Universidade Federal de Pernambuco

Centro de Informática

Engenharia da Computação

An analysis of the influences caused by a Software Ecosystem in Organizational Strategy

_____

UNDERGRADUATE CONCLUSION PROJECT

Student: Rodolfo Vasconcelos Correia Lima de Andrade (rvcla@cin.ufpe.br)

Advisor: Professor Dr Carina Frota Alves *(cfa@cin.ufpe.br)*

Recife, December/2009

Universidade Federal de Pernambuco

Centro de Informática

Engenharia da Computação

An analysis of the influences caused by a Software Ecosystem in Organizational Strategy

UNDERGRADUATE CONCLUSION PROJECT

Work presented at Universidade Federal de Pernambuco, as undergraduate conclusion project in Computer Engineering, to obtain the bachelor degree in Computer Engineering

Student: Rodolfo Vasconcelos Correia Lima de Andrade (rvcla@cin.ufpe.br)

Advisor: Professor Dr Carina Frota Alves *(*cfa@cin.ufpe.br)

Recife, December/2009

Signatures

This undergraduate conclusion project is the result of the efforts made by Rodolfo Vasconcelos Correia Lima de Andrade, advised by Professor Dr Carina Frota Alves, entitled "An analysis of the influences caused by a Software Ecosystem in Organizational Strategy". The ones who signed bellow agree with the content of this document as well as the results of this undergraduate conclusion project.

_____

Carina Frota Alves (Advisor)

_____

Rodolfo Vasconcelos Correia Lima de Andrade (Student)

Recife, December/2009

"Life is like a theater production that allows no rehearsals. Therefore, sing, laugh, dance, cry and live intensively each moment of your life before the curtain is down and the production ends with no applause"

Charles Chaplin

AKNOWLEDGEMENTS

First of all, I would like to thank God. He has always shown me the way to pursue, no matter how hard a decision might be and assisted me throughout my life, giving me the strength to overcome the odds. Without his help and support, I would not be here.

To my parents, Ana and Edvaldo, who provided me full support during tough times and in many occasions, left other commitments behind to give me full assistance. They have always advised me so as to succeed and acted as an example of how parents should support their sons.

To Annuska, who patiently listened to my doubts and worries throughout these years and always tried to soothe me and make me believe in myself.

To Carina Alves, my personal and research advisor. For teaching me about technical issues, carreer issues and for patiently listening to me and providing very useful advices that certainly influenced my decisions during the undergraduate course. She also provided me with several research opportunities.

To Fernando Fonseca and everyone in PET who I had the opportunity to meet and learn with each of them throughout a four-year period.

To Orlando Campos, who taught me so much about Project Management, not only by passing me useful information and tips, but also by being an example of leadership in workplace that I could observe. And for the suggestion about a possible direction my study could take

To my classmates, for sharing good and bad times throughout 5 years. We are all warriors and our union enabled us to fight till the end.

ABSTRACT

Time-to-market imposes pressure on software companies. To meet customers' needs and keep them satisfied, the traditional organization of software business as independent units might not enable enterprises to provide everything the customer wants. To overcome this problem, enterprises act in Software Ecosystems, so that there are strong interactions among participants aimed at meeting market demands. In this new configuration, different parts of the supplying activities are divided among the participants, so as to increase return on investment, share costs of innovation and research and development (R&D). Although a Software Ecosystem (SECO) configuration can represent several opportunities, it brings challenges, risks and threats as well. In order to thrive in a SECO, organizations need to understand the role they play in the network and strive for the best way to behave. To support this process, it is important to model the whole ecosystem and the interactions among the players. By analyzing the SECO in which the organization is involved, it is possible to conduct an analysis of the environment the organization is involved, so that is possible to see the influence it has on organizational strategy. Business Process Management (BPM) can assist on this analysis. This work presents concepts, definitions and issues that are exposed in the literature concerning Software Ecosystems and identifies the impacts it has on the strategy of the Ecosystem leader, by using two modeling techniques, one presented in the SECO literature and other used in Business Process Management Context. A real world example concerning a Project Management software is presented and analyzed to illustrate the study.

RESUMO

Time-to-market impõe pressão a empresas de software. Para atender às necessidades de clientes e mantê-los satisfeitos, a organização tradicional de negócios de software pode não possibilitar as empresas a prover o que o cliente deseja. Assim, empresas atuam em Ecossistemas de Software, de modo que há fortes interações entre os participantes para atender a necessidades do mercado. Nesta configuração, diferentes partes das atividades de suprimento são divididas entre os participantes, de modo a aumentar retorno sobre investimento, dividir os custos de inovação e pesquisa e desenvolvimento (P&D). Apesar de a configuração de um Ecossistema de Software poder representar várias oportunidades, também traz desafios, riscos e ameaças. Para prosperar em um Ecossistema de Software, as organizações precisam entender o papel que elas têm na rede e buscar a melhor forma de agir. Para auxiliar nesse processo, é importante modelar todo o ecossistema e as interações entre os participantes. Através da análise do Ecossistema de Software em que a organização está envolvida, pode-se entender o ambiente em que a organização está inserida, de modo que seja possível avaliar o impacto na estratégia. O gerenciamento de processos de negócios pode auxiliar nessa tarefa. Este trabalho apresenta conceitos, definições e questões que são expostas na literatura sobre Ecossistemas de Software e identifica os impactos na estratégia da organização líder do ecossistema, utilizando duas técnicas de modelagem, uma apresentada na literatura referente a Ecossistemas de Software e a outra usada no contexto do Gerenciamento de Processos de Negócios. Um exemplo do mundo real envolvendo um Software de Gerenciamento de Projetos é apresentado e analisado para ilustrar o estudo.

.

Índex

LIST OF FIGURES

LIST OF TABLES

1. INTRODUCTION

This chapter aims to present the motivation for the research concerning this undergraduate conclusion project as well as the context involved. It aims to define the objectives of this work as well as show how this document is structured.

1.1 Motivation and Context

According to [8], time-to-market imposes constraints upon software suppliers, as the customer has several needs and wants them to be met quickly. Nevertheless, not always the set of functionalities to satisfy the customer can be implemented in a short period of time. Furthermore, there are other needs such as technical support, user support, customization and integration with other systems [3][4][10]. If these needs as well as the ones which involve the software itself are met, the customer is satisfied.

As [3] emphasizes, increasing customer base is a key factor for long term success. For achieving this goal, it is necessary to keep customers satisfied, what demands several efforts. If a software company works as a single unit, it is hard to sell software, develop it, elicit requirements, customize it, provide services related to it, etc. This is the way software companies used to act. Nowadays, as [6] exposes, software businesses act in Software Supply Network (SSNs) and Software Ecosystems (SECOs), in a way that several enterprises collaborate as SECO or SSN participants, so that everyone get benefits from that. The customers are also part of a SSN and SECO.

