Leveraging ecosystems for Growth

An industry perspective on consuming software ecosystems

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Abstract. Today, the competition and speed in software development has increased. Companies are forced to produce more value to the customer at an accelerating pace. This has led to the phenomena where companies, who can leverage existing code, ecosystems and services to rapidly produce value to the customer can scale their operation faster. This has led to many companies becoming a part of a selected ecosystem, locking themselves into it, but reaping the benefits. Here we investigated what kind of ecosystems software companies use to grow and in what role do they want to participate in these ecosystems to leverage them for their growth. Two main types were identified, software ecosystems which provide ready made technologies to focus on providing added value to the customer, not in infrastructure development, and mutualistic software ecosystems where the value provided to the client is a sum of services provided by multiple companies in the ecosystem.

Key words: agile software development, software ecosystems, industry experience, case study

1 Introduction

In the last few years, the world has witnessed a tremendous progress in the ways software is developed with. For example, there has been a great acceleration in the speed software teams are able to release new versions.

While earlier in software engineering, companies produced the whole service in-house, now a software product is an collection of open source libraries, third party vendor components and in-house development. These networks that produce software form the software ecosystems. [1]

Inside these ecosystems participants maintain a business relationship between the controlling entities in the ecosystem and with other participants.

But what are the value propositions that actually get small companies to pledge their allegiance to certain ecosystems and are all software ecosystems created equal? In this paper, we explore the reasons one Finnish SME , SW-Development oy, has participated in these ecosystems and what are the aspects that they are leveraging for value. A single case company is easily accessible and

provides an interesting view into how many ecosystems are intertwined into the product of even one company. An unfettered access to the companys personlle from the CEO down to the coders provides a great source to examine software ecosystems.

Specifically, we address the research question:

– **How are software ecosystems utilized in the case company?**

To answer this overarching research question, we have derived four sub-questions.

1. **What software ecosystems are in use in the case company?**
2. **How are these different ecosystems used to gain an advantage in the company?**
3. **What are the negatives that come with joining ecosystems?**
4. **How can the ecosystems be categorized by their usage patterns?**

The rest of the paper is structured as follows. In Section 2, we present the background of the study. In Section 3, we explain the research approach for this exploratory case study and the case involved. In Section 4, we describe the results collected. In Section 5 we discuss the results and in Section 6 we present the final conclusions of the study.

2 Background

Software ecosystems(SECOs) are typically compared to biological ecosystems because of the root of the definition of the word ecosystem. We cover basic biological ecosystem concepts and then move on to the related ecosystem categories to SECOs, Business ecosystems, Digital Ecosystems and lastly background on software ecosystems themselves.

2.1 Biological ecosystems

Biological ecosystems for the basis for the definition of SECOs. Ecosystem was frist used as a word by Sir Arthur Tansley in 1935 in his publication *"The use and abuse of vegetational terms and concepts"*[2]. He defined the ecosystem as a community of living organisms in conjunction with the nonliving components of the environment as a system. Many parallels between the natural ecosystem and have been highlighted in the behavior of participants in SECOs. Both types of ecosystems have a finite amount of resources and secondly participants in an ecosystem might be forced out or included in the ecosystem by changes in the dynamics in the ecosystem. Both ecosystems have their life cycles and similar behavior between participants, be it competitive or collaborative. [3]

2.2 Business ecosystems

A precursor to software ecosystems, Business ecosystems were coined by James Moore in 1997[4]. Moore defines business ecosystems as an economic community supported by a foundation of interacting organizations and individuals: the organisms of the business world.

Members in this business ecosystem produce goods and services that are traded between the participants in the ecosystem. Members can have varying roles, suppliers, lead producers, competitors and other combinations of these or their biological analogies. Over time the roles and the members of the ecosystem co-evolve their capabilities according to the intricate changing landscape and interaction of the ecosystem. Typically these ecosystems develop a central company, which guides the members of the economy and is valued because they help the members move towards a shared vision. [5]

It has also been found out that business ecosystems help to quickly evolve new products than a traditional "in-house onyl" product development processes, because all members do not have to reinvent the same wheel.[6]

2.3 Software ecosystems

Software ecosystems can be seen as hybrids of Business ecosystems and Digital ecosystems, where the business ecosystem has grown to use and encompass digital ecosystems. Digital ecosystems are defined as distributed adaptive open socio-technical systems with properties of self organization, scalability and sustainability.[7]

Bosch[8] defines a software ecosystem as consisting of the set of software solutions that enable, support, and automate the activities and transactions by the actors in the associated social or business ecosystems and the organizations that provide these solutions.

The field of Software ecosystems is still a young field and as such, the field is still looking for a consensus on the definition of software ecosystems and how to study them. A longitudinal literature study done on the subject points, that most research papers on the field are still classified as reports of single cases, but some progress has been made. [9]

Many studies have been focused on the side of the ecosystems creators, keystone players and the ecosystem governance, but the role of an ecosystems consumer is till an open question.[10][11] some position papers have been written, but no larger studies have been created [12].

