



# Activities and Challenges in the Planning Phase of a Software Ecosystem

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**Abstract.** Increasing competition forces companies to find new business opportunities by building business ecosystems together. The business ecosystem, where a set of companies develop and provide digital services together for a specific customer segment, can be referred to as a software ecosystem. The planning of ecosystems has been researched in some case studies, but more comprehensive knowledge on how to start building software ecosystems is still needed. The goal of this case study was to investigate activities and challenges in the planning phase of a Finnish software ecosystem. The case study was conducted by interviewing representatives of all six actors of the ecosystem and analyzing the material of the 12 planning workshops. The definition of a vision and objectives, the selection of actors, and the definition of a governance model were the main activities of the planning phase. It was also essential that the actors of the software ecosystem started the conceptualization of digital services and the definition of the business model together. One of the main challenges was that a clear strategy was not defined at the beginning of the planning phase. Furthermore, trust-building between the actors, different decision-making capabilities and a lack of the substance knowledge slowed down the planning phase. The actors also felt that much stronger leadership was needed.

**Keywords:** Software ecosystem · Digital service · Challenge · Activity · Planning

## 1 Introduction

Growing competition in markets drives companies to find new business opportunities by building business ecosystems together. The business ecosystem concept was proposed by Moore [17, 18] in the 1990s. The business ecosystem, where digital services are developed and provided, can be considered as a software ecosystem (SECO), where a set of actors interact with a shared market, develop software and services together and operate through the exchange of information, resources and artifacts [10]. The creation of the ecosystem starts from a planning phase, where a basic paradigm of the ecosystem and how value will be created and shared need to be determined [18].

Some earlier studies have reported activities [5, 9, 18, 21] and challenges [e.g. 18, 19, 24, 25] in the planning phase of software ecosystems. However, more comprehensive knowledge of these phenomena is still needed. Manikas and Hansen [14] point out the importance of using existing and real software ecosystems as the subject

of studies. Focusing on specific types of software ecosystems and studying the different aspects of this type can provide results, which can then be applied to different types of software ecosystems. Eventually, this will enable repeatability and theory confirmation [15]. Furthermore, a need to study the life cycles of ecosystems has been recognized. An investigation of processes that steer the creation and dynamics of business ecosystems can bring new understanding about roles of different actors in those life cycles [22].

The goal of this study was to investigate activities and challenges in the planning phase of a software ecosystem, and it was performed by using a descriptive case study method [26]. The study focused on the planning phase of a Finnish software ecosystem, which took place from February to June 2018. This paper describes the main activities and challenges of the planning phase of Case SECO. The main contribution of this study is that companies that are aiming to build a software ecosystem can use the descriptions of the activities as a checklist. In addition, the descriptions of the challenges can help actors to minimize the effects of these challenges when they start building their software ecosystem.

The rest of the paper is organized as follows. Section 2 summarizes the main concepts related to software ecosystems and the activities and challenges of the planning phase of ecosystems identified from the existing literature. The research questions and research methods of the study are described in Sect. 3. The results and answers to the research questions are presented in Sect. 4 and discussed in Sect. 5. Finally, the paper concludes and pinpoints direction for future research.

## 2 Related Work

### 2.1 Overview of Ecosystems and Software Ecosystems

In the 1990s, Moore [17, 18] proposed the concept of the business ecosystem, concentrating on how the economic community worked and the interactions between companies, their business environments and business opportunities. Iansiti and Levien [9] have expanded Moore's concept by defining different role types for participating organizations and their strategies. A software ecosystem is a subset of a business ecosystem and the literature contains many definitions of the SECO [e.g. 1, 7, 10, 11]. The main common characteristic for all these definitions of the SECO is the use of software, which differentiates SECOs from other ecosystem types. In this paper, the definition by Jansen et al. [10] of a SECO is used: *“a set of actors functioning as a unit and interacting with a shared market for software and services, together with the relationships among them. These relationships are frequently underpinned by a common technological platform or market and operate through the exchange of information, resources and artifacts.”*