Broadly speaking, a SSN is a set of hardware, software and services organizations that establish relationships and interact to meet market demands [4]. A SECO might be seen as the set of SSNs in which an organization actively cooperates or a set of businesses that act in a shared market for software and services.

In [12] [13][14][15], several factors concerning SECO and SSN are pointed, such as: innovation, sharing of research and development (R&D) costs, increasing return on investment, value generation and collective learning. The idea is that by acting in SSNs and SECOs, organizations satisfy customers by adding value to them, reduce R&D costs by sharing it with other organizations, increase customer base and consequently return on investment, and learn from the interactions that take place among them.

Despite the importance of Software Ecosystems and the fact that several software organizations take part in SECOs, there is not extensive literature about this issue, as it is a novel concept. Given the fact it is a recent field, there are several challenges exposed in academic works concerning technical and business issues. Most of them are still open questions, demanding new research to assist in finding answers.

In the general sense, there is the need for techniques to model SSNs and SECOs, so that participants know exactly the role they play in a network configuration [4][5][6]. Just a few works addressed this problem and the techniques presented so far are under construction. In the business context, the fact that a company acts in a Software Ecosystem influences its business environment and consequently, impacts on its organizational strategy.

To summarize, it is possible to understand and analyze how a Software Ecosystem works by using some modeling technique that enables organizations to identify the interactions among several enterprises, challenges and opportunities, so that they can ferret out how it influences organizational strategy. The importance of this for enterprises is enabling them to thrive in a dynamic and complex environment.

1.2   Objectives

This work aims to understand Software Ecosystems and the concepts intimately related, like Software Supply Networks, for instance. By understanding SECOs starting from a modeling approach, this work strives for identifying SECOs characteristics, particularities and factors that can be associated to concepts concerning organizational strategy, such as the SWOT (strengths, weaknesses, opportunities and threats) matrix and the Balanced Scorecard (BSC). It is intended to use a real Software Ecosystem example so that the concepts and relations presented are seen in a real world situation. This way, the software ecosystem of a Project Management Software was chosen, as project management is a trend among companies from diverse economic sectors and countries. Moreover, for a Project Management Software to successfully meet customer needs, several enterprises need to interact in a SECO configuration. For example, one company develops the software, while others resell it, provide technical support, assist in the deployment, etc.

Most of the concepts concerning Software Ecosystems and Organizational Strategy were collected from the bibliography and this work seeks to establish the linkage between these two topics, focusing on the Ecosystem Leader point of view. For assisting in this linkage establishment, Business Process Modeling (BPM) is used, as it provides strategic alignment and a modeling technique, known as BPMN [17], that can be useful for helping in the SECO analysis process, including opportunities and challenges identification.

1.3   Document Structure

This document is structured as follows:

- Chapter 2 (Software Ecosystems): this chapter shows general definitions of Software Ecosystems and related concepts, presenting real examples of SECOs, the roles played in a Software Supply Network, a modeling technique for SSNs structure and general considerations and particularities concerning Software Ecosystems;

- Chapter 3 (An insight into organizational strategy): this chapter presents general definitions and concepts of strategy, focusing on the Competitive Strategy Management school of strategic thinking. Concepts such as SWOT matrix and BSC are exposed, as well as BPM as a managerial resource for strategic alignment and modeling;

- Chapter 4 (Analyzing a Software Ecosystem in the context of a project management software): this chapter presents a real world example of a SECO, referring to a project management software that actually exists in the market. In this chapter, the referred ecosystem is modeled and strategic issues are considered, so that it is made clear the influence a SECO has on organizational strategy. The strategic issues are focused on the ecosystem leader;

- Chapter 5 (Conclusion and future work): this chapter shows several considerations concerning the content presented throughout this document, as well as limitations and difficulties. It also indicates future work that could be carried out based on this study.

2. SOFTWARE ECOSYSTEMS

This chapter aims to present Software Ecosystems, exposing definitions that origin from the insight of several academic works, as well as the concepts and definitions that are inherent to this reality, which is currently faced by several software businesses. Besides, this chapter presents a modeling approach for understanding these ecosystems and the implications of being inside a Software Ecosystem.

2.1 Definitions

2.1.1   Software Supply Networks and Software Ecosystems

According to [4][5][6], software businesses no longer act as separated and independent organizations, when there is one enterprise which has needs that can be satisfied by a software solution and another one that provides the solution, performing not only commercial activities (customer relationship, contract negotiations, elaboration of proposals, etc) but also the ones that refer to software engineering (requirements elicitation, analysis and project, coding, testing, maintenance, etc). According to [3][4][5][6][11][14], this insight is rather simplified. The environment concerning software businesses nowadays seems more complex, containing several stakeholders: customers, partners, suppliers. These stakeholders interact frequently and contribute for everyone to take advantage of the opportunities.

From the point of view of software vendors, based on [14], it is possible to see that outsourcing part of software development is commonplace, meaning an enterprise might develop a product that is integrated to components that are developed by other enterprises. To [6], this outsourcing process would go beyond just acquiring and using a component developed by a third-part supplier, as software engineering and commercial activities might be delegated to other organizations as well. This way, the enterprise that develops the software not necessarily is the one who is going to commercialize it, as this activity might be under the commitment of a reseller, for instance. Another possibility: the company might even develop and sell software, but outsource the requirements elicitation task. Another example would be a situation in which a company develops and sells its products, but outsources maintenance and support services. There are several possibilities, including a more pro-active participation of the customer, who could be seen both as a partner, as its needs for customizations might yield product enhancements that might give the developing company much advantage in the market. In some cases, the customer only mentions possible customizations. In others, it might implement the customizations either with its own team or by joining its own team with external ones.

This new configuration, in which several businesses work united for meeting market demands make them act in networks. Based on [5], by acting in networks, software businesses depend on other software, hardware and services businesses, that turn out to be suppliers.

Thus, two crucial concepts emerge, which are: Software Supply Network (SSN) and Software Ecosystem (SECO).

As exposed in [5], "a Software Supply Network is a series of linked software, hardware and service organizations cooperating to satisfy market needs". Based on [6], Software Supply Networks differ from the Supply Networks that take place in industry because of two main aspects: firstly, software is malleable after it is released and delivered, as there is normally the need for maintenance. Secondly, for software a lower level of quality is accepted, what is not verified in other segments, like civil construction and car industry. Therefore, the literature concerning Supply Networks scarcely encompasses the software reality. It largely talks about other kinds of products, not frequently mentioning these particularities that are verified in the software market.