3 Research Approach

The study was conducted using case study methodology. It allows us to explore and describe the single case specific circumstances related to the usage of sotware ecosystems in a more deep and flexible way. Allowing for more insights to bubble to the surface from the research than in with a rigid research methodology with

set variables. Case study investigates contemporary phenomena in their real-life context [13], and this suited the purposes of the study well.

3.1 Explanatory Case Study

This study uses *explanatory* case study methodology because its aim is at finding the reasons why software companies choose to use specific software ecosystems in their work. Runeson & Höst [14] have categorized case studies by their purposes into exploratory, descriptive, explanatory, and improving. Since exploratory case studies investigate phenomena that lack detailed preliminary research and established hypotheses, against the background of software ecosystems research, this approach is well suited for this study.

Data Collection The data was gathered in September 2017. For this study, key personnel from the company were interviewed, the CEO, product manager, a software architect and head of delivery. we aimed to get an extensive coverage of people from different levels of the company to attain a full picture of the ecosystems used. Each of these interviews took approximately 45 minutes and a semi structured interview was used to collect the data. Each of the interviews took place at the company premises.

During the discussion, the conversation was let to evolve freely into the directions that the interviewees deemed interesting and the interviewer tried to avoid guiding the participants back to the preselected questions unless the interviewees had covered what they wanted to say.

In addition to the data gathered in meetings, the researcher has been involved with the company and worked there for 4 months. Therefore, data was also gathered by observation and by participating in informal meetings although these data were only used for verifying some of the previously collected data in the meeting notes.

Validity and Reliability Considerations Even though this study looks for patterns in how software companies use software ecosystems, the aim is not to find definitive proofs or certain amounts of statistical significance in these relations – rather to explore the reasons why companies are willing to participate in different ecosystems. This paper tries to present directions for research.

Case company SW-Development Oy (SWD) is a SME software company specializing in the production of software systems to optimize and track production scheduling in factories in industries such as forestry, food manufacturing and machine shops. SWD has their own MES (Manufacturing execution system) solution that helps clients track, document and the process of transforming raw materials to finished goods.

4 Results

The results of the study are twofold. First, we describe the processes with which the data was collected and secondly we which the techniques were selected in

each case. Secondly, we dive into the data collected from the case company on the use and roles of different software ecosystems. New not foreseen directions that the conversations took will also be covered in this section.

4.1 data processing

The topics covered in the interviews proceeded from the initial establishment on what do software ecosystems mean for each participant, to deeper discussion on the different ecosystems the company is a part of, what roles does the company have in these ecosystems and what benefits does the company gain from these ecosystems and what are the limitations that these ecosystems impose on the company.

For each interview, the persons had an uniform vision on what ecosystems the company was participating in and a fairly uniform vision on the roles that the company has on these ecosystems. These opinions were also colored by the background of the person being interviewed, for example the product manager focused more on the product development aspects of ecosystems and sales focused more on the marketing possibilities of ecosystems.

All in all these interviews were not in conflict with each other, but together formed a greater image of the status of the company in these ecosystems. Each of the interviews lasted approximately 45 minutes.

The different ecosystems and their traits were collected to post it notes and grouped by the researcher. This method helped identify patterns and categorize the different aspects of the ecosystems.

To answer the first research question **What software ecosystems are in use in the case company** , two main software ecosystems can be identified. The ecosystem that was prevalent in all the interviews was the Microsoft[1] ecosystem. The second large ecosystem identified was the ERP (enterprise resource planning) ecosystem where the company software integrates into. Whereas the Microsoft ecosystem has a single company in its focus, the ERP integration ecosystem is formed by all the partner ERP providers, largest being SAP[2].

Multiple other smaller ecosystems were noted during the discussion and also the role of standards as ecosystems formers were discussed when the question was raised, if the internet would form an ecosystems of its own. All the ecosystems that came up during the conversation are listed in Table 1.

To answer the second research question **How are these different ecosystems used to gain an advantage in the company**, The interviewees were asked to list all the benefits the company received form the ecosystems and the reasons on why the company joined these ecosystems. A list of all the reasons listed can be found in Table 2. This table also contains negative aspects that came up during the interviews to answer the third research questions **What are the negatives that come with these gained advantages**, as during

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[1] www.microsoft.com
[2] www.sap.com

Table 1. Summary of the different software ecosystems that were recognized

SECOs	interview 1	interview 2	interview 3	interview 4
Microsoft	x	x	x	x
SAP	x	x	x	x
NPM	x	x		
Internet standards	x	x		
MES systems		x	x	x

the interviews it was found out that the result is not always black and white, and the aspects of these ecosystems can be grouped into both categories.

