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MANAGING A BUSINESS ECOSYSTEM IN THE PILOTING OF A TECHNOLOGY-BASED HEALTH-EXERCISE SERVICE

ELINA ANNANPERÄ
UNIVERSITY OF OULU
elina.annanpera@oulu.fi

KARI LIUKKUNEN
UNIVERSITY OF OULU
kari.liukkunen@oulu.fi

JOUNI MARKKULA
UNIVERSITY OF OULU
jouni.markkula@oulu.fi

ABSTRACT

Business ecosystems are a way of contextualizing the collaboration between organizations during the development of new business. Traditionally, business ecosystems are forming around one leader company, but they can also be formed with the support of public funding bringing together companies and research organizations to develop new technological innovations. Managing the collaboration and activities that lead to the commercialization of technology-based services can be challenging if the interests of the organizations are changing and lack of leadership within the ecosystem. In this paper, we have studied the evolutionary activities and changes in an emerging business ecosystem when it reached the stage in its research and development collaboration where piloting a ready service became relevant and the commercialization of the service was looming. At this time, we are able to learn from organizing a large-scale service pilot. Reaching a large user-base of 3500 visitors, testing the technical integrations and service logic was possible. The research activities were conducted as action research, where the researchers planned and learned about the actions on the pilot in an iterative manner. Action research brought an iterative, multi-methodological approach from explorative to more structured, to study the organizational change and pilot activities. The successful piloting lead to the stabilization of leadership in the ecosystem, but anticipated the changes in the organizations when the technology-based service prepared to enter the markets. This research offers a learning point of the reality of technology innovations developed through public funding in an ecosystem context, and what are the necessary actions and changes that precede commercialization.

Keywords: Business ecosystem, service design, interoperable service pilot, action research

INTRODUCTION

Increasingly, traditional industries are combining technology and services to create new business to gain advantages in the global markets of today. These new services are built on top of underlying technology and are increasingly developed in collaborations between companies. The current trend of new technology-based services can be seen, for instance, in health, wellness, and exercise services and the technological devices that mediate them. This has created new possibilities for businesses in this field. However, creating successful technology-based products and services may be challenging when companies work together to create them. Still, the formation of such collaborations is necessary as technology-based services become more specialized and competition is tough.

Companies are forming business networks and collaboration entities, such as business ecosystems. These business ecosystems can be described as economic communities where organizations interact to create and produce value for their customers. These organizations can include a wide network of actors using their capabilities to collaborate in the value creation process [17]. A common characteristic of business ecosystems is that the organizations involved are from different industry backgrounds. They do, however, share the common interest, for example, a technical platform that they all utilize. Business ecosystems are typically considered to form around one strong leader company. Ecosystem formation can also be facilitated by different strategic organizations that direct funding for research and development (R&D), for instance. In this type of forming ecosystems, the organizational roles are not as clear at the beginning of the collaboration. Still, on the whole business ecosystems are seen to include a wide range of organizations, such as research institutions and possibly governmental bodies that are involved or need to be accounted for. For instance, companies in a business ecosystem can directly benefit from the involvement of a research organization, as researchers have both the R&D capabilities that are often needed and the experience in cooperating and even facilitating collaboration for the benefit of new innovations and services [19]. In cases where organizations come together to create new business opportunities together, the formation of a collaboration may be somewhat unstructured. In the beginning, there is a need to concretize the vision of the ecosystem and establish the capabilities of the organizations involved, as well as determine their initial roles. All of these factors may be subject to change as the collaboration progresses.

Collaborative service design in business ecosystem requires a clear process and structure. Basically, the process of designing a new service goes through several steps, from early innovation activities to more focused service concept creation and testing [3]. Testing the viability of a service is done by organizing a pilot, i.e. the service is tested for its appeal in a real-world context. Successful service piloting helps companies evaluate the appeal of a service as a whole and identify the necessary and complementary components of the service. It also helps to ready the service for markets and confirm the target customer base. Service design emphasizes the importance of including customers in the design process. This inclusion of customers can be done by determining their needs, which can then be incorporated in the service at different stages of the design process [30], and piloting is a natural stage for this inclusion. On the other hand, with the introduction of open innovation [cf. 6], the whole process of designing new innovative products and services can be opened to not only to customers but also a larger set of actors and expertise.

In the business ecosystem setting, service design activities, and piloting in particular, are important for establishing the necessary capabilities in an ecosystem. A successful pilot helps organizations to fine-tune their roles with regard to the service and enables further development of the business model. In particular, when a business ecosystem has been emerging around a new idea for a technology-based service, there is no proof yet that the service would be appealing to customers. Furthermore, if the ecosystem members' roles have been evolving throughout the design process, each testing their capabilities against the other actors and the service, the ecosystem may be in a volatile state. It is easier to test different combinations of technology and the roles of ecosystem members in a controlled pilot environment than it is to change them later in production.

Business ecosystem conceptualization endorses the notion that varied actors contribute to the core business according to their capabilities. De Reuver and Bouwman [7], in their research on innovation networks governance, concluded that companies need to have base of power in the network—usually resource-based power—in order for their innovations to reach a marketable stage. Successful service innovations require strong leadership but also flexibility in the mutual contracts that the cooperation is based on. They also state that trust-based mechanisms in the network governance are important, the closer the commercialization of the service or product the companies get. Their research is one of the few that aims to cover the management of innovations in collaborative networks. Business ecosystems, particularly in their

emerging phase, can be considered to be operating in a similar environment.

In the study presented in this paper, we have studied the activities that transform an emerging ecosystem when the ecosystem approaches the stage of commercialization of the technology-based service. The business ecosystem was formed together by an electronics company making wearable exercise computers, a gym equipment manufacturing company, a health club chain, and a rehabilitation company involved in traditional post medical operation services. The companies all involved with exercise and wellbeing technology and related services, but their backgrounds are different. In addition, in these industries, companies have their own traditional ways of doing business and developing new solutions. As the research organization, we have been part of the core ecosystem, bringing in action research as an approach.

We focus on the activities in the ecosystem during its service design finalizing stages while preparing and executing a service pilot. We analyze the changing roles and leadership in this ecosystem caused by the transition to the commercialization of the developed technology-based health-exercise service. We also elaborate on what each organization in the ecosystem contributes and what they gain in terms of new capabilities. We are able to learn of the ecosystem while it organizes a large-scale pilot, during which the ecosystem organizations were able to test the results of their long-term collaboration in service design and R&D efforts. The research program context meant that the researchers were an active part in the emerging ecosystem. The research approach applied to the conducting of the pilot is action research, with much attention given to the execution and evaluation of the piloting activities and the suitability of the chosen approach in the execution. In action research, researchers and practitioners work together in a process that aims at practical problem solving while expending scientific knowledge [5].

The rest of the paper is organized as follows: First, the business ecosystem theoretical framework is presented, including service design and service piloting in such a setting. Next, the context of the health-exercise pilot in the nationally funded research program is presented. This includes the organizations, their input in the service innovation, and the steps that led to the actual piloting of the new concept. Then, the research methodology is presented, focusing on the research process in conducting the pilot. The action research cycles are presented in the methods section, followed by a discussion of the results. Finally, the discussion and conclusions are presented.