Based on [11], the traditional approach for software supply, described in the beginning of this subsection and referring to the case in which one company performs all the activities, constitutes Software Supply Chains. As for the new way of approaching the software market, in which there are several organizations interacting for satisfying market needs, there are Software Supply Networks. Thus, these two concepts cannot be confused. To [15], the term "chain" normally refers to the notion of a vertical sequence of activities that lead to delivery, consumption and maintenance of products and services, while the term "network" normally refers to inter-organizational relationships. Having considered this difference, it is possible to conclude that in Software Supply Networks, instead of a set of activities for simply developing and selling products, there are interactions among several parts in order to conceive them and to make them stand in the market, providing support, maintenance and customizations. In a Supply Chain, the customer is merely a buyer, not playing an active role, situation that can happen in a network. In addition, a Software Supply Network regards suppliers as partners, not as mere service or product providers. Last but not least, a Software Supply Chain has a vertical approach, while a Software Supply Network has a horizontal one.

Taking this distinction into account, [11] defines a SSN as a "network that aims for participants (vendors and customers) to jointly create competitive advantage from diverse sources for themselves and for others".

According to [5], a Software Ecosystem is "a set of businesses functioning as a unit and interacting with a shared market for software and services, together with the relationships among them". There are several examples of SECOs presented in the literature, such as:

- The iPhone SECO: in this case, there is Apple, who conceived and who coordinates Apple Store. In Apple Store, there are programs that are developed both by Apple and by third-part developers. Apple designed the iPhone, but it does not mean Apple manufacture it. Furthermore, it is sold by telecoms or by

specialized retailers, not directly by Apple. Without mention that support services for users might be outsourced as well.

- The Microsoft SECO, comprised by Microsoft's solutions and established relationships with partners, suppliers and customers worldwide. Each Microsoft product might be in a different SECO. So, there might be a SECO inside the other, so that each product is in a SECO that is part of Microsoft SECO. Sometimes, Microsoft products are sold by resellers and services related to support and maintenance might be provided by these resellers or by other organizations. These resellers might establish relationships with hardware providers as well, as some Microsoft products are targeted to the corporative segment, which not only needs software, but also hardware and infrastructure. Occasionally, there are companies that develop solutions that can be integrated to Microsoft products, without even Microsoft noticing it;

- The Oracle SECO: just like Microsoft, Oracle SECO encompasses numerous SECOs, for each product they have. Oracle has an ERP (Enterprise Resource Planning) solution, ECM (Enterprise Content Management) solution, Project Management solution and numerous stand-alone applications. Its ERP interacts with other applications and it not always is deployed by Oracle themselves, so that this work might be under the commitment of a partner. For the ECM and Project Management solutions, it is also true. As for standalone applications, some of them can be used with not only its ERP and ECM, but also with ERP and ECM software developed by other suppliers.

In [3], there is another definition for Software Ecosystems: "A software ecosystem consists of the set of software solutions that enable, support and automate the activities and transactions by the actors in the associated social or business ecosystem and the organizations that provide this solution. Of course, a software ecosystem is also an ecosystem, specifically a commercial ecosystem, and hence the goods and services are the software solutions and software services that enable, provide support for or automate activities and transactions". To [3], actors are business (suppliers and customers) and transactions include financial transactions, information, knowledge sharing, pre and post-sales contacts, etc. In other words, [3] sees SECO as a set of software solutions that meet customer needs, without putting the relationships that exist among the suppliers and the customers aside.

Actually, SSN and SECO are intimately related concepts. In [4], it says that "the software ecosystem of a software organization are all the software supply networks in which the organization actively cooperates". To illustrate this definition, the iPhone Ecosystem can be used. In this example, the iPhone manufacturing and selling processes would form a SSN and

the Apple Store development and maintenance would be another SSN. Apple acts in both SSNs and so, these two SSNs comprise the iPhone SECO.

To [5], there are three levels that need to be considered when talking about SECOs: the software vendor level, the software supply network level and the software ecosystem level. This view helps figuring out the distinction between Software Supply Network and Software Ecosystem and is presented in Figure 1, extracted from [5]:
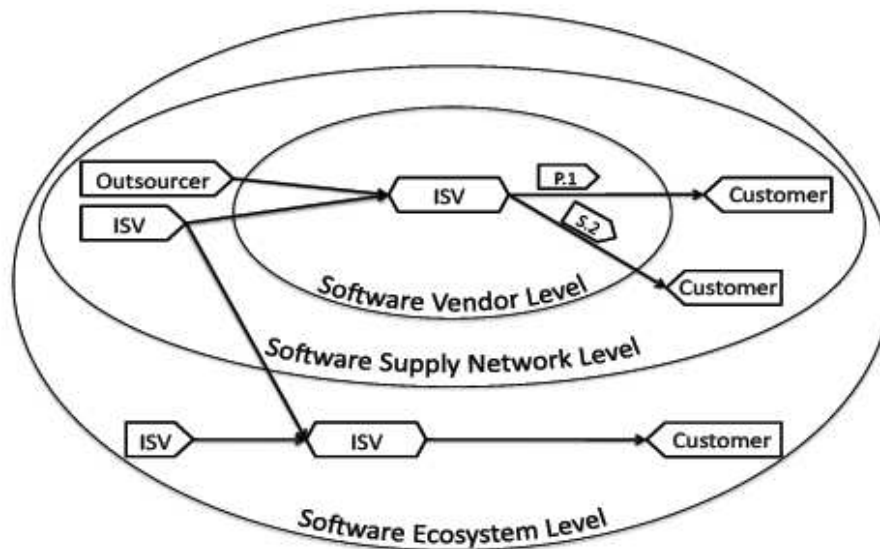
Figure 1. Software Vendor Level, Software Supply Network Level and Software Ecosystem Level

Figure 1 shows that the difference between each level is a matter of perspective. Based on Figure 1, at the Software Vendor Level, relationships are not taken into consideration, just the software vendor itself and its products. At the Software Supply Network Level, it is possible to see the software vendor, its suppliers and buyers and the relationship among them. At this level, it is possible to devise actions in order to manage the relationships with customers and suppliers and even prospecting opportunities. At the Software Ecosystem Level, it is possible to see the whole environment in which the organization is involved, concerning various products and forms of interactions. It also includes organizations that do not have direct relationships. In order to make strategic decisions, it is paramount to have a software supply network insight, at least. If a company can analyze all the SSNs it is involved, it can analyze the entire ecosystem and consequently, obtain a more complete analysis.

2.1.2 The roles in a Software Supply Network

There are several works in the literature that present nomenclatures and definitions for the several roles played in a Software Supply Network and consequently, in a Software Ecosystem. As seen in subsection 2.1.1, Software Ecosystems can be regarded as a set of

Software Supply Networks an organization takes part and for that reason, if you define roles that are applicable to SSN, they are applicable to SECO as well.