Moore [17] defines four *phases* for the ecosystem: birth, expansion, authorities and renewal. Thereafter, Rong and Shi [21] have enriched Moore's definition and defined five phases: emerging, diversifying, converging, consolidating and renewing. Participants in the software ecosystem can be called *actors* and can have different *roles*. For example, Iansiti and Levien [9] define four different roles for the participating organizations:

keystones, dominators, hub landlords and niche players. An actor may have one or more roles in the software ecosystem [12], and the role may also change during the ecosystem's life cycle [16]. Moore [18] highlights the importance of the leaders of an ecosystem, which is further reformulated as "platform leaders" [6]. The leaders need to create and promote mutualism and try to convert individual organizations' competitive relationships into mutualistic ones [18]. Cusumano and Gawer [6] point out that the leaders need to consider the meaning of a scope, a product technology, relationships and an internal organization aspect.

## 2.2 Activities in the Planning Phase of Ecosystems

Some earlier studies have pointed out activities in the planning phase [e.g. 5, 9, 18, 21]. Definition of a vision and objectives [9, 18, 21] and definition of roles [5, 9] seem to be important activities in the planning phase.

Moore [18] points out the importance of visioning the ecosystem by defining a value proposition and providing it more effectively than the status quo. Rong and Shi [21] emphasize vision-sharing, and Iansiti and Levien [9] recommend defining the vision first, which is then utilized for defining the value creation and sharing methods before the structure and a strategy of an ecosystem can be formulated. The key to a successful ecosystem is to provide real value to the end customers, which will be realized by the combination of actors and contributions involved [18].

Iansiti and Levien [9] also highlight the need to determine roles. Dedehayir et al. [5] identify several key roles in the planning phase, which are classified into four groups: leadership roles, direct value creation roles, value creation support roles and entrepreneurial ecosystem roles. The ecosystem leader role is suggested to be crucial in the planning phase [5]. The leader should be able to conceptualize value chaining and develop strategies by mixing and matching capabilities, processes and organizations to determine the ecosystem with selected key actors [18]. The leader should take care of the governance-related actions, which include the role definition of actors and coordinating interactions between actors [5]. In addition, the leader should forge partnerships by finding relevant partners, enabling collaboration between them and providing opportunities for niche creation [5]. The leader also ensures that the scope of the digital services meets the market needs, and that the ecosystem's offering will accrue all the actors' own value [5].

## 2.3 Challenges in the Planning Phase of Ecosystems

Some earlier studies have reported challenges, which usually occurs also in the planning phase of ecosystems [e.g. 1, 4, 8, 13, 18–20, 23–25]. Pichlis et al. [20] report that a lack of a clear vision is one of the main challenges of collaborative plan solutions in the software ecosystem. Valenca et al. [24] have also reported that strategies and roadmaps are not fully shared between the partners. To ensure value distribution for the actors, there needs to be a strategy in place [19]. Moore [18] reports competitive challenges around how to protect the idea from others who might be defining a similar offering. Some actors may also have doubts about the market potential [20].

Trust among partners needs to be in place in strategic alliances [4]. It can be challenging to define what each actor brings to the ecosystem, their individual and combined business value, and the value for the customer [20]. There is a need to understand the co-evolution of each actor's offering in the software ecosystem [24]. Moore [18] highlights challenges related to co-operation, such as how to work with the other actors and customers to define a value proposal for a recognized innovation.

The actors may have different structures in their own organizations [13], their decision-making principles may vary [13] and their cultures and ways of communication may be different [13, 19]. The actors may have different substance knowledge which can cause or increase the challenges of conflict [19]. It is also possible that actors are unequally investing resources in and unevenly committed to the construction of the software ecosystem [20]. At the beginning of the ecosystem planning, conflicts of the interests of multiple partners may occur [24, 25]. Having a high number of partners is vital for innovation, but it raises coordination costs and increases complexity [19]. In addition, during the early stages of a software ecosystem, small and medium-sized actors may struggle with the thoughts that are actors in the software ecosystem competitors or collaborators [24]. The roles and relationships between actors in young ecosystems have been recognized as being volatile and flexible [24].