SERVICE DESIGN IN AN EMERGING BUSINESS ECOSYSTEM

Service design research has identified the need to collaborate to create new, innovative services. The inclusion of customers and end-users is a highly valued point of view, and this inclusion needs to be carefully planned. However, in the business ecosystem setting, there are also several other actors present. While there is a need to align the strategic views among the organizations that have worked together to create the service, feedback on the service is also needed from the actual users. This need applies not only to potential users and customers but also to the other recognized actors within the extended business ecosystem. This variety of actors within the extended ecosystem requires an informed strategy for managing of the ecosystem and its value creation process.

The Business Ecosystem

Recent trends in the business and information communication technology (ICT) related literature have identified the need for companies to collaborate within and across industries to create value and survive global competition [22]. One way to understand and analyze this collaboration among companies and the current way of working is through business ecosystem research, borrowing its terminology from biological ecosystems [17]. Rong et al. [23] reviewed the literature concerning business network theories, including business ecosystem theory. They concluded that business ecosystems are loose networks with high-interoperability and also high uncertainty that can span across industries. Business ecosystems aim to create antecedents for new business. The organizations involved lend each other their abilities and capabilities to benefit from the business ecosystem and create synergy. Traditionally, business ecosystems have been formed around one keystone, a leader company, which is usually a large company that brings smaller actors together under one brand. For instance, big ICT brands such as Apple, or any mobile phone platform, have created an ecosystem where many smaller actors make additional services or devices available, mainly through this platform or brand. The leader of the business ecosystem needs to have the vision of the target state of the ecosystem. The role of the leader company is important in creating a strong business ecosystem, along with other factors, such as productivity and robustness [13]. However, it is also possible that the roles in a business ecosystem are not set, or they change as the business ecosystem evolves and matures. Heikkinen

and Still [11] have observed that the bigger evolutionary stages in particular may cause for the ecosystem roles to change, or they may cause some of the actors to change altogether. Also, if the organizations in a business ecosystem have some ties together from previous collaborations, these ties help to build the level of trust between the companies [7].

Business ecosystems include other actors in addition to companies, for instance, research organizations or regulatory bodies and, of course, customers [17; 8; 13]. Therefore, looseness and changing roles of interests are just side effects of the dynamic nature of ecosystems. Increasingly, companies and research organizations are coming together to create a business ecosystem because they see the value in the potential of their collaboration. This is particularly the case when an ecosystem is formed around national or European Union level funded research programs. The aim of these programs is to research and develop new solutions that cross various business domains, either horizontal or vertical. McKelvey et al. [16] studied university and company collaboration in research. They concluded that these university partnerships help to generate new technological knowledge for companies. In particular, smaller companies can benefit from an ecosystem aiming to complement each other's mutual business. Intentionally forming an ecosystem based around the common interest to create a mutually produced service that does not yet exist requires vision and the ability to aim actions within the ecosystem to innovatively create a new service together.

If there is no strong keystone from the beginning, this may cause challenges in the management of an ecosystem. The role of a keystone organization is to bring direction and stability to a business ecosystem [13; 18]. In this study, the research organization was used as the initiator, analyzer, and facilitator of the organizations' goals and to help them establish a common vision and find the ways to organize the business around the new technology-based exercise service they set out to design.

The Service Design Process

Service design can be seen as the realization of an innovative idea or an improvement to an existing service. The service design process involves the stages of activities required to take the service to be formed from an idea to a concept that is in a market ready state. According to Von Hippel and Katz [30], the same models of service design can be applied to both manufacturing industry product development and service development. While this may be so, services have their own characteristics (intangibility, for instance) that set them apart and require a

design process that takes these characteristics into consideration. At the same time, a number of service development process models have been presented in the literature, and the main phases of these various process models can be generalized as being design, provision, and consumption [31]. The design phase can be further divided into several steps in different ways. The stages of idea generation, concept development, and evaluation; business analysis; market testing; and introduction and post-introduction evaluation can be seen in the entire process of developing a new service based on the processes presented in the literature [see 3; 4; 24; 28]. Considering the business ecosystem context, in the beginning of the service design process, the goals of the companies involved may differ from each other, and if the companies are not very familiar with each other's capabilities in the new service creation, they may have conflicting expectations. Including the user point of view early on in the process may help to direct the service design process and align the interests of the companies around the most interesting service concept designs with the most commercial potential.

In the service testing or piloting phase, the service is constructed to provide the users as well as the company or companies involved with the real look and feel of the delivery of the service. The service is either fully constructed or simulated as far as possible. The users are invited to give feedback on the delivery of the service, and changes can be made before moving to the provisioning stages of the process [3]. Piloting a service aims at concretizing the conceptual plans, and it helps in finalizing the service. In a technology-based service, piloting provides an opportunity to test the integration and usability of the technological solutions. The overall aims of piloting are described by Schwabe and Krcmar [25] as being twofold: the pilot can demonstrate the realization of the designed socio-technical service, and through piloting, the use and effects of the service can be observed. These aspects are particularly important in the context of health-related technology-based services. Piloting benefits both researchers and businesses alike. Pilots serve as an example for innovative outcomes in R&D. Moreover, they are a vital opportunity to test a concept in a real-life situation, allowing for the collection of data, which benefits businesses and allows them to make informed decisions [25].

Service design research is focused around the utilization of user feedback and ideas to create an interesting, usable, and appealing service. The developed user toolkits (i.e. tools and methods developed to engage users) and service design processes aim at designing new appealing services, creating value for users, and testing the marketability of a service. According to Alam [3], the most impor-

tant stages for involving customers are in the beginning, in the idea generation stage, and later, when the services are being designed and finally in the testing phase. Piloting a testable, ready service offers a concrete way to investigate its appeal and market potential, as well as fine-tune its usability. Particularly in a technology-based service that consists of several components creating a smart environment, rather than just a single device, piloting is a task that requires resources and collaboration. A piloting environment that comprises many components of technology and actors is a challenge and must be carefully planned and managed.

In our work, the service design process is seen as the phases that closely relate to the designing of a service concept and turning the concept into a service pilot [1]. The final stages in the service development process: the test marketing and service provisioning, can also be included when an extensive, large pilot of the service is conducted. The traditional service design process relies on the idea that service design is the effort of an insider team in a single company. The literature does emphasize the inclusion of users in the design process, but lately, company collaboration, such as business ecosystems, has become a research focus as well. Business ecosystems as a set of actors involved in enabling the new service to be designed and brought to market allows also a wider point of view to the potential of new technology-based services. Business ecosystems are a natural setting for involving different ecosystem members and stakeholders who may otherwise have a loose connection to the core business, allowing them to be involved in a different way in the service innovation and service design activities and the stages of the overall process [32].