There is not a consensus among authors about the nomenclatures and roles for Software Supply Networks, in a way that, as [4] affirms, many terms can be used and some of them are synonyms to others. Hence, there might be numerous terms and so, researchers in the field must define the pattern they intend to follow so as not to get lost with so many terms.

These nomenclatures and roles are exposed in [3][4][15]. Based on the way these papers present this issue, bellow we define groups, roles and some characteristics that are related to each one. These roles will serve as a basis for further information presented in this work. We decided to establish a categorization that is based mostly on [4], complemented by the [3][15].

- **Group 1: resellers**

  o **Value added reseller** (VAR): committed for adding functionalities to a software and reselling it, either rebranding or not the product;

  o **Reseller**: committed for reselling the product, either by simply buying and reselling it or by reselling it in partnership with the supplier, in exchange for receiving part of the transaction incomes;

  o **Software assembler**: committed for assembling components and reselling the final product;

  o **Software publisher**: committed for rebranding and reselling the product. This is common in the games market, as explained in [8]. The publisher might either pay for the product and then resell it or make an agreement with the supplier so that they share the incomes and also the risks;

- **Group 2: Service organizations or Turn-key Providers**

  o **Software Engineering Service Provider:** committed for supplying services related to software engineering tasks, such as Requirements Engineering, software design and architecture, tests, etc, when their customer decide to outsource these activities. The decision to outsource these tasks may be due to expertise of the provider or for cutting costs, for instance. Some companies that develop critical applications, for example, normally outsource the testing process;

  o **Product Deployer:** deploys the product, also reselling it in some cases. In some occasions, the software developer is not the institution that implants the solution in the customer's place. This task might be carried out by a third-part deployer, who might also be a reseller;

  o **Software Developer, Outsourcing partner:** committed for developing part of the software under an outsourcing agreement.

- **Group 4: Service providers**

- o **Application Service Provider:** committed for providing a hosted solution in its own server as services to others.

  - o **General Service Provider:** committed for providing services related to support, maintenance, training and customizations either independently or in partnership.

- **Group 5: Software Vendor**

  - o **Independent Software Vendor (ISV):** builds and sells a product, either directly to a customer or in a partnership scheme in which incomes are shared with a reseller, for example;

  - o **COTS Vendor:** builds and sells COTS (Commercial Off-The-Shelf) components. These components might be sold to other organizations, such as a Software Assembler, that integrates them so as to comprise a suitable software solution to the end user. The main difference between COTS vendor and ISV is that a COTS vendor deals with COTS components, while an ISV deals with products;

  - o **Original Design Manufacturer (ODM):** designs, develops and sells software;

  - o **Lead firm:** defines the product and develops it entirely, partially or does not develop, outsourcing the entire development. Lead firms focus on strategy, marketing, revenues, licensing, etc and are normally big businesses. Examples: Oracle, Microsoft, Apple, SAP,etc.

- **Group 6: Customer**

  - o **Customer:** buys the product and depending on its needs, can contract other organizations to meet its demands. Some customers play active roles, by making themselves customizations that are incorporated to the product and meet other customers demands. This kind of situation depends on the relationship the customer has with its suppliers.

According to [15] organizations that supply services or products to others are categorized as being part of first, second or lower tiers. To understand the question of the tiers, it is necessary to be presented to the concept of Original Equipment Manufacturer (OEM). Based on [15] the term OEM was applicable mainly to motor and electronic industries, to refer to companies that designed and manufactured part of its products, buying other parts from suppliers. Thus, first tier suppliers are those that provide important and complexes parts of the product. As the participation and the importance of the supplier decreases, it then belongs to second or lower tiers. OEMs are also known as lead firms. As shown in [15], as OEM grows, there is the tendency that they manufacture just a small portion of their product, delegating the rest to suppliers or that they simply do not manufacture one single part of it, concentrating their efforts on strategy, marketing, financials, sales, strategy and design. In some cases, first tier suppliers are heavily involved in the design phase. In the software context, some works about SSN and SECO name lead firms as OEM, although the etymology of the terms does not seems applicable to this context.

As the SECO of an organization is, broadly speaking, a set of the SSNs in which the organization takes part actively, an enterprise might play different roles in a SECO, as it might have different roles in the SSN in which it takes part. Lead firms in SSN are normally ecosystems leaders.

2.1.3 A model for Software Supply Networks

In [6], it is presented a way of modeling SSNs. The importance of modeling a SSN lies in the fact that, as exposed in [6], "The SSN model can function as an overview diagram for a business plan or even for year end-reports to indicate how a software business made profit". Actually, a SSN enables the participant organizations to understand the interactions that take place among them as well as to visualize a flow that is followed in the network, concerning the artifacts and services.

Based on [6], by setting up a SSN model and analyzing it, it is possible to be aware of the influences related to:

- Business Identification: by visualizing the inputs and outputs, each participant knows its role in the SSN. For example, an enterprise which buys a product, develops additional functionalities and sells it to another one is a VAR. If this other company takes the VAR's solution and commits for installing that on the customer`s infrastructure, then it is a Product Deployer. Knowing your role is the first step for being aware of your importance in the SSN and that can assist you in the decision making process;

- Product Architecture Design: depending on the interactions inside a SSN, the software might have one architecture design or another, so as to maximize profitability. By understanding the SSN in which a company is involved, it is possible to make decisions about it;

- Risks Identification: by visualizing the relationships with suppliers, it is possible to indentify risks in advance. If a company depends enormously on another, what happens if this company goes into bankruptcy or it is bought by a competitor? Your business might be at risk and identifying that in advance might represent a good way of trying to avoid it or devising contingency plans;

- Product Placement Planning: a SSN can be designed so that software vendors can determine the way its product will be sold. An OEM, for instance, might sell a product directly to the customer, through a reseller or in both ways. What is best? By designing the SSN and including both cases, the company has one tool for evaluating this issue;

- Business Network Redesign: if the current design of a SSN is not profitable enough, an enterprise would try to redesign it, so as to reach its objectives.