Table 2. Summary of the different software ecosystems aspects

SECO Features	Microsoft	SAP	NPM	Internet	MES
Vendor lock in	x	x		x	x
Training	x	x			
Certification	x	x			x
Trust	x	x			x
Market	x			x	x
Limits recruitment x		x	x	x	

Lastly to answer the fourth research question **Can the ecosystems be grouped by their usage into categories** The interviewees were asked to group the ecosystems by their definitions. Again a clear pattern between ecosystems was formed, where the Microsoft ecosystem was seen as a source for technology solutions, the role of the SAP ecosystem was more twofold, where it was categorized more as a marketing channel, the ecosystem where the company produces most of its value and a source of trust. From these groupings, two main groups were discernible, **Technology ecosystems** and **Mutualistic ecosystems**. These two groupings are discussed in the next section.

5 Discussion

Looking at the data collected in Section 5, we can identify two main software ecosystems that SWD is a part of, but for different reasons and in different roles.

5.1 Technology ecosystems

Looking at the Microsoft ecosystem, which came up in all the interviews, SWD is a nearly pure consumer in the ecosystem. The main advantages gained from this ecosystem come from choosing to use Microsoft technologies. The microsoft ecosystem provides a plenthora of other aspects on top of the technology which provide advantages.

5.2 Mutualistic ecosystems

The ERP ecosystem is the main software ecosystem where SWD is a producer with its software and shares a mutualistic relationship with other software producers. The main product of SWD is built on top of the products in the ecosystem and the intrinsic value for the customer is not just in the product of SWD, but with the integration with other software.

In a sense, this ecosystems is more of an economic ecosystem than an software ecosystem, but the participants are connected by APIs that enable the software to connect. Open APIs enable the building of new services on top of each other without large actions demanded from the API serving company. These many participants provide an ecosystem of interdependent companies, that could not exist without the main open APIs of ERP systems. SWD software solution for example would be much more tedious to build without the use of products made by others, the economies of scale just would not be there if every single company would have to develop their own solutions. The CEO of SWD even said during the interview that: "Our company would not exist without ERPs."

These networks for a typical software ecosystem where each company has their own ecological niche which they inhabit. Competition is typically limited to inside each niche and the different niches are interdependent and usually mutualistic, forming a larger whole.

5.3 Software ecosystem growth features

Looking at the features that SWD is looking for in the ecosystems and the major features that influence whether the ecosystem can be leveraged for growth.

Technology support The archetype of software ecosystems. By joining the ecosystem a participating company gets access to a technology base that gives an edge to the company. Not everything needs to be invented in house and part of development transforms more into learning how to use the resources of the ecosystem than building the same features by themselves. The ecosystem also gives credibility to the technical choices. Proven solutions which have been typically well documented by the community and already tested in multiple use cases.

Market Market ecosystems give focus to the company. By joining an ecosystem, limited marketing resources can be focused. In a shared ecosystem where software partners share an united technology base development that is being used on one clients solution can be more easily ported to other clients solutions in the ecosystem. The reduced need to spend resources on integration in the product allows the company to use its limited resources more efficiently to cover more potential customers.ecosystem

Trust and validation In a shared ecosystem the participant companies share the underlying technology choices. As the technology base is the same as the potential clients, the company can loan trust from the already recognized technology vendor. Typically these vendors also provide certification and other ways to validate the knowledge of partners in the software ecosystem.

Training and skills As software certification is offered, these ecosystems typically attract partners that focus on training the skillsets required in the ecosystem. Participating companies can leverage large ecosystems with multiple providers to receive the best training and skills available and validate their recruits against the ecosystem. This also focuses the recruitment efforts of the company and guarantees a pool of fresh recruits with the proper skillsets.

Focus An overarching common feature in the features before has been focus. The software ecosystems allow companies to limit their market, limit their needed skillset and limit their recruitment. By initially focusing on one ecosystem the limited resources of the company can be leveraged in an efficient way to attain growth. Of course with this focus comes vendor lock in. If you lock yourself too deep into an ecosystem, transitioning out of it will prove difficult. This trade is something that has to be valuated by each company based on their own.

6 Conclusions

In this paper, we studied the use of software ecosystems in a single case company and differing roles all these ecosystems take on the company. In the study we were able to identify patterns for the use of software ecosystems and the different roles that companies can participate with into these ecosystems. There seems to be concrete benefits that come with accepting the vendor locking of ecosystems that can help the company focus and reap the benefits.

As this paper focuses on just a single company and their experiences, a wider study about the benefits that companies gain by consuming ecosystems should be constructed. The data gained in this study can be used as a starting point in constructing a more rigid parametrized study on ecosystem usage.

Acknowledgments

The author wishes to thank the company SW-development for participating in this study and for opening up the data on software ecosystems used for discussion.

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