In an ecosystem that aims to create a common technology-based service, the managing of service design activities and process become important. However, the ecosystem members that are each contributing to the service design may have their own, possibly conflicting, interests in an ecosystem that is still in the emerging stages and where the roles are not stabilized. On the other hand, the inclusion of research organizations in the business ecosystem brings about methodological know-how on data collection and the involvement of relevant stakeholders, such as customers, in the service design process. In the selection of suitable methods in the business ecosystem service design context, action research is a suitable method. In the context of business ecosystems, action research has been used by Heikkilä and Kuivaniemi [10] to study the construction of an ecosystem and identifying the relevant actors involved when a new business ecosystem emerges in a particular case. There is a long tradition of action research being used in designing services and

products, particularly when the internal process of a company needs changing because of services [see for example 9 or 26]. Action research was also linked in health-related service research in Taylor et al. [27], where the action research process was used in an occupational therapy context. Managing an ecosystem and its activities during service design and data flows also requires similar perspectives as managing knowledge in organizations in general. Action research as an approach can help facilitate decision making in an ecosystem based on the data collected during piloting.

EMPIRICAL RESEARCH CONTEXT

The reported research in this paper was conducted in the context of a research program titled “Devices and Interoperability Ecosystem, DIEM” (part of the Strategic Centers for Science, Technology and Innovation programs in Finland). In a larger perspective, these research programs exist to bring together companies, with their expertise in the business domain, and the research competence and capability of research organizations. These organizations form business ecosystems that through scientific and business collaboration create new growth or opportunities under the theme of the program. Organizations join this program to collaborate with other companies and research organizations; the organizations share with other participants their R&D outcomes developed in the program, so that common platforms for joined business can form. These programs can be seen as facilitating the emergence of innovative business ecosystems. The research program ecosystem projects are partly funded by national R&D funding, and their progress is evaluated and planned on a yearly basis. Due to funding and licensing regulations, these programs allow R&D activities to span from very early, fundamental research relevant for new concepts and ideas to until the concepts are tested and piloted. This funding type is not available for the commercialization of a certain product (marketing and branding, for instance).

The described DIEM research program consisted of 36 companies forming smaller ecosystems. One such ecosystem was the one described in this paper; it included four companies and a research organization. This particular project lasted four years. The collaboration and formation of the business ecosystem started in 2008, and the activities involved in developing the health exercise concept are described in more detail in an article by [2]. The organizations involved in this research project were as follows (Table 1).

Table 1: Organizations Forming the Health-Exercise Business Ecosystem

Organization	Operational Domain	R&D in the Project
Wearable Exercise Computers	Manufacturer of wearable exercise computers	Developing and testing new technologies regarding a technology controlled gym, and developing the heart rate capture algorithms.
Rehabilitation Institute	Rehabilitation service provider	Including technology and monitoring of real-time health parameters in the rehabilitation process. Acting as health care experts.
Health Club	Health club chain	Developing and testing the overall concept of the health exercise gym.
Gym Equipment	Manufacturer of exercise gym equipment and control software	Developing and testing new technologies regarding gym controls and equipment.
Research Organization	Research	Conducting research activities focusing on methodological expertise and empirical data collection.

Prior to the piloting phase, which is the focus of this paper, the organizations had gone through several development cycles to reach the point where there was a health-exercise concept ready to be piloted. In the beginning of the project, the exercise computer company was considered to have the lead role in the ecosystem. It is possible to identify some main steps in the design activities in the research project that led to the construction of the pilot. The starting point for the joined activities in this business ecosystem in 2008 was the common interest to develop a new, innovative exercise concept that would be built over recent advances in technology related to the companies in the project. The process began by utilizing

potential users and company interests through innovation competition and user diaries [reported in detail in 14; 29] (steps 1 and 2 in the Figure 1 below). From the point of view of the ecosystem formation and collaboration, the ecosystem was quite open to outside views and resources to help identify potentially interesting new concepts. The innovation competition method was used in the early steps for the purpose of looking for new types of technology-based service visions in the exercise domain. User diaries and workshops where users tested personal health exercise devices were included to tie the idea to the everyday life of the potential users.

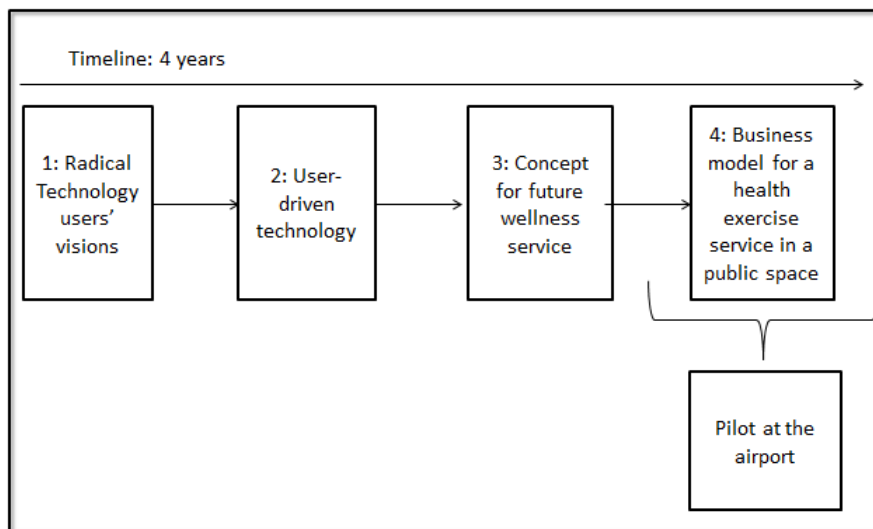


Figure 1: Timeline and Activities of the Health-Exercise Service Design

As a result of the first two steps, we were able to identify the users' expectations regarding technology-based exercise devices and monitoring and what further needs they have. The users' expectations tended toward more personalized services than have available before, and those that would also motivate them. Our studies also revealed that user behavior data could be collected over a long period of time, and this would further the possibilities of personalization. The ecosystem set out to answer those needs and expectations in the exercise service design.

Step 3 focused on developing a concept for a personalized, smart exercise service. The health-exercise concept was formed through the previously used innovation competition and using a business model canvas as a tool for analyzing the potential of the concept. Aside from the technology development and service design, there was a need to develop the business logic. During step 3, the ecosystem became more closed; some relevant extended ecosystem actors were involved in a workshop, such as business domain experts. Business modeling tools were utilized in a workshop format to analyze and refine the business model that could be used to make the concept viable and marketable. Interestingly, the roles among the organizations were changing from technology-oriented thinking toward service-oriented thinking, and the health club took a stronger lead at this point. The collaborative open innovation and service design activities are presented and discussed in more detail in [2].

After step 3, the building of a functioning health-exercise environment began. It combined R&D from the ecosystem companies. While the innovation steps were occurring, the development of new R&D in both the exercise computer and gym equipment companies was also taking place. There was also a need for new solutions for managing the interoperable data in the smart environment. One solution for the interoperability of large amount of data, platform *Smart-M3* [see e.g., 12 and 21 for a *Smart-M3* application], was made available for the member organizations of the research program. The platform was designed to be used as a common platform for new services requiring the underlying technology and for managing data from several sources. The availability of such a platform was one example of the benefits of a research program, where all the R&D does not have to come from within the core companies but can from a larger set of actors.