The model presented in [6] is still evolving and adaptations might be needed when particular networks are designed. Before showing an example, it is important to be aware of what the symbols in the model present. Figure 2, extracted from [6] shows that.
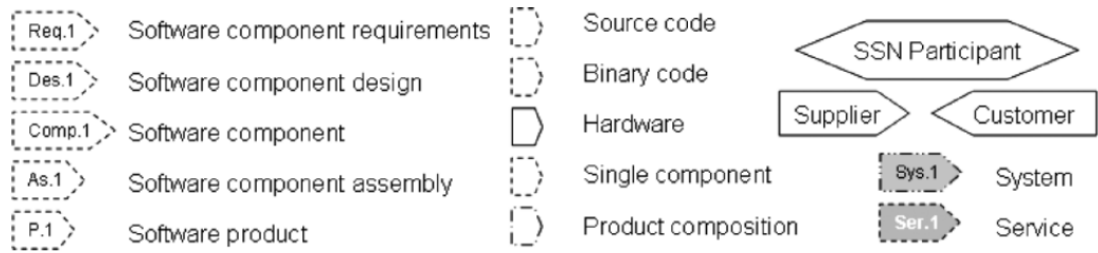
Figure 2. Symbols for modeling a SSN

Figure 3 shows an example of a modeled SSN:
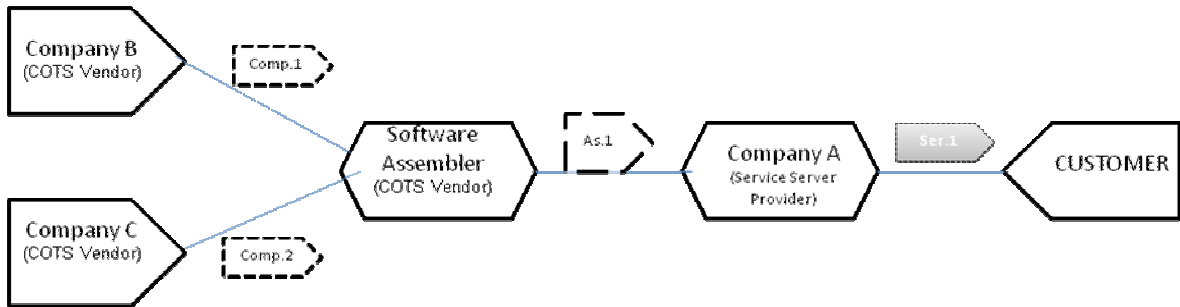
Figure 3. An example of a SSN Model

In Figure 3, we are supposing a Service Server Provider provides an application for the customer as a service hosted in its own server. The application was bought from a Software Assembler, which got one component from Company B (Comp.1) and another one from Company B (Comp.2). The integration of these two COTS components originated As.1, which is hosted by Company A.

In a nutshell, by combining the elements in Figure 2, it is possible to model a SSN. If all the ecosystems the company takes part are modeled and joined, then it is possible to analyze the SECO of the company as well.

2.2 The implications of being in a Software Ecosystem

For a company, being in a SSN and consequently, a SECO is not the same thing as acting independently. In a SSN/SECO, companies establish relationships in order to provide solutions to customers. In this environment, there are some challenges, which may turn into risks and threats. Nevertheless, there are opportunities for companies to thrive in an interaction-driven environment.

2.2.1   The opportunities in a Software Ecosystem

Software enterprises normally face heavy strain due to time-to-market. Time-to-market, as exposed in [8], is a key factor for the success of software product companies, because if a

product delays to be launched in the market, concurrent businesses might launch a similar product previously and take the lead in the market. Furthermore, the customer does not care about technical difficulties or anything else, the customer just wants its problems to be sorted out promptly. Therefore, software companies need to launch products in a fast pace that meet customers' needs and consequently, add value to them.

In this environment with plenty of pressure, being in a SECO might represent an opportunity to deal with the time-to-market, adding value demands and consequently, gaining advantage and maximizing profitability. According to [3], in a SECO, the win-win principle is applicable, in which all involved business obtain advantages. Based on [7], in a network environment, participant companies learn more and gain advantage. In [6], it is said that companies that are prepared to engage in conversations, relations, partnerships and alliances can profit more. Indeed, being in a SECO brings the possibility for enterprises to:

- Do more with less effort: as several business interact in various forms, in a way that each one performs some activities instead of only one company doing the whole work for products to be in the market (both related to Software Engineering and commercial issues), it is possible to have better products, with plenty of functionalities that meet customers needs and perform quicker customizations. All that without overloading the SECO participants;

- Share the costs of innovation: if companies interact and collaborate and, as said in the last topic, they can do more with less, it means that the SECO as a whole can foster innovation without overloading one company. Each participant takes part in this process and gives its contribution and obviously, the cost is shared;

- Increase customer base: when software vendors interact with resellers and partners in the general sense, more customers might be reached by several distribution channels. Thus, the product might have higher sales.

Hence, if you can do more with less effort and share the costs of innovation, you can reduce costs. In addition to it, if you can increase customer base, you can have higher incomes. If you can combine higher incomes with lower costs, you can increase the return on investment, meaning you can profit more.

In spite of the opportunities that can be seized in a SECO, the environment also might bring challenges, which will be discussed in subsection 2.2.2.

2.2.2 The challenges in a Software Ecosystem

In a SECO, there are both technical and non-technical issues to be considered, which constitute challenges.

In the technical field, the main issues relate to software design [3]. As it is said in [6], "software business are blends" and so, products that come from a SSN/SECO are formed by codes, components and services from more than one supplier, in a way that software design must be flexible to accept integrations throughout its development. Furthermore, companies interact, in a way that each one does part of the job that used to be performed by only one company in the traditional approach. Thus, their software design must make this interaction easy, meaning software vendors and suppliers might need to make their artifacts or deliverables "available outside the organizational boundary" [3], so as to facilitate not only integrations but also customization efforts after the software is released.

Quality issues are also part of the technical challenges. As several companies are involved in a SSN/SECO, ensuring the compliance of suppliers with quality standards is not straight-forward, as [3] highlights. It then becomes a tough challenge, because as [5] points out, quality might influence customer approval of software and consequently, customer satisfaction. Lack of quality can lead to costs rise and loss of revenues.

In the non-technical side, the implications are the strategic decisions that must be made. In this sense, there are some questions that need to be answered, as some exposed in [5], such as: "Should we deliver our products and services to small or large numbers of customers? Are we better at building software or at exploiting software?" Still in the strategic field, as shown in [5][13], companies need to decide if they can or want to be SECO leaders/orchestrators or SECO followers, the kind of relationship they intend to establish with other businesses (strong, loose, etc), whether they want to sell to specific or to wide markets, whether the company will sell products or services, etc. The answer to these questions depend on the strengths and weaknesses of the firm.

In a dynamic environment, the organization strategy might be overwhelmingly shaken by some moves, such as: the acquisition of an important supplier or partner by a competitor, the bankruptcy of a supplier or partner, etc. Actually, depending on how important the supplier or partner would be, these would be risks or threats.

This work focuses on the strategic implications of being in a Software Ecosystem. Further analysis concerning this point will be made and presented in chapter 4.