There needs to be leadership in place driving the planning and taking responsibility for the progress [20]. Having more than one leader complicates the ecosystem governance [19]. Effective coordination mechanisms need to be deployed [19]. The clear responsibilities of each role need to be defined and the level of knowledge-sharing decided [24]. Shared responsibility may lead to problems of mutual understanding [24]. Communication channels must be improved to ensure that the purpose, direction and responsibilities are understood [24]. The interaction of different actors and the different levels of knowledge of the actors will present a difficulty, and governance-related issues take time [13].

From the perspective of digital service conceptualization, it is challenging if there is no common value proposition [20] and if a business strategy is defined at a level of abstraction that requires significant interpretation [1]. In addition, earlier studies report challenges around controlling the most valuable product features [24], managing limitations set by the customer and technology maturity [8] and the lack of continuous validation with the customer [8]. Lenkenhoff et al. [13] describe the challenge of the degree of incompatibility of information systems. Schultis et al. [23] have reported challenges where the actors have different requirements based on their business objectives, and if all the actors are involved in the architectural decision-making, it takes time to reach a common agreement on the architecture.

Pichlis et al. [20] report that it is challenging if no common business model is defined. In addition, adapting new business models may be challenging if the offering of the ecosystem requires fundamentally new business models [8].

### 3 Research Questions and Methods

This study focused on the planning phase of the software ecosystem and the goal was to investigate:

- RQ1: What are the main activities in the planning phase of a software ecosystem?
- RQ2: What are the main challenges in the planning phase of a software ecosystem?

This qualitative research was performed by using a case study research method [26]. A descriptive approach for the case study was used to describe a single-case in depth and to gain deep understanding of the activities and challenges in the planning phase of a software ecosystem. The data was collected from multiple sources by interviewing representatives of all six actors of the software ecosystem and analyzing the material of the 12 planning workshops. We applied the coding and code comparison guidelines of the grounded theory for analyzing the data [3]. The grounded theory method for analysis was selected because it offers systematic and flexible guidelines for analyzing qualitative data [3]. In this case study, we applied the open coding of the grounded theory. Our plan is to conduct case studies in other software ecosystems and apply the axial and selection coding of the grounded theory for the cross-case data analysis.

### 3.1 Case Description and Research Process

In this case study, the activities and challenges in the planning phase of one Finnish software ecosystem (called Case SECO in this paper) were investigated. The aim of Case SECO was to provide digital services for new entrepreneurs. New entrepreneurs were identified to be a customer segment which did not have enough services at the beginning of a journey to becoming an entrepreneur. The first set of digital services was launched in July 2019. A Fig. 1 shows a timeline of the phases of Case SECO and the main research activities.

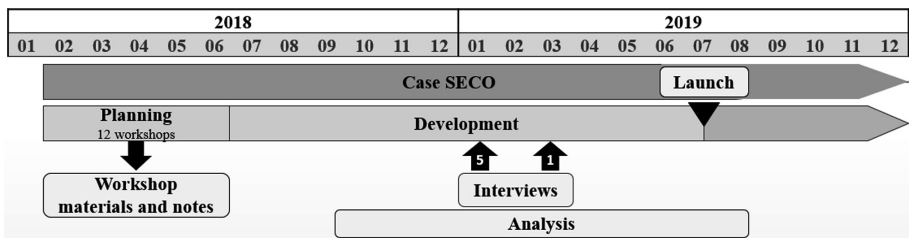


Fig. 1. Timeline of the phases of Case SECO and the main research activities.

The planning of the software ecosystem took place from February to June 2018 and was performed by arranging 12 workshops in which one to three people from each actor participated. The length of the workshops varied from 1 to 4.5 h. In the beginning, there were five actors, and the sixth actor joined to the planning phase in the eighth workshop. The actors represented five different business sectors and two actors were categorized as small and medium-sized companies and four were large companies. All the actors had a keystone role in the planning phase in terms of governing Case SECO. In addition, one actor took the facilitator’s role in the planning phase. Each workshop had a predefined agenda, but other topics were also covered during the workshops. The planning was done in an iterative manner.