Step 4 resulted in identifying new business opportunities and business models for the "future wellness business," and it combined the ideas generated from the future gym scenario and the user perspective outcomes from steps 1 and 2, respectively. The technology needed

was coming together, and preparation for the health-exercise pilot began. A workshop was arranged to include the business ecosystem organizations and some selected actors to bring an outside vision into the mix. The fourth step did not follow the innovation competition structure as there was no need for a competitive element at this point. Instead, at this point, the constructed health-exercise concept was finalized using a business model canvas that resulted in a business model that could be implemented. In other words, the piloting of the health-exercise concept (reported in this paper) was already under way. As a result, the workshop produced the Exercise Corner concept and a business model that offers a scalable and modular health and well-being service. The outcome helped to focus the piloting of the concept on a reliable, easy-to-use, and personalized Exercise Corner, where the underlying technology enables personalization by collecting information about a user's state of health.

The basic Exercise Corner exercise process is as follows. From the gym equipment control system—a "kiosk"—using a touch screen, the user selects the choices that best correspond to his/her basic information (language and gender) and desired level of exercise (light, average, or hard). The system adjusts the basic program to the user's input. The selected exercise is loaded onto a provided smart card, which is then inserted by the user into each piece of gym equipment as the user goes through them. After the user is finished exercising, the smart card is brought to the kiosk card reader, where a summary of the information about the exercise can be read and sent to the user's e-mail if desired.

The overall concept was technically ready at this point of the R&D process, and there was a need to collect feedback regarding the use of the concept. The idea of organizing a pilot where a group of potential users could test the Exercise Corner and evaluate its appeal was formed. Based on the overall aims of the research program, it was decided that the concept could be tested in a public space.

RESEARCH SETTING AND METHODOLOGY

The research presented in this paper focuses on the piloting of the Exercise Corner concept. The common overall goal of the ecosystem was to create a service concept that would integrate the technological and service R&D activities achieved in the research program, and also act as a showroom of the companies and increase their overall recognition. The reasoning behind building the pilot was to test the technological development and inte-

grations completed during the project, to see how users would react to such new exercise environment, and to learn from the pilot to commercialize the Exercise Corner. The aim of piloting the Exercise corner as a research activity was twofold. First, to determine what we could learn from the emerging ecosystem roles, activities, and leadership during a large-scale pilot and how to conduct a pilot of a technology-oriented new service concept in a business ecosystem context. Second, to determine what can be learned of the use of action research in such a pilot. The first issue that needed to be overcome was to test the technical integrations and the practical appeal of the Exercise Corner. The pilot needed to be placed in a location that would be accessible to potential users, and it needed to be interesting and easy to use.

Regarding the piloting, in addition to the common ecosystem goals, the companies had their own individual goals as well, depending on the role they had in the Exercise Corner concept. The gym equipment company wanted to test the technology of the Exercise Corner; the health club was interested in finalizing the concept in terms of appeal, marketability, and possible business model; exercise computer company wanted to test its new technology for a measurement device; and the rehabilitation institute, in addition to producing information about the users of the Exercise Corner, was also working with the measurement device.

The approach adopted to study the piloting was action research. Action research in the context of collaboration within a business ecosystem is different from conducting action research inside a single organization. One facet of the setting is the ecosystem and the role of the research organization as part of the ecosystem; the pilot is also targeted to a wide audience in a public location, which brings its own challenges. In particular, following the participatory action research process of Kemmis and McTaggard [15], the research aim was to investigate the process of piloting consisting of cycles of planning the overall research and the target of the pilot. The research process then continued during the actual process and changes, and it involved observing the results, reflecting on them, and revising the plan for another iteration of the research cycle. Overall, the action research approach emphasizes research as a social practice, meaning that research should have an effect on the social interactions in the research setting and it should bring about a change to people or organizations [15; 20]. It also helps to structure the research process in terms of systematic planning, carrying out data collection, and reflecting on the research activities. The research principles applied in conducting this pilot study can be seen as a investigating a contemporary phenomenon in depth within a specific real-life con-

text, where the study context and the real-life context are not easily distinguishable [33].

The emphasis on the action research method here was to learn from practical experience, be adaptable to any challenges occurring from the pilot and its environment, and have the flexibility to change and revise plans when needed. The pilot in this research acts as an interaction mediator for both the business ecosystem organizations and the users of the pilot. The independent use of the Exercise Corner and the seamless flow of data are facets of the interaction in this pilot. The overall research process is described in Figure 2 below. The details of the construction of the pilot are explained below.

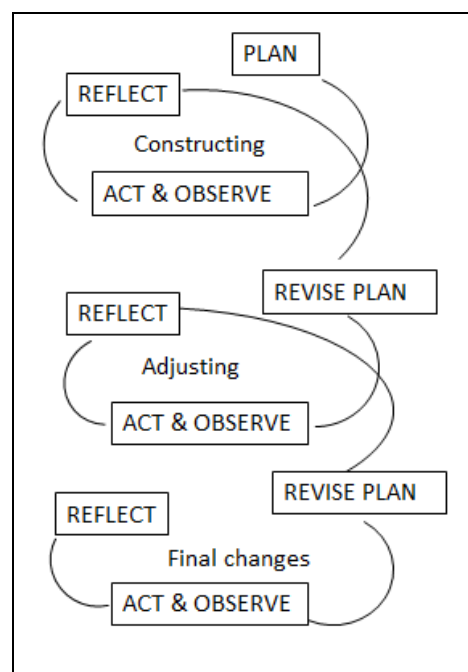


Figure 2: Overview of the Research Process in the Pilot [adapted from 15]

The timeline of the research began with the planning the pilot, which took six months, and after that the actual piloting, which took nine months. The piloting itself consisted of three cycles in which the pilot was developed and investigated iteratively. The research cycles were constructed so that the overall aim of the pilot would be achieved. Solving smaller issues as they arose and incorporating various data collection tools and methods helped to form the full picture of the successful and appealing concept that could be commercialized by the ecosystem. The first cycle lasted about a month, and its pur-

pose was to identify the most pressing issues that would prevent users from being able to successfully use the Exercise Corner and to get visitors' first impressions of the concept. The second cycle lasted about four months, and its main purpose was to collect general feedback from users using qualitative methods, such as observing and interviewing. The third and final cycle lasted three months, and its aim was to collect a larger user dataset by using two quantitative data collection devices: a survey tool and a personal vital measurement station. The data collection was carried out by a team of three researchers, who planned the research cycles, collected and reported the data, and presented and discussed the findings within the ecosystem.

Based on these experiences and observations, the ecosystem organizations agreed on changes to be made to the space. The effects of the changes were both observed by visits to the pilot lounge and by collecting data through short interviews and a questionnaire given to users. Throughout the pilot, the role of the research team was to help the ecosystem organizations make the decisions needed to further develop the pilot and concept. The researchers planned to analyze the collected data and together with the companies make decisions regarding the next steps in the pilot. The data used in the reflections were from several sources including observations, short thematic interviews, use-frequency and visiting-frequency data, and survey data. These were all recorded and analyzed according to conventions of each data collection method. The observations and interviews were recorded in large tables and summarized, and the survey data were treated by quantitative analysis using statistical tools.