3   AN INSIGHT INTO ORGANIZATIONAL STRATEGY

This chapter aims to present the idea behind organizational strategy, firstly presenting some definitions of strategy that are exposed in the literature. Secondly, this chapter aims to present the Competitive Strategy Management, which is a school of strategic thinking that is explained in the literature. Thirdly, some strategic tools such as SWOT Analysis and Balanced Scorecard (BSC) are shown and explained. Last but not least, a means of aligning IT and Business Strategy is exposed, based on the concepts of Business Process Management – BPM.

3.1   The concept of Strategy

The first definition of strategy is dated from ancient times. It was applied to war scenarios, referring to the command of army troops. This idea evolved and changed, so that nowadays, this word is heavily used in the context of business. Based on [2], in a business environment, strategy is normally related to the fast pace of change, not only in society but also in the entrepreneurial world.

In [1] it is said that "Strategy is the set of policies that an organization adopts in pursuit of medium to long-term performance objectives, and an issue is strategic if it has a significant impact on that likely performance." From this point of view, strategy is seen as a set of decisions and actions targeted to reach objectives that can impact on organizational performance.

More definitions and explanations about strategy are presented in [2]. In this reference, strategy has several aspects concerned. Therefore, the following considerations are applicable to the concept of strategy:

- Strategy defines the direction to be taken. It provides a course of action so that the company can move from a current state to a future and desired one;

- Strategy concentrates organizational efforts, so that it promotes activities coordination and make the efforts work with synergy;

- Strategy defines the organization, enabling people to understand it and differentiate it from other organizations. It gives sense to the role the organization plays in a business environment;

- Strategy is a simplification of reality which makes action easier.

As explained in [2], these previous considerations show positive aspects of strategy. However, some of these considerations might imply negative effects as well. When analyzed carefully, some risks related to these definitions might be identified, such as: the loss of flexibility due to the determination of a direction, excess of effort concentration in some specific points, which can prevent organizations from seizing new opportunities and the

oversimplification of a complex environment which is actually complex. Therefore, when working with strategy, these points must be attentively observed.

Joining the concepts brought from literature [1] [2], strategy in the business context can be seen as a way of an enterprise to understand and analyze its environment and further define a plan so as to reach its objectives and thrive.

In the next section, strategy will be detailed under the insight of the Competitive Strategy Management school of strategic thinking.

3.2   The Competitive Strategy Management

As explained in [2], there are several schools of strategic thinking, each one focusing on specifics aspects of strategy and each one with its insights. In some cases, different schools have conflicting ideas. The scope of this work does not include a comparison of the different insights of each of these schools.

After analyzing some of schools in the literature, the Competitive Strategy Management school of strategic thinking was chosen, as it exposes a logical sequence of activities for an organization to devise its strategic plan (as shown in Figure 4), and its insight is very broad, not being restricted to specific factors, meaning the Competitive Strategy Management considers planning, environmental analysis, power and several other issues as part of organizational strategy. Other schools normally take only one or few factors into consideration. Moreover, part of the characteristics of the Competitive Strategy Management, which will be discussed further in this section, such as proactive attitude, incentive to creativity, emphasis on alliances, etc, can be associated to the environment of a Software Ecosystem. Thus, we consider the Competitive Strategy Management is suitable for the application in a Software Ecosystem context.

Based on [2], the business environment is constantly changing and organizations need to cope with this reality. The Competitive Strategy Management School stresses the importance of potential to new contributions to strategic thinking. This way, strategy definition is a learning process throughout time. According to [2], the main characteristics of Competitive Strategy Management are:

- **Global Acting**: Globalization was inevitable and the global acting of modern companies is a key characteristic of Competitive Strategy Management. Globalization, according to this school, might bring opportunities and risks, determining the survival of the strongest;

- **Proactive attitude:** to conduct the Competitive Strategic Management, enterprises must have abilities to keep informed about the environment and to be aware of its strengths so as to convert opportunities in success. To reach this point, enterprises must envision the future based on a proactive attitude;

26

- **Incentive to creativity:** as the environment changes – new technologies, new methods of production arise. The environment in general changes. To remain in the market, companies need to be creative to deal with a mutable scenario;

- **Control with Balanced Scorecard (BSC):** Balanced Scorecard will be discussed in more details in section 3.4. To summarize, it is a management system that approaches organizational strategy based on four perspectives: financial, customer, internal processes and learning and growth.

- **Organization in strategic units of businesses:** the concept of strategic units of business is applicable to big companies that are geographically spread or to groups that own several enterprises. For companies that have several offices around the world, for instance, each office could be seen as a strategic unit of business. In the competitive strategy management, strategy must be defined to the whole organization and to each unit of business, so that the final result of the set is bigger than the sum of each result individually;

- **Emphasis on alliances:** a strategic alliance is a formal relation aimed at reaching jointly mutual objectives. In the competitive strategy management, companies join together in order to develop new technologies, sharing investments in research and development (R&D) and consequently reducing costs. According to the competitive strategy management, the best alliances are true partnerships;

- **Sustainability:** sustainability normally refers to social and environmental issues. The competitive strategy management sees sustainability also as the importance of a win-win approach, which is sustainable in the long run. This way, all the stakeholders must get benefits from the business environment (the enterprise, its partners, its customers, its suppliers, the society);

- **Continuous learning:** in order to thrive in a dynamic environment, learning continuously is mandatory. This is also considered to be a renewable competitive advantage. This way, the company needs to have an strategy that encompasses the acquisition of new abilities.

Figure 4, adapted from [2], shows a model for building the strategic planning in an organization.
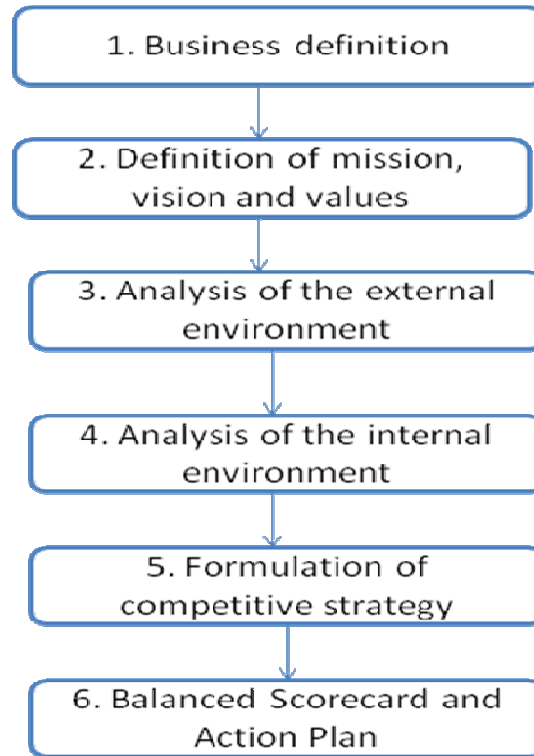
Figure 4. Development of strategic planning according to the competitive strategy management

In Figure 4, items 1 and 2 refer to the beginning of the strategic planning. At this point, the company must define its business as well as it mission, vision and values for a defined period of years. Items 3 and 4 comprise the SWOT (Strengths, Weaknesses, Opportunities and Threats) matrix, which is a result of both an internal and external analysis. The SWOT Analysis brings factors that can influence the achievement of the definitions in the previous steps throughout time. It also provides information that is used in the subsequent steps. Steps 5 and 6 are the final steps of strategic planning. Step 6, in special, involves actions and indicators devised so that the company can monitor its actual performance compared to what was planned.

