been possible to maintain the early views of how these would realize, as we are talking about companies that have to respond to the changing environment around them. In Paper I (DS context), the complexity of early vision did become disrupting, and not all companies were part of one ecosystem at the end, it is impossible to say would there have been actions that could have been done to keep all the companies together. In Paper II, the goal of the innovation phases was to produce new ideas and service innovations, and that goal was met. In Paper III, the different data collection methods in different action cycles were meant insure that the researchers’ had enough data to base their reflections for recommended changes. Similarly, in DIEM, the ecosystem did get many new ideas and development streams to follow, but at the end of the research program also became divided in how they would proceed.

Construct validity in the empirical research setting of this study can be seen to correspond with the used operational measures and does the collected data or the interpretations of the data really respond to what was studied. Specifically this potential issue can be seen in the interpretation of how the workshops and actions imposed by the researchers influenced the ecosystems, did they cause the intended effect. Adopting the terminology used by the research programs (regarding business ecosystems), elaborating carefully on the purpose of each action to the participants was used to avoid misinterpretations. However, when studying a specific context and its participants, the possibility to assume that both the researcher and the participants share the same language and terminology, without really making sure every time is a valid concern.

In particularly in DIEM, and regarding workshops and innovation process in Paper II, where there were more than one active researcher dealing with the process,
the possibilities of misinterpretations were tried to be minimized by sharing the data and interpretations in as detailed level as possible. In both Papers II and III, the internal logic of research phasing was ensured, by applying the cyclic approach of action research, to make sure that what was done would correspond to why it was done.

External validity is considered when thinking about the extent to which the findings can be generalized. First, this setting of this research was regarded context specific. The context here being the Finnish national research programs. In similar context, similar findings could be made considering the way small companies aim to find partners and collaborate in other research programs. Secondly, the context is related to the SME ecosystem operating in a relative new market domain, the health and wellness related technology based services. In this regard, these ecosystems had similarities in their challenges and way of seeing the markets. The found issues with business ecosystem leadership and co-creation can be seen to exist in other similar settings as well, regardless of the specific ecosystem type or context, so in that extend the results can be generalized.

5.6 Limitations

The framing of this research, along with the study context and chosen research methods set certain limitations. Limitation coming from the study context means that the study was designed to answer the needs identified from small company ecosystems in research programs. However, even when considering other types of research programs, the starting points may be different for companies and research organizations joining them, so similar phases or needs may not be recognised in them at the same scale. Small company business ecosystems emerging outside such research program contexts may also have different formation phases.

Assuming the role of active facilitator as an action researcher, the researcher influenced the outcome of the emerging business ecosystem. It was on one hand expected from the researcher to present tools for collaboration, and on the other hand present possible solutions for the companies on the issues at hand while working together. A more passive role of observation for instance would have probably resulted in the companies to reach their collaborative solutions differently, and might have produced different results overall.

In this research, mainly qualitative and interpretive approaches were used as interventions and data collection methods. It was up to the researchers to interpret
the outcome and effects of those activities. Other choices for collaborative actions and data collect could have been made with varied results.

Choosing the business ecosystems and service innovation as a theoretical background was a conscious choice for this research. The chosen theoretical background effected the mind-set of the researcher and directed the researcher to pay attention to certain details, directed the interpretation of the actions in the study context, but also may have directed the participants of the research programs to see the operational context in certain way.
6 Conclusions

To answer the question posed at the beginning of this dissertation of the key aspects of affecting the formation of business ecosystems in research programs, we have to look at the research results as a whole. The key aspects in the research program context can be identified as business domain derived effects, organizational specific effects, such as size and familiarity between the organizations. Other aspects are the importance of active leadership and goal setting as well as either adapting to the ecosystem environment or detaching from it, if the ecosystem strategies and goals change. These aspects are further elaborated in this section.

Technology-based health and wellness services are still considered a new business domain in Finland. This means that new small companies continue to enter the market and there are still recognised challenges associated with companies working in silos and competing against each other. The supporting R&D funding offered to companies at national and European Union levels is increasingly being directed towards creating increased collaboration and new ecosystems, not only in the wellness technologies field. It can be therefore concluded that the research conducted in the context of this dissertation will remain relevant in the future.

Collaboration between any organisations that have not worked together previously takes time. Not only are the ways of working and perspectives different, but the organisations are also yet to build trust or a shared understanding of the goals that are being pursued together. When the organisations have agreed to collaborate, there is an initial recognition of the potential in the collaboration and a willingness to work together. For the emerging business ecosystems in this research, the start of the collaboration, involving the formation of the business ecosystem, was a central point in which the researchers actively helped the organisations to recognise each other’s competences and capabilities. Once the organisations became familiar with each other and openly shared their visions and concerns, they were able to start creating the common vision and start the actual collaboration in the emerging business ecosystem.

The common service innovation and design becomes important once the goals are set. The programmes presented in this study took two main approaches to the joint value creation of services: innovation of a technology-based service or design activities that aimed to integrate existing services into one or two existing wellness service platforms. In both programmes, the ecosystem identified requirements to finalise the services: goal setting and openness within the ecosystem, integration between the organisations (technology, business logic, service logic),
understanding and allowing the changing of roles within the ecosystem and, in particular, stabilising the leadership role.