The pilot contained technology and expertise from all the organizations involved in the ecosystem, and each organization had a role and interest in the pilot. After the pilot ended, the ecosystem organizations held a feedback meeting where the main benefits and issues of the pilot were discussed. They also summarized the main development advances gained in relation to the pilot and where these could be used in the future. The collected experiences of the pilot were reflected together, and steps to take the Exercise Corner to other locations were prepared. The roles and contributions of these organizations are elaborated in the next sections.

RESULTS OF THE EXERCISE CORNER LOUNGE PILOT

When the actual piloting began, the objective was to instantiate the Exercise Corner concept to a particular environment; this involved locating a suitable place

for the concept pilot, choosing a suitable combination of gym equipment for the concept in the chosen setting, and designing the environment to be attractive, inviting, and interesting for potential users. In this health-exercise concept, the idea was that the ideal user would be one who would benefit from light exercise while waiting (has some extra time) or has been sitting for a long time.

The health club, being in the leading role, contacted a regional airport. After negotiating with the airport management company, it was agreed that the pilot site would be located inside the gate area. The location was selected because the Exercise Corner could provide health benefits for travelers. First of all, air travel can cause some health risks that can be reduced through exercise, travelling for long periods can be tiresome, and light exercise before and after helps make travelling physically less stressful. Second, at airports, travelers often have nothing interesting to do while they wait, so a free lounge offering health- and exercise-related services was expected to draw attention. In addition, the pilot location would be good opportunity for the ecosystem organizations to gain more visibility, for instance, for marketing purposes. The yearly number of passengers at this regional airport is nearly one million, so the needed visibility was expected to be gained. This potential for the visibility was also recognized by the business development unit of the city, as it wanted to take part in an advisory role for the ecosystem organizations. It even contributed to the pilot by paying for the lounge location at the airport, but it also wanted to influence the look of the Exercise Corner Lounge that was to be constructed.

The main results of the pilot study are presented in a cyclic format, where the reporting follows the activities conducted during the pilot. The focus is on the technological and service design aspects, the roles of and R&D outcomes for the organizations during the pilot, and the collected data as the basis for feedback collection and decision making during the pilot.

First Cycle: Constructing the Exercise Corner Lounge

PLAN: First, the combination of equipment and other components to create the lounge needed to be determined. The target of the Exercise Corner was the completion of light exercise that takes only three to five minutes and is useful specifically in the use context (the airport). Exercise of this duration will not cause the user to sweat but will increase blood circulation and refresh the muscles, making it less tiresome to have to sit for long periods on an airplane. It was decided that the Exercise Corner would consist of three pieces of gym equipment

(leg press, abdomen crunch, and chest press) and a cross-trainer. The first three were operated via a smart card that loads the exercise program into the equipment. The equipment and their control systems were provided to the pilot by the gym equipment company. The composition of the equipment and the development of the control system was tested and developed together with the health club during the course of the research project. Massage chairs were included as a complementary service to add to the health effects of the gym, and these were provided by the health club. There were also two TV screens to help advertise the services available in the lounge. The role of the exercise computer company was somewhat separate at this point; it provided a stand where its products could be tested. The research organization's role was to conduct research on the appeal and usability of the pilot and to report on the construction and user perspectives of the pilot concept. It was also in charge of maintaining the pilot space.

The Exercise Corner Lounge environment also required maintenance and control. A good solution would have been to install video cameras for distance monitoring and to arrange for online connections for system monitoring and software maintenance. However, due to the location inside the secure area of the airport, video or other online control was not allowed, and visiting the airport was the only way to ensure that each piece of equipment worked. Therefore, it was decided that the researchers would maintain the pilot space and some of the systems locally, while the company partners participated if software maintenance was needed.

To be attractive and interesting to users, the Exercise Corner Lounge needed to be inviting and have a relaxing feeling to it. To ensure that the environment design was inviting, a professional architect was hired to plan the color scheme and materials of the lounge. It must be noted that the plans regarding the look of the lounge had to be approved by the owner of the location facilities, i.e., the airport management company as well as the local business development unit. To engage the interest of us-

ers, the rehabilitation institute recommended the exercise to the passengers via the TV screens in the lounge. Good visibility of the pilot was also desired. Therefore, it was decided that press announcements and invitations to the launch of the Exercise Corner Lounge would be sent to the media.

ACT & OBSERVE: The Exercise Corner Lounge at the airport was officially launched at a special event, where national and local press and TV stations were present. At the event, the aspects of the lounge and its health-related benefits for airport passengers were emphasized. The rehabilitation institute doctor gave a speech about the health aspects related to flying and the importance of exercise, and the other project organizations provided their own perspectives on the lounge and its purpose. The health club organized a demonstration of the use of the Exercise Corner Lounge.

For the first few days, the researchers were at the lounge as much as possible to observe the first reactions of users. The researchers collected feedback first through informal observation of users, allowing them to look around the lounge and try the services by themselves. The users were then approached and asked if they needed some guidance and whether they would like to answer a few questions about the lounge. The questions were related to hearing about the lounge beforehand and their first impressions of the look and feel of the lounge. The visibility of the pilot in the media was also evaluated in the following few days after the launch event. When asked, many of the persons visiting the lounge told the researchers they had heard or seen something about the lounge before coming to the airport.

Based on the initial observations and informal interviews with users, the researchers noted that although the lounge attracted attention, people were unsure of its purpose and were timid to try the equipment. Also, some visitors thought it would cost something to enter the lounge. The Exercise Corner part of the lounge is presented in Figure 3.



Figure 3: The Initial Outlook and Composition of the Equipment

REFLECT: In order to discuss the experiences, feedback, and issues identified during the first days of the pilot, a reflection meeting was organized among the ecosystem partners. The meeting took place at the airport, where the feedback about the Exercise Corner Lounge could be concretized and action plan for altering the space could be created. The observed media interest meant that the pilot had raised the initial interest that was wanted from the point of view of the research project and the ecosystem organizations in general. All the parties agreed that the launch was successful in gaining attention to the pilot. In general, based on observations, visitors were giving positive feedback about the look of the lounge. It was concluded that the goal of raising suitable interest was achieved. However, at this point, the ecosystem organizations were now interested in the appeal of the Exercise Corner Lounge in more detail. Despite gaining interest, getting users to actually use the Exercise Corned Lounge equipment was an issue; users were timid about trying the services. Therefore, it was determined that the main goal for the next cycle was to adjust the Exercise Corner Lounge so that the users were able to use the lounge on their own without problems. Therefore, it was agreed among the ecosystem that changes would need to be made

and more thorough user interviews and data collection were to be carried out.

Second Cycle: Adjusting the Pilot Environment

REVISED PLAN: The adjusted plans needed to address the issue of making the independent use of the Exercise Corner Lounge easier. The first action was to increase the visibility of the lounge at the airport, and the content of the TV advertising needed to be revised. For this purpose, the exercise computer company's marketing department designed and brought in posters that were placed around the gate area. The content of the TV advertising was adjusted to emphasize the available services and that it was free to use the lounge. A video was produced by the health club and an external producer to demonstrate the use of the gym in a detailed manner. To further encourage the use of the equipment, the researchers and health club physiotherapists would spend more time at the site than initially planned.