In this work, we intend to focus on the environment of a Software Ecosystem and the impact it has on organization strategy. Therefore, the scope of this work is intimately related to steps 3, 4 and 6. Steps 3 and 4 describe the analysis of the environment of an organization and this work intends to show the impact on the environment of the organization due to the participation in a SECO. In addition, by influencing the SWOT matrix, the SECO also influences the Balanced Scorecard, which is one of the main tools of strategic planning. These approaches will be detailed in sections 3.3 and 3.4 of this chapter.

3.3   SWOT Analysis

As explained in subsection 3.2, the SWOT analysis is one of the activities for an organization to build its strategic planning, according to the guidance of the Competitive Strategy Management.

SWOT means Strengths, Weaknesses, Opportunities and Threats. SWOT provides an analysis of the environment concerning the organization. This environment is comprised by two perspectives: the internal environment and the external one. According to [1] [2], Strengths and Weaknesses refer to the internal environment while Opportunities and Threats refer to the external one.

By joining the analysis of both perspectives, the SWOT Analysis establishes relations among Strengths and Weaknesses, and Opportunities and Threats.

3.3.1   The external environment: Opportunities and Threats

According to [2], the analysis of the external environment is a way of mapping the evolutions faced by this environment, in an attempt to anticipate opportunities and threats that can influence the desired performance that is aligned with the vision, mission and objectives of the organization.

Based on [1] the external environment encompasses competitors, partners, etc. As defined in [2], opportunities are external events to the organization that can contribute positively to the company, so that it can achieve its mission and vision, while threats are external events to the organization that can harm the company in this sense.

In [2], it is said that the external environment is formed by two environments: the general environment and the sector one.

The general environment is comprised by four elements: demographic, sociopolitical, technological and economical. It represents the society and the way it can influence the organization. Based on [2], the emphasis on one element or on another as well as the scope of the analysis concerning each element depends on the company needs. If you think about the strategy of a local company, for instance, the scope related to these elements, with regard to opportunities and threats, is restricted to a local market. On the other hand, if you are talking about a Global enterprise, then the environment might involve several countries. An economical crisis might not represent a threat to an organization if it does not act in the countries that were affected by the crisis, for example.

The sector environment is the business environment in which the organization is involved. According to [18], the Five Forces Competition Model helps in the analysis of the sector environment. The five forces in the model are:

- **Existing competitive rivalry between suppliers:** this force focuses on determining till which extent the value created by an organization will be dissipated by the struggle of concurrent companies in the market;

- **Threat of new markets entrants:** new competitors might arise in the market at a determined time or there might be potential ones, threatening the market position of an organization. Barriers to entry can prevent this threat from happening;

- **Bargaining power of buyers:** this force is related to the power that buyers have to negotiate prices and it can lead competitors to either lower the prices or to offer best services at reasonable costs;

- **Power of suppliers:** depending on the market configuration, suppliers might be in advantage to raise prices or lower the quality of services or products. In concentrated markets, for instance, when there are few suppliers, this situation happens. To deal with this force, it is necessary to establish long term relationships with suppliers, with win-win purpose. Otherwise, an enterprise might be in trouble whether a supplier offered better conditions to its competitors or it was an unique supplier and vanished;

- **Threat of substitute products**: similar products that have similar purposes increase competition in a sector. Like the threat of new market entrants, barriers to entry can also prevent this threat from happening.

By analyzing the general and the sector environments, an enterprise is aware of the tendencies that can influence the organization throughout time. Examples of tendencies are: at 2050 the portion of the elderly population will be the same as the portion of the young one; the Brazilian economy will grow at the rate of 3,5% a year since 2009; new giants in the IT sector have plans to act worldwide in the ERP Market from 2010 on; etc.

After having the tendencies related to the external environment, organizations can think of scenarios, which represent the way the organization believes the trends will evolve. Based on [2], normally three scenarios are devised for each tendency: an optimistic, a realistic and a pessimistic.

According to [2], based on the scenarios elaborated, it is possible to extract the opportunities and the threats. This way, the analysis of the external environment is accomplished.

3.3.2 The internal environment: Strengths and Weaknesses

According to [2], the analysis of the internal environment represents the diagnosis of the organization's strengths and weaknesses, as well as its capabilities and competences to achieve success.

Figure 5, based on [2], exhibits the elements that form the analysis of the internal environment.
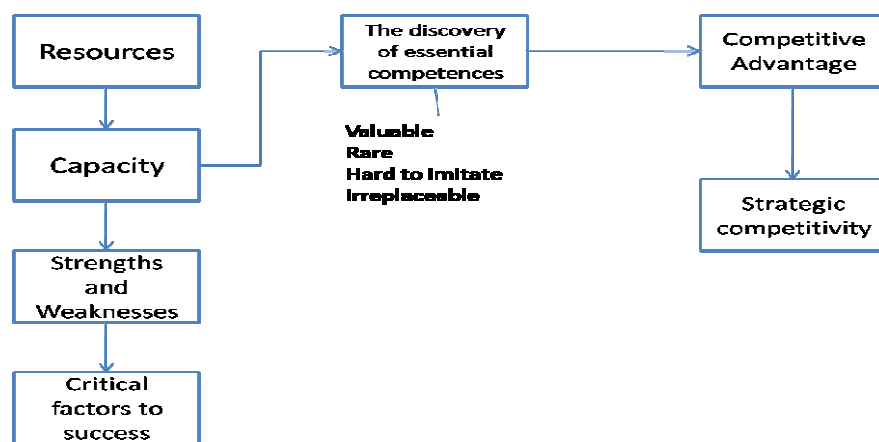
Figure 5. The analysis of the internal environment

In [2], resources are defined as inputs to the production process. In [1] it is defined as "something useful to which the firm has access". That does not necessarily mean the firm owns it: a resource might belong to a partner, for instance, as long as the firm can use it when necessary. Resources might be either tangible or intangible. Examples of tangible resources, based on [1] [2]: customers, staff, products, equipments. Examples of intangible resources: product quality, production efficiency, brand, staff morale. As explained in [1] a good way of finding out intangible resources is by first listing the tangible ones and then, thinking about characteristics of these resources (quality, performance, etc). Thus, you might have a list of intangible resources.