The answers to RQ1 are based on the workshop materials and notes from the planning phase. First, the first author of this paper read through the workshop materials and notes and added descriptive codes. Then, similar descriptive codes were combined in sub-categories, which were the main tasks of the planning phase. These main tasks were further compared, and the overlapping sub-categories were combined. Finally, the high-level categories were defined. These high-level categories were the activities of the planning phase. The second author of the paper reviewed the results of the analysis. The authors discussed the analysis and the tasks of the planning activities were clarified.

The answers to RQ2 were gained through the results of the semi-structured theme interviews performed in January and March 2019. The interviews were designed by following the guidelines from Boyce and Neale [2]. The themes of the interviews covered main topics related to ecosystem creation. The six actors who were active participants of the planning phase were interviewed. All the interviewees had over 15 years of work experience and had extensive knowledge of their company's business and its development, but only one of them had previous experience of planning ecosystems together with other actors. Table 1 presents a summary of the interviewed actors.

**Table 1.** Summary of the interviewees.

Business sector	Company size	Role in the company	Work experience	Ecosystem experience
Insurance	Large	Business development director	>15 years	No
Pension insurance	Large	Business development director	>15 years	No
Telecommunication	Large	Business director	>15 years	No
Financial and accounting	Medium	Chief executive officer and owner	>15 years	No
Financial and accounting	Medium	Business development director	>15 years	No
Information and communication	Large	Principal consultant	>15 years	Yes

The interviews were conducted in Finnish, because Finnish was the mother tongue of all the interviewees and we wanted to collect as rich data as possible. The length of each interview varied from 25 min to 55 min. Before each interview, the research objective and structure of the interview was presented to the interviewee. The interviews were recorded and transcribed by a professional external organization. The analysis was done by following the grounded theory method [3]. First the first author read though each transcript separately and added descriptive codes. Then, similar descriptive codes were combined in sub-categories, which were the main challenges. The challenges were further analyzed and categorized against the main activities of the planning phase (RQ1). The second author of the paper reviewed the results of the analysis. The authors discussed the analysis and the categorization and descriptions of the challenges were clarified.

## 4 Results

### 4.1 RQ1: Main Activities in the Planning Phase of a Software Ecosystem

**Preliminary preparations of the planning phase of Case SECO.** Before the actual planning phase, some of the actors refined an idea, which was originally born in discussions during co-operation between the companies in autumn 2017. The companies had recognized that there is a need in the market for comprehensive digital services for new entrepreneurs. They saw that existing digital services do not cover enough of the functions new entrepreneurs require. Based on their own businesses, the companies also saw the potential of this customer segment. Therefore, they were interested in reaching new entrepreneurs in the early phase of their journey to being an entrepreneur and create a targeted offering just for them. The preliminary discussions addressed that creating this kind of digital service offering requires a sufficient set of companies developing it together. *A software ecosystem was recognized as a suitable model for this kind of cooperation.*

The actors started to gather appropriate companies for discussing an interest in joining this software ecosystem creation. Based on the preliminary discussion, potential companies were selected. The potential actors were aware of the idea of the digital services which were going to be planned and that the aim was to build up the software ecosystem together. All participating actors signed a non-disclosure agreement (NDA) to ensure that all further discussions could be undertaken confidentially. One actor took the role of facilitating the planning phase because it had previous experience of ecosystem creation and knowledge of digital services development.