Before the emerging business ecosystem prepares for commercialisation and entering the market, the R&D artefacts and technology-based services need to be tested. In this phase, it was evident that the roles within the ecosystem stabilised further. This phase also requires the business logic to be finalised.

The emerging business ecosystem takes time to form regardless of what motivates the emerging business ecosystem. This research made the formation visible, whether the organisations were aiming to create something completely innovative together or integrate their existing services and related technologies. The acceleration of the formation, in light of this research, requires the organisations to be ready to respond to each other’s influence. This requires flexibility and openness to changes that are evident when collaboration starts without a clear leader. Second, in cases such as this study, where SMEs form the business ecosystem without a prior leader, the rise of leadership is required early on. There needs to be an organisation that has a vested interest in the business side of the ecosystem; without that the collaboration will remain an R&D project of little consequence. The earlier the leadership is established, the more focused the collaboration can become.

Being part of an emerging business ecosystem is an important opportunity for a small company. Participation in a well-managed emerging business ecosystem directs and focuses the work and enables organisations to take advantage of other capabilities within the ecosystem. Even a small start-up company with a strong vision can grow fast and assume a leadership position in an emerging business ecosystem, as occurred in the wellness ecosystem in this study.

The research programme setting brings uniqueness to emerging business ecosystems. The setting allows a more research-oriented focus. Indeed, it seems that in such a setting, the companies expect the researchers to take the initiative in the early stages and help the companies to form their collaboration. The companies seem to trust the researchers to facilitate the formation process to the companies’ best interests from the very beginning. This creates the possibility to try different approaches, develop a new understanding of the workings of research programmes and ensure companies are able to reach the aims not only set for themselves but also by the programme operator.

When planning new large-scale research programs, it would be good to take into consideration who the program is directed to. Small companies benefit from working with other small and growing companies in similar domain in terms of
business goals. Bigger, more established companies could also be included to bring resources to the ecosystem, such as access to markets and R&D knowledge. However, bringing together small companies that are new to each other needs active facilitation and the research programs should focus on this in their program structure and services they are offering to the companies.

6.1 Main contribution

Small companies willing to form a business ecosystem can learn from the results of early phase ecosystem formation.

- Focusing on the very early phases of the business ecosystem evolution, the pioneering phase, and this research has been able to increase the understanding of the practices that ease the emerging business ecosystem in the research program context.
- Openness towards other actors in the emerging business ecosystem, and inclusion of new innovative ideas is the key to successful outcome.
- Leadership should be established to focus the purpose and strategy of emerging business ecosystem, but that leadership can be challenged and changed in the process from innovation to productisation.
- The service innovations and the way to markets takes time. Companies can learn from the working ways and phasing explored in this research. The most effective ways of working in the early phases, are bringing relevant participants together and use collaborative methods.
- Methods for service innovation in business ecosystems can be learned from this research. It is important to match the suitable service innovation method to the phase of design and ecosystem evolution. In the beginning, more probing methods to gather innovation were needed, whereas towards the end of service innovation phases, the needs are more focused on finalizing the ideas and adding business logic to them.

6.2 Future research

This research identifies several research avenues. The first avenue is the research setting of research programmes and their aim to enable the formation of new ecosystems. Additional long-term research could be conducted to follow up the evolution and success of the business ecosystems after the research programmes
and their support ends. Such longitudinal research would deliver interesting and relevant results on the use of public funding for this type of support. The long-term effects for the companies in the business ecosystem in terms of their success or failure in the markets would also provide valuable information for the design of future funding instruments for R&D collaborations and would be create a bigger picture of this research.

Second, research on business ecosystems has seen recent advancements. Specifically, the research of different types of ecosystems has increased the understanding of the defining aspects. The ability to specify the ecosystems based on their backgrounds or purposes, and how the ecosystems are separate types could help to focus the research on specific problems in the future. For instance, innovation ecosystems hail from the purpose of innovating new value among the ecosystems and their relevant aspects, issues and practices. Thus, if the ecosystem is seen as a service ecosystem, what are the focal points?

There is need for a deeper understanding of the acceleration of the early formation of emerging business ecosystems. In this research, the formation took some time and some major challenges were recognised. Further research is needed on how to overcome these challenges when working together. An increased understanding of effective working methods for sharing and creating new knowledge within the ecosystem is also needed.

Finally, the R&D emphasis of the research programme context limited the inclusion of commercialisation-related research. It can therefore be speculated that an emerging business ecosystem with a stronger business interest oriented lead from the beginning would have a different formation process or different innovation process than that presented in this research. Investigation of such an emerging business ecosystem is an important future research direction that could implicate need for changes in the funding models of research programmes.
References


Original publications

This dissertation is based on the following publications, which are referred throughout the text by their Roman numerals:


Reprinted with permission from Springer (I), World Scientific (II), and Association of Information Systems (IV, V). Original publications are not included in the electronic version of the dissertation.
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