Considering resources are strategic to the firm, it is crucial to develop and enhance its capacities to manage them. In [2], firm's capacity is defined as the ability to manage resources in a complex and unpredictable environment. According to [2], for the company to obtain a sustainable position in the market, it has to optimize the resources usage when compared to competitors. Scarce resources might be a setback. Nevertheless, the excess of them without a good capacity of the firm might be a setback as well.

The importance of strategic resources is mentioned in [1] as well as some factors concerning this, which are:

- The durability of resources: "a resource that decays, deteriorates, or becomes obsolete is not likely to provide sustainable advantage". Staff morale may decrease throughout time, for instance;

- The mobility or tradability of resources: resources are mobile if they are easily bought and sold. For example, a software tool might be easily bought, not only by you but also by your competitors;

- The easiness to substitute resources: similar resources might be built with similar purposes. If your competitor has access to a resource you do not, then you can try to obtain another that does the same. For example, if you do not have access to retailers, you can consider alternatives ways to get to customers;

- The fact of resources being complementary: one resource is rarely self sufficient, meaning it might not be of great value by itself. For example, you cannot have in the IT sector, whose intellectual contribution of the employees is critical to the success, product efficiency without staff morale. In the industry, you cannot have delivery performance without distribution channels.

Resources and capacities are the basis for finding out the firm's essential competences. As explained in [2], the essential competences are a set of abilities and technologies that can produce benefits to customers. A competence is not only an enhanced capacity, but also a source of sustainable competitive edges of the firm. For a capacity to be an essential competence, it has to be:

- Valuable: enables the organization to boost its strengths, in order to take advantage of opportunities and neutralize threats;

- Rare: when none or just a few competitors have access to the resource;

- Hard to imitate: when competitors do not have the competence or they have to spend much to get it, becoming financially disadvantaged with regard to those who already have the competence;

- Irreplaceable: when there are not equivalent competences.

Examples of essential competences, extracted from the literature and from other real-world examples:

- Sony: miniaturization, enabling them to launch innovative products;

- Coca-cola: marketing control and ability to keep the brand always valued;

- Apple: engineers and designers work in consonance, enabling the firm to launch innovative and visually appealing products;

- General Electric: they produce from airplane turbines to appliances, with high operational efficiency;

- Embraer: they produce small to medium airplanes, complying with international standards of comfort and autonomy, high degree of customization and competitive costs.

According to [2], the essential competences enable companies to obtain greater performance in relation to its competitors, adding value to customers and developing sustainable competitive edges. Therefore, strategic decision concerning resources, capacities and essential competences impact on the ability of the firm to develop sustainable competitive edges, reach its vision and accomplish its mission.

Once resources, capacities and competences are identified and understood, it is possible to diagnose the internal environment of the organization. Strengths are internal characteristics of the organization that allow it to reach its objectives, while weaknesses are internal deficiencies that can prevent companies from reaching its objectives.

According to [2], while opportunities and threats indicate what must be performed, strengths and weaknesses indicate what can be performed. Some techniques such as benchmarking with relation to competitors, brainstorming of strengths and weaknesses, implementation of a suggestion collection box and team evaluations might be used for the internal diagnosis. The organization must have strategies that will minimize weaknesses, transforming them into strengths, building capacities and capabilities that are relevant for the firm, in consonance with its mission.

3.3.3 The SWOT matrix and diagnosis

The strategic analysis based on the SWOT matrix is one of the tools used by the competitive strategy management, as shown in section 3.2. This matrix shows Strengths, Weaknesses, Opportunities and Threats, helping strategists to relate the internal with the external environment. Table 1 is an example of a SWOT matrix.

Stregths	Weaknesses
Experienced staff	Difficult access to distribution channels
Patented technology	Lack of customer fidelity
Efficiency in costs	Lack of focus on business
Opportunities	**Threats**
Soaring demand for the product	The entrance of big competitors
Possible small and promising business susceptible to acquisitions at reasonable costs	Hard financial conditions of potential customers
Change in regulations	Change in regulations

Table 1. An example of a SWOT Matrix

In Table 1, it is possible to see that one factor would be a Threat and an Opportunity at the same time, like the "Change in regulations" case, as this factor might either be good or not to the organization.

After the SWOT matrix is conceived, it is possible to make the SWOT diagnosis, which is based on the SWOT matrix. Table 2, adapted from [2], shows the four quadrants for the SWOT diagnosis.

	Opportunities	Threats
Strengths	1. Increase in the offensive capacity	2. Defensive capacities
Weaknesses	3. Constraints or debilities	4. Crisis or vulnerability

Table 2. An example of the SWOT Diagnosis

The first quadrant (increase in the offensive capacity) represents organization's strengths and capacities to take advantage of the identified opportunities. The second quadrant represents firm's strengths that serve as deterrent to the threats, enabling the organization to simply defend from these threats. The third quadrant represents firm's weaknesses that prevent it from taking advantage of opportunities. Eventually, the fourth quadrant represents the

weaknesses of the organization to deal with the threats. It means the organization might be in decline.

The SWOT diagnosis is then, the way of relating the external to the internal environment. This way, it is possible to analyze the strategies that can be implemented. A firm might have activities and business processes that put them in each of the quadrants. However, a concentration of them in the third and fourth quadrants might imply that the organization is not in good shape, needing corrective actions to revert this scenario. As explained in [2], the organization must strive for developing competencies and capabilities that place them mostly on the first and second quadrants.

3.4   Balanced Scorecard (BSC)

Balanced Scorecard is a tool that assists the process of implementing and controlling strategies that encompass both financial and non-financial aspects. This is the reason why it is "balanced", as it balances financial and non-financial aspects. Based on [2], for companies to outdo in a complex environment, they have to use tools that provide alignment, support and strategic controls in several levels of the organization, producing abilities and knowledge to the firm. In the competitive strategy management, strategic alignment and control are supported by Balanced Scorecard, which provides the elaboration of financial and non-financial measures that enables the devisal of strategies to be implemented.

According to [2], BSC is a system which aims to integrate the strategic management in the short, medium and long term, targeting to organizational learning and growth, allowing the firm to correct its course when needed.

As exposed in [2], when implanting BSC, strategists are aimed at:

- Making clear the business strategy to the entire organization;

- Providing focus to business;

- Developing the leadership in high positions;

- Aligning programs and investments;

- Direct the process of capital and resources allocations;

- Promote enhancements.

BSC has four perspectives: financial, external customers, internal processes and learning and growth. These four perspectives must be