**The main activities in the planning phase of Case SECO** are summarized in Table 2. One of the first important tasks of the planning phase was to determine the **vision** and main **objectives** for Case SECO, which were defined as “*Case SECO will provide extensive digital services for new entrepreneurs or persons who are aiming to be an entrepreneur. The digital services will be provided through one software platform. The digital services are easy to find, the context is represented in plain language and digital services are offered cost-effectively for end users.*”

One significant aim at the beginning of the planning phase was to **introduce** the actors and strengthen the common **motivation** and **capabilities** of the actors to continue the ecosystem planning together. The participating companies agreed that it is better at first to have quite a small **number of actors** to plan the ecosystem, to avoid spreading the idea and to help the planning phase proceed effectively. The actors, however, needed to have an adequate **offering** for the planned digital services. Therefore, the actors analyzed the offering of each actor against the defined vision and objectives of Case SECO and recognized that one more actor may be needed to enable a sufficient set of digital services. The actors decided together to contact one potential new actor, which was then joined into the software ecosystem. This new actor strengthened the service offering of Case SECO.

The actors agreed that all of them had a keystone player’s **role** and were in an equal position with each other in **decision-making** during the planning phase. An advisory board was set up consisting of all the actors of this planning phase. The advisory board in the planning phase was the highest decision-making governance body, to enable the

**Table 2.** Main activities in the planning phase of Case SECO.

Activity	Task
Definition of a vision and objectives	<ul style="list-style-type: none"> <li>• Definition of a shared vision</li> <li>• Definition of main objectives</li> </ul>
Selection of actors	<ul style="list-style-type: none"> <li>• Introduction of actors</li> <li>• Clarification of motivation and capabilities of actors</li> <li>• Definition of number of actors</li> <li>• Determination of offering of actors</li> </ul>
Definition of a governance model	<ul style="list-style-type: none"> <li>• Definition of roles and responsibilities of actors</li> <li>• Definition of decision-making rules and practices</li> <li>• Creation of a rule book</li> <li>• Creation of needed contracts</li> </ul>
Conceptualization of digital services	<ul style="list-style-type: none"> <li>• Definition of a value proposal</li> <li>• Definition of target groups and customer paths</li> <li>• Benchmarking of existing similar digital services</li> <li>• Creation of a Proof-of-Concept</li> <li>• Determination of the scope of a Minimum Viable Product (MVP)</li> <li>• Definition and prioritization of functionalities</li> <li>• Determination of costs and a schedule</li> </ul>
Definition of a business model	<ul style="list-style-type: none"> <li>• Determination of a business model</li> <li>• Determination of operation roles and practices</li> </ul>

planning of the ecosystem and steer the planning of the digital services. The **roles** and **responsibilities**, limitations, cost-sharing principles, rules for co-operation and business model were described in the **rule book**, which is the main guiding document for the governance of Case SECO. The actors agreed that **contracts** for a Proof-of-Concept and a development phase would be created later.

The actors highlighted during the workshops that the conceptualization of the digital services should be based on a determined **value proposal** and well-recognized and defined **target groups and customer paths**. In addition, it required understanding of customer behavior, the current pain points customers are struggling with, and a thoroughly done **benchmarking** of the existing digital services for new entrepreneurs. The value proposal for end users was crystallized around the following terms: *removal of uncertainties, carefree, believable* and the digital services consisted of the following main customer paths: (1) *recommendation of the appropriate company format* (2) *setting up a company* and (3) *supporting the growth of the company by offering tools, services and insurances for operating the company*. The actors needed to recognize their interests in the customer paths of planned digital services. A **Proof-of-Concept** was created during the planning phase. The Proof-of-Concept enabled a concrete look-and-feel of the planned digital services e.g. page layouts, main functionalities and interactions.

Based on the defined customer paths and the Proof-of-Concept, there was discussion about the scope of a **Minimum Viable Product (MVP)** and its schedule for the launch. The aim of the MVP was to cover the most valuable customer paths and



functionalities for end users and launch it as soon as possible. The **functionalities** were **defined and prioritized** to be included in the MVP, to be implemented in the next versions or recognized as out of the scope of the digital services. After the MVP scope was clarified, a development **schedule** with the main activities and an overall view of the **costs** of the MVP were preliminarily determined.