As was agreed during the reflection meeting, more detailed information on users' views needed to be collected. In order to further investigate of the appeal and usage of the lounge, a qualitative approach was continued

for the data collection. Also, because other means of monitoring the lounge were not possible, a user rate calculator device was installed to monitor the number of visitors coming to the lounge.

ACT & OBSERVE: Short thematic interviews were done to expose the possible problems with the independent use of the lounge and its services and also to determine which aspects of the lounge users liked. The researchers asked users thematic questions about the Exercise Corner, the accompanying services, and the lounge. Users of both the exercise equipment and the massage chairs were asked these questions. The themes were what aspects in the lounge were the most interesting and were there any problems in using the aspects displayed or in performing the exercise.

Data collected during the adjustment phase from the pilot users revealed the interests of the airport passengers but also some challenges that needed to be overcome. The interviewed users (n=24) mostly thought that the lounge looked interesting, fresh, and full of light, but some were still not sure at first if they were really allowed to use the equipment. Most of the interviewees had used some of the equipment, mainly the massage chairs, which proved to be the most interesting item in the lounge. Those who used the Exercise Corner said that it was not difficult to use, although at first it could seem so. Most gym equipment users had skipped the cross-trainer, as it was not smart card controlled. Those who said they had paid attention to the guideline video had found it helpful. In general, the interviewees thought that the piloted concept was a welcome addition to the airport services, as the waiting time for a flight is sometimes long and tiresome. Some interviewees also appreciated the health and wellness aspects of the service.

REFLECT: The changes to the Exercise Corner Lounge's look and feel and the guidelines given to users were reflected upon. The researchers reported the results to the other organizations in the ecosystem. Based on the observations of and interviews regarding the actual use of the Exercise Corner, the health club and gym equipment company decided that the cross-trainer did not fit this particular setting very well, and it was decided that it should be removed. The interviews and observations and the presence of physiotherapists helped to promote the Exercise Corner inside the airport and encouraged its use. However, the presence of the researchers and physiotherapists at the airport was resource consuming. Also, there was a need to collect a larger dataset of user feedback in a more systematic way. Therefore, the researchers were put in charge of planning and executing data collection that included questions from the ecosystem members' points of view, mainly with regard to usability and commerciali-

zation interests. During this time, the exercise computer company had been developing a new measurement device that was to be included at this point in the Exercise Corner Lounge.

Third Cycle: Final Changes and User Data Collection

REVISED PLAN: The final cycle of the pilot began when the agreed-upon changes were introduced and the new data collection method was implemented in the lounge. The exercise computer manufacturer brought in a newly developed prototype of a personal measurement device: a chair in which a person's heart rate sample is used to combine data regarding the person's health. The user then gets the result for their personal use. In addition, updates to the Exercise Corner gym equipment control software were made by the gym equipment company, and the cross-trainer was removed.

Researchers introduced a feedback system, which was a tablet device, attached to one of the massage chairs. The tablet contained a survey about the Exercise Corner Lounge. The questions were based on the themes discussed with the companies and the earlier experiences collected through the interviews, and the survey included questions about how users saw the market potential of the Exercise Corner Lounge. The data collection at this point included a user profile (some relevant background information) and questions that would help determine the most interesting aspects of the entire lounge and possibly help in further development of the Exercise Corner business model.

ACT & OBSERVE: The tablet device was used to collect feedback on the pilot. The survey included a total of 12 questions, seven of which were background questions (demographic, flying frequency) and five were related to user experience. Data collected via the tablet survey revealed that the majority of the respondents (n=545) reported that they found the lounge attractive, that there was enough guidance to use the lounge, that the equipment in the lounge was easy to use, and that they would like to use similar services in other airports. Nearly a third of the respondents reported that they would be willing to pay for services of this kind. In this cycle, the researchers were still visiting the pilot site regularly but not as frequently as before. The final outlook can be seen in Figure 4 below.

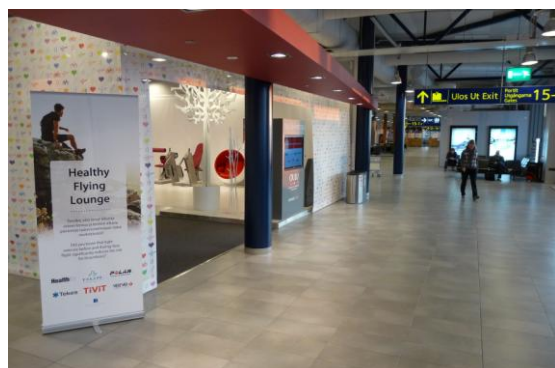


Figure 4: The Final Look of the Lounge at the Airport

REFLECT: The pilot environment was stabilized, and there were less need for onsite monitoring and visits by the researchers. Automating the data collection allowed for a larger dataset to be collected. The data collected through the survey were particularly interesting to the health club since it was preparing to take the lead in a future business ecosystem forming around the health-exercise gym concept in the lounge, with the help of the gym equipment company. The set of equipment used at the end of the pilot was deemed suitable for the airport, but it was anticipated that in other locations, the combination could include different equipment. For the final months of the pilot, the lounge was quite low maintenance, meaning it had reached the purpose of the public pilot set by the ecosystem organizations.

UNDERSTANDING SERVICE PILOTING IN AN EMERGING ECOSYSTEM

The main result of the pilot was the move from service design and technological development to commercialization. Starting with the idea to create a smart, modern exercise environment and moving through several design steps before finalizing the service as the Exercise Corner and Lounge directed toward air travelers, the ecosystem organizations each played an important role. The emerging health-exercise ecosystem had, however, come to a phase in its evolution where changes take place. These changes became increasingly visible during the pilot. The business ecosystem was able to showcase the collaboration results to a wider audience and at the same time get valuable feedback on the concept and solutions they had developed.

Ecosystem and Organizational Outcomes; Knowledge, and Expertise Gained in the Pilot

The ecosystem concluded that the targets of the pilot were met. The first target was to test the Exercise Corner for its suitability for the intended use: The concept garnered good feedback from its users, and it was deemed suitable as a lounge service. After the adjustments, it was also deemed not too difficult to use, even without assistance. There was the possibility of collecting sufficient data to make conclusions about the user friendliness and also about the general attractiveness and even marketability of the concept. In general, the ecosystem was able to test and fine tune the technical executions, control, and concept of the Exercise Corner that they had developed in the project. For instance, they learned that the original combination of equipment was not suitable, i.e., the cross-trainer was seen separate from the gym equipment by the users and not fitting the concept of the lounge.

Second, regarding the desired visibility, the launch of the Exercise Corner and Lounge was reported in the media. The number of visitors throughout the pilot was high, at approximately 3500 visits overall over nine months. However, as this information was collected from the visitor counter device, we are not able to distinguish between individual visits and recurring visits. The data collected via the survey and the frequency of use and the number of visitors provided direction regarding future development of the concept.