The actors also defined a **business model** during the planning phase. It was defined that a new company would be set up, which would operate the digital services, and the advisory board would be responsible for steering the digital services development. The actors also discovered that there might be regulatory restrictions on who could own the digital services of the ecosystem and these regulatory restrictions needed to be examined before establishing the new company. In addition, options for how to operate the digital services were discussed. These **operational practices** included customer service activities around the digital services and the technical maintenance of the digital services. Three options were represented; (1) *one single party is responsible for providing the customer service and maintenance of the digital services*, (2) *one party is responsible for the customer service and another side maintains the digital services*, and (3) *actors are investing in a new party, who will manage both the customer service and the maintenance of the digital services*. The actors agreed to examine options 1 and 2 further.

The actors defined four **roles for operation**: (1) *a digital service partner*, which has a keystone role in Case SECO's decision-making and is a member of the advisory board, (2) *a digital service operator*: a new company will be set up to operate the digital services, (3) *a customer service provider* will provide the customer service together with each actor's own customer services, (4) *a digital service technical provider* will be responsible for developing and maintaining the digital services.

At the end of the planning phase, the rule book and the Proof-of-Concept were reviewed and accepted. The aim was that the rule book would be updated during Case SECO's life cycle and the Proof-of-Concept act as a starting point for the development of the digital services.

## 4.2 RQ2: Main Challenges in the Planning Phase of a Software Ecosystem

Table 3 summarizes the main challenges in the planning phase of Case SECO. The challenges are categorized by the main activities of the planning phase (RQ1).

**Definition of a vision and objectives.** The actors saw that there is a risk of a failure in building a successful software ecosystem if a clear strategy for achieving the defined vision and objectives was not defined at the beginning of the planning phase. Actors did not share their business logics openly together. The motivation for each actor to join to Case SECO was based on their own vision and market understanding.

**Selection of actors.** Some actors did not know each other at the beginning of the planning. In the beginning, actors were somewhat vigilant and did not openly share all their thoughts and concerns. It required time and meetings to build trust by getting to know each other on a personnel level, getting acquainted with the companies of the software ecosystem, understanding the actors' backgrounds and the way in which they

**Table 3.** The main challenges in the planning phase of Case SECO.

Activity	Challenge
Definition of a vision and objectives	<ul style="list-style-type: none"> <li>• A clear strategy was missing</li> <li>• The business logics of the actors were not openly shared</li> </ul>
Selection of actors	<ul style="list-style-type: none"> <li>• Trust-building between actors was time-consuming</li> <li>• Actors had different decision-making capabilities</li> <li>• Actors had different speeds for proceeding in the planning phase</li> <li>• Actors did not have enough substance knowledge</li> <li>• Actors were creating a software ecosystem for the first time</li> </ul>
Definition of a governance model	<ul style="list-style-type: none"> <li>• Stronger leadership was desired</li> <li>• Definitions of the roles of actors were missing at the beginning of the planning phase</li> <li>• Expectations and concrete activities with resource estimations of each role were not determined</li> </ul>
Conceptualization of digital services	<ul style="list-style-type: none"> <li>• It was difficult to understand the needed definition level of digital services</li> <li>• It was difficult to define the scope of the MVP and prioritize functionalities</li> <li>• Lack of substance knowledge made it difficult to define common functionalities</li> </ul>
Definition of a business model	<ul style="list-style-type: none"> <li>• Actors needed to make compromises when defining the business model of the software ecosystem</li> <li>• External regulation had impacts on the selection of a business model</li> </ul>

communicate. Some participants changed during the planning phase, and this also affected the trust-building. The trust-building was time-consuming, but the actors felt that it was necessary to achieve enough trust between them.

The decision-making capabilities of the actors varied. Depending on the actor's role in their own company's organization and the size of the company, certain decisions needed to be taken away to their own organization's decision-making process before it could be done in Case SECO. This slowed the planning phase and decreased the dynamics. The actors saw that participating actors need to have enough decision-making authority in their own organization. It takes a lot of time if all, even small, decisions have to be made first in the actors' own organizations.

The actors had different velocities for making decisions and proceeding with tasks during the planning phase. Consequently, it was sometimes difficult to proceed with the topics of the workshops if not all the actors had time to prepare topics beforehand.

The actors did not exactly know what kind of substance knowledge they needed to have during the planning phase. In some cases, they needed to find more knowledge inside their own organization. They felt that there should have been more professionals from business operations, who are responsible for customer segments and the business itself. In addition, the actors considered how much innovation, service design and marketing knowledge was needed.

Most of the actors were participating in a software ecosystem for the first time. They were not familiar with the software ecosystem concept beforehand and did not know what the planning of a software ecosystem and digital services required. The planning phase was a learning process for the actors at the same time as the actual planning was being done. It took time for the actors to become familiar with the software ecosystem concept and how this software ecosystem should be established in.

**Definition of a governance model.** The leader's role was highlighted in the planning phase. The facilitator enabled the execution of the planning phase, but the actors felt that much stronger leadership was needed. The actors desired that the leader would have defined clear steps and milestones, systemizing the way of working, making work estimations and scheduling the work, and taking care that the needed decisions were made on time and the quality of the digital services was in place. The actors saw that roles in the planning phase, expectations and concrete activities for each role should have been defined in the early phases. This would have given more concreteness on how much and what kind of individual resources from each actor's side were needed and the estimated resource allocation.

**Conceptualization of digital services.** The actors saw challenging to know how deep and detailed the conceptualization of the digital services needed to be in order to have a sufficient determination of costs and a development schedule. The definition of the MVP scope needed some compromises from the actors. This was seen challenging, but the actors understood that the prioritization is done based on customer paths that had been defined together. The actors knew their own offering well and how their offering could be provided in the digital services in this software ecosystem, and they were capable of defining functionalities based on their own offering. But it was seen challenging to define the common functionalities (e.g. registering, interactions, security and layout) of the digital services. The actors hesitated, considering that they did not have enough substance knowledge to define common functionalities.

**Definition of a business model.** The business model definition required some compromises and flexibility from the actors. It was understood that the business model must be defined from the perspective of Case SECO and this differed from the business models the actors were used to use in their own organizations. In addition, it was challenging to examine and understand the regulation restrictions which affected the business model definition.

## 5 Discussion

### 5.1 Activities and Challenges in the Planning Phase of the Software Ecosystem

In this study, the following **five activities** in the planning phase of the software ecosystem were identified: (1) the definition of a vision and objectives, (2) the selection of actors, (3) the definition of a governance model, (4) the conceptualization of digital services, and (5) the definition of a business model.

The results of the case study indicate that the definition of the vision and objectives was one of the main activities that the actors in a software ecosystem must do at the beginning of the planning phase. The importance of the definition of a vision has also been highlighted in some studies of business ecosystems. For example, Moore [18] emphasizes ecosystem visioning and that it is important to define a value proposition and provide it more effectively than the status quo. Iansiti and Levien [9] also point out that the vision needs to be first in place, and then it can be utilized to define the value creation and sharing methods.

The results of the case study also point out the importance of the selection of actors. It was essential for each actor to clarify their motivation and capabilities for joining the software ecosystem. In addition, the actors needed to have an adequate offering for the planned digital services. Moore [18] also emphasizes that the key to a successful ecosystem is to provide real value to the end customers, which will be realized by the combination of actors and contributions involved.

The results of the case study also indicate that the definition of a governance model was important. The governance model steered the work during the planning phase of the software ecosystem. It was especially important to define the roles and responsibilities of the actors. Iansiti and Levien [9] also highlight a need to determine roles, and the ecosystem leader role is suggested to be crucial in the planning phase [5].

This study shows that the vision and objectives provided information for the actors to start conceptualizing the digital services and defining the business model. It was also essential that the actors of the software ecosystem started conceptualizing the digital services and defining the business model together during the planning phase.