The pilot was an opportunity for the organizations to test and get feedback on the work they had done during the research program and the new expertise they

had gained. There was new technology developed that allowed the building of the concept. Connecting the gym equipment and the control software allowed for personalized tailoring of the exercise program. Even in the pilot context, when the possibilities for personalization were still limited, the health club and gym equipment company were able to design the concept so that by asking a user a few basic questions, the software could scale the health-exercise program to fit most users' abilities. The exercise computer company and rehabilitation institute provided important testing facilities for the gym equipment in the

earlier development phases, so the scales provided by the program were fairly accurate. The exercise computer company had also helped test and determine the best way to transfer the personal data between the control system and the equipment, as well as the best way to identify a user. These were valuable collaboration efforts which would carry the technological development of the equipment and the concept beyond the research program. The contributions to and gains from the pilot for each ecosystem organization are summarized in Table 2.

Table 2: Business Ecosystem Expertise and Outcomes in the Pilot

Organization	Contributions to pilot	Gain from pilot
Wearable Exercise Computers	Measurement station for heart rate based health data. Technical testing facility.	New measurement device prototype of. Testing new heart rate algorithm.
Rehabilitation Institute	Flying related health information; collaboration with heart rate algorithm development.	Visibility. Testing new heart rate algorithm.
Health Club	Exercise Corner concept plan based on equipment and software.	Data on public interest in the business concept and possible marketability and user feedback.
Gym Equipment	Exercise Corner gym equipment and the control software.	Testing of equipment prototypes and software.
Research Organization	Research methodology; data collection and analysis. Maintenance of the pilot lounge.	Action research methodology and tools used in conducting a pilot. Dissemination of research from practical and scientific aspects.

The exercise computer company was able to test and verify new the heart measurement algorithms and measuring equipment developed during the project. The company could also use the collected data to further develop its heart measuring algorithm. It was able to test its new prototype measurement chair, which was to be made as part of its range showcased in fairs or other promotions.

The rehabilitation institute and its medical expertise had an integral role in the development of the measurement algorithm. For further development of the heart rate measurement, the companies are able to collect heart rate samples from different occasions using the new measurement chair.

The health club was able to get data regard user interest in and user issues with the Exercise Corner concept. This company was the most interested in commercializing the concept, and this experience was important in the fine tuning of the concept. Furthermore, it was able get visibility and interest for the Exercise Corner concept, which helped when setting up corners in other locations.

The gym equipment company was at the center of the R&D for the interoperable gym equipment. It was able to do extensive testing of the new control system and be involved in the development of a new exercise concept that would be commercialized using its equipment.

From a research point of view, we as research organization were able to conduct research in the context of a large-scale pilot that would reliably test the appeal and readiness of the Exercise Corner and other R&D outcomes from the research project. We were able to develop methodological experience in action research and pilot-related action as part of the emerging ecosystem. At first there was need for more holistic, qualitative data, which were collected through interviews and observations. As the Exercise Corner Lounge went through alterations, the researchers were able to design more structured data collection methods using an electronic tool, which allowed for more extensive quantitative data collection. The collected dataset provided direction for the future development of the Exercise Corner.

Leadership and Roles during Piloting in an Emerging Ecosystem

The contributions and gained expertise in the pilot reflect the change in the ecosystem. The roles within the ecosystem had been changing during the final steps of the innovation and service design process. This becomes clear when at the contribution of each company to the pilot. The ecosystem produced an overall health and wellness experience, the Exercise Corner Lounge, but the elements in the lounge reveal that two separate items—the Exercise Corner and the heart rate measurement station—were developed as an outcome of leadership by different companies. Here, we focus on the changing roles and leadership from the Exercise Corner ecosystem viewpoint.

From the core ecosystem point of view, the business ecosystem collaboration started with a focus on developing technology for the new innovative exercise environment. Therefore, the technology-oriented exercise computer company was considered to be in the leader position. The ecosystem roles had gone through changes prior to the starting of the pilot preparations. This happened when the service design began to focus on a health-exercise service using the gym equipment company's equipment. The health club then rose to the central position. This was because the Exercise Corner did not fit well with the exercise computer company's business vision, but the health club saw that there would be potential business that they could develop further. They could also choose to collaborate with other organizations that would complement and contribute to their vision of the health-exercise concept. Toward the end of research program, the close collaboration between the health club and the gym equipment company was a factor that took the transition of the ecosystem to a new phase, where it transformed from what it had been during the project, and a new ecosystem was formed around these organizations as they started planning follow-up projects.

This meant that the roles of the other companies were more complementary from the point of view of the core business coming out of the ecosystem. During the concept development exercise, the computer company and the rehabilitation institute had contributed to the development and testing of the smart technology that the Exercise Corner was based on. Additionally, they had taken other ideas from the early stages of the service design process and developed a new concept for producing personalized health data based on a new heart rate algorithm. The measurement technology was integrated into a chair that could be taken to various locations. These two concepts, however, were separate. Although future collaborations where both the Exercise Corner and the measurement de-

vice from the exercise computer company would both be present were seen as possible, as they complemented each other, they were planned to be taken on separate development tracks after the pilot. By their nature, ecosystems are an evolving set of actors that attach to the core ecosystem or leave it, depending on the need of the core ecosystem and the joining or leaving of other organizations. In this respect, this emerging ecosystem behaved differently than is traditionally understood in the business ecosystem literature. The ecosystem did not eventually form around the expected electronics technology company but rather a smaller service provider.

The pilot also brought in new actors around the core ecosystem (airport management, an architect, and the city business development unit). These actors had an invested interest in the pilot or were otherwise essential for its realization. The roles of these actors, who were not directly involved in the core business ecosystem, were to provide resources for the practical organizing of the pilot. Their involvement was needed to get the facilities for the pilot. The support of the business development unit brought in expertise in the marketing and launching of the pilot, and it also provided resources in building the lounge. Although this meant that the core ecosystem companies had to allow the business development unit to have a say in some things (the look of the lounge, for instance), it was considered a good collaboration.

On the other hand, the research organization's role was somewhat different. Throughout the technological development and service design of the health exercise gym, the role of the research organization had been to facilitate the activities based on the needs agreed upon with the companies. Researchers have the know-how and the resources to arrange data collection to get the necessary data and then analyze it to move forward in the development process and make decisions so that the desired outcome can be achieved in the business ecosystem. Within the business ecosystem, the researchers have acted as a mediator in the sense that they brought the companies together to discuss the possibility of joined R&D, and they helped in the clarification and elicitation of the goals that the ecosystem set together. During the piloting, the researchers were not only involved but acted as catalysts in planning the phases, listening to the wishes of the other organizations, and making decisions together with them. Outside research programs, it is not always possible to arrange such research and resource intensive piloting and feedback collection. In the context of the nationally funded research programs, this is quite a typical situation; the research organizations are usually involved in several similar programs, and they know what the set targets for these programs mean in practice. Bringing in the academic ex-

expertise of their respected field, they can help companies integrate that expertise into their R&D.

One continuation or extension of the Exercise Corner is to scale the concept to be used as a health exercise environment in other locations. The first such location is office buildings and workplaces, changing the concept to promote occupational health and wellness. In the long run, the scalability of the health exercise environment would depend on the space available and the user profile; in an office location, the equipment may be different as it would be aimed at improving workers' wellbeing and working health in that particular location. Therefore, the amount of equipment would vary depending on the space available. This also meant that the leader of the new ecosystem needed to collect a new set of relevant and interested actors around the commercialized service.

Action Research in an Emerging Ecosystem Service Pilot

The research approach that the researchers took in the pilot was action research. This research approach allowed for cyclic development of both the methods and tools used for collecting data from the pilot, and it also allowed for the development of the pilot concept and design in a responsive way. At first, when the pilot was constructed and launched, we utilized explorative approaches, observation and short interviews, to collect the experiences from the Exercise Corner and Lounge visitors and equipment users. As the pilot progressed, and changes were made based on the collected data, and the data collection and analysis methods needed to be more structured. Action research guided the interplay between data collection, analysis, reflection, and decision making, which led to changes in the pilot.

From the pilot concept development and research point of view, collecting useful data through the means possible in a public pilot environment needs to be planned carefully. Being present at the pilot site has its benefits, but it also demands plenty of resources. The data collected at the beginning of the pilot was done by the researchers being personally present at the site in order to get the rich data that talking to users and observing them could provide. It was vital to quickly identify the problem points, but this also allowed users to ask someone for help at the beginning before more guidelines were added. However, the ultimate goal from the service concept point of view was that the Exercise Corner would be independently used, so improving the ease of use meant that these guidelines were needed.

Collecting data through electronic devices and utilizing the data that equipment collects while being

used can be more cost effective, but it gives a limited insight into users' feelings and insights toward the tested concept. However, doing so allowed for the collection of a larger dataset, which would have been time consuming to collect through interviews. Combining and balancing different approaches and methods for data collection and being willing to change the plan as more or diversified data as needed required flexibility.

The key learning point of the methods used in the pilot was that when approaching a new type of research setting, everything cannot be planned beforehand. By adopting a research method that allows for the aforementioned flexibility, it was possible to start with explorative approaches and then advance to systematic approaches of data collection. The researchers were able to use multimethodological approach that requires wide methodological expertise and skills from the research organization. As a method, action research also helped the research organization to analyze its own role as part of the emerging ecosystem in the research program setting. We as the researchers gained hands-on experience of the challenges and possibilities of a large-scale public technology-based service pilot.

CONCLUSIONS

We have analyzed the activities in an emerging business ecosystem formed by four companies and a research organization during the planning and execution of a technology-based service pilot aiming at the commercialization of the new health-exercise services. The development of the piloted service was done during the span of the research program with the purpose of facilitating the emergence of new business ecosystems that could create new business. We have focused on the activities in the ecosystem and the change in power balance and roles as the support of the research program is ending and the commercialization of the health-exercise service is starting. Piloting a collaboratively developed service concept marks a change in the emerging ecosystem. The capabilities needed during the technical R&D are often not the same as those needed during business modeling and commercialization. When the development of a service is done in the context of a research program, piloting becomes even a larger trigger for changes. By analyzing the overall ecosystem gains and learning from the pilot and the activities, the change in roles, and the role of the researchers through the use of action research, we are able to make conclusions on service piloting in the ecosystem context.

Overall, the ecosystem successfully organized a pilot where they were able to test the technical integrations and service logic of the health-exercise service. In

particular, the feedback collected from the services in Exercise Corner Lounge gave the ecosystem insight into suitable combinations of equipment and complementary services. The long duration of the pilot allowed for the removing and replacing of equipment to fine tune the services. It also enabled the testing of the technology behind the service and stabilizing it.

The pilot also made visible the changes in the ecosystem roles. The thus-far smaller actor in the ecosystem, the health club, took on a bigger role as it started to see the Exercise Corner as having potential to be part of its business. This rise to leadership was backed up by the gym equipment company, which also had an interest in commercializing the concept using its equipment. The exercise computer company and rehabilitation institute had directed their interest to developing other R&D results from the research program, and so the ecosystem started to split. The research program offered an opportunity for these organizations to work together, but after it ended, the real ecosystem began to emerge, in which the health club started to lead the Exercise Corner and build new ecosystem with actors it sees as relevant.

From the practical experience of organizing a large-scale pilot, we can conclude that setting clear aims and planning thoroughly before starting the pilot are important. Here, there were two main learning points: location-specific service design and the iterative, cyclic research approach. The ecosystem designed the health-exercise concept to fit to the airport by scaling the Exercise Corner and Lounge to address air travel-related health aspects. The service was designed so that it would fit the specific location with ease. Other locations, such as the office environment and its specific needs, remain a topic for further study.

The participation of a research organization provided methodological know-how and structure to the planning and activities of the pilot. Collecting feedback from users was important; thus, the researchers started the data collection from holistic, qualitative data, and collected structured quantitative data as the pilot progressed. The researchers acted as a resource for practical data collection, analysis, and dissemination, something that the companies would have had difficulties in organizing otherwise. Action research as a research strategy suits the participatory approach, where researchers try to gain a wide overview but also solve practical issues that arise when interacting with users and the extended ecosystem. The participation of a research organization in this project was possible because of the Devices and Interoperability Ecosystems research program.

Future research directions should focus on the further understanding of the dynamics of emerging busi-

ness ecosystem. The research program context brings the challenges of finding the leadership in the ecosystem and future research could help find more efficient ways to bring stability earlier to the roles and leadership. Methodologically, further research on adapting action research to fit to the business ecosystem as an agent of bringing change and analyzing the ecosystem dynamics is needed. Validation of the change process of the emerging ecosystem, the roles and enhancing the collaborative technology-based service design is needed.

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AUTHOR BIOGRAPHIES

Elina Annanperä, M.Sc. (Information Processing Science), is a Doctoral student since 2012 at University of Oulu, Finland. She is currently working as a project researcher, with the focus of her research in technology based wellness service design in business ecosystems. Main areas of interests are user-involvement utilizing open and social aspects in the service design, and the formation of a business ecosystem through co-evolutionary process. Her research is themed around the health and wellness services domain.

Dr Kari Liukkunen (Ph.D., M.Ed.) has 20 years of management and R&D experience in industry and academy in Finland. He has worked at University of Oulu since 2001. Now he works in a Director position in the HILLA program. HILLA is at the moment the largest research program in Finland. He is also the head of the Software Factory laboratory and has worked as a visiting researcher in Fraunhofer IESE, Germany. He has published over 50 papers in international conferences and journals and served as chair and committee member in organizing numerous international conferences.

Dr. Jouni Markkula is Senior Research Fellow at the University of Oulu, Finland. He received his Ph.D. in Computer Science from the University of Jyväskylä in 2003. Before the University of Oulu, Dr. Markkula was working at the Information Technology Research Institute of the University of Jyväskylä as a Research Director. His main research areas are knowledge management, decision making, privacy, software engineering, and service design. He has published more than 80 international peer-reviewed journal and conference articles and book chapters on these topics. He has also lead and managed several research projects in these fields, in co-operation with industry.