This paper describes a considerable number of **challenges** that actors may encounter during the planning activities of a software ecosystem. One of the main challenges was that a clear strategy was missing at the beginning of the planning phase. The actors saw a risk of a failure in building a successful software ecosystem, because a clear strategy for achieving the vision and objectives of the software ecosystem was not defined at the beginning of the planning phase. Pichlis et al. [20] have also reported that strategies and roadmaps were not fully shared between the partners in a software ecosystem. According to Mukhopadhyay and Bouwman [19], there needs to be a strategy in place to ensure value distribution for the actors.

The results of this study also point out that trust-building between the actors, the different decision-making capabilities and a lack of substance knowledge were challenges that slowed down the planning phase. The actors emphasized the importance of trust-building because it enabled them to share thoughts and ideas openly. Das and Teng [4] also emphasize the importance of creating trust in strategic alliances. We consider strategic alliances as similar to ecosystems. Previous studies have also recognized that actors' decision-making principles vary [13], and the actors may have different substance knowledge [19].

The conflicting interests of multiple partners reported by Valkokari et al. [25] did not arise as a challenge in this study. One reason for not having conflicting interests might be that the existing services of the actors did not overlap.

In this case study, the actors felt that much stronger leadership was needed. According to Pichlis et al. [20], there is a need for leadership in a software ecosystem. The actors desired that the roles, expectations and concrete activities of each actor

would have been defined at the beginning of the planning phase. Valenca et al. [24] also report that clear responsibilities for each role in the software ecosystem need to be defined.

The results of this study also point out the challenges related to the conceptualization of digital services. For example, the actors found it challenging to understand the needed definition level of the digital services in order to be able to define preliminary costs and a schedule. In addition, the actors felt that they did not have enough substance knowledge to define the common functionalities of the digital services. The definition of the MVP scope needed some compromises from the actors. This was seen challenging, but the actors understood that prioritization is done based on the customer paths that have been defined together. Valenca et al. [24] also indicate the challenge of prioritizing features in a software ecosystem.

In this study, the actors felt that the definition of the business model required some compromises and flexibility from them and merging it with the actors' own business models was seen challenging. This same challenge has been reported in a multi-case study [8].

## 5.2 Threats to Validity

Here, we discuss four potential threats to the validity of the results. First, the interviews were conducted six months after the planning phase had ended. This might lead to deviations in the answers. This threat was mitigated by before each interview, the researcher encouraging the interviewees to try to answer as they felt during the planning phase. In addition, the objectives of the study and interviewee's rights and responsibilities were presented to them. The interviewees knew that the interviews were done anonymously, and the material would be kept confidential. Therefore, it could be assumed that the interviewees gave honest answers.

Secondly, one of the limitations of this study is that only one representative from each actor was interviewed. The triangulation of data sources was used to reduce this validity threat. The detailed material from the workshops was another source of data.

The third validity issue concerns investigator triangulation, which we were able to use in a restricted way. The first author of the paper was responsible the design, execution, analysis and reporting of the study, and the second author reviewed the results of the study. The first author started to work in Case SECO after the planning phase, which enabled her to consider the planning phase neutrally. In addition, participation in Case SECO after the planning phase enabled her to understand the context and actors in detail.

The fourth limitation is that the findings of this study are derived from a single-case study, where the case software ecosystem was quite small. It could be assumed that similar findings are achievable by conducting the same research, investigating the planning phase of another software ecosystem or repeating the same research for this case software ecosystem.

## 6 Conclusions

The results of this study suggest that the definition of a vision and objectives, the selection of actors, and the definition of a governance model are the main activities of the planning phase that place the foundation for the software ecosystem and the co-development of digital services. The results of the study also indicate that the planning phase of the software ecosystem can be demanding, because actors can face many challenges, such as a lack of a clear strategy, trust-building between actors, different decision-making capabilities, the lack of substance knowledge, and weak leadership.

Our future research goal is to gain more detailed knowledge of how actors can conceptualize and develop digital services together in a software ecosystem. We also plan to conduct case studies and gather data from other software ecosystems in order to validate the findings of this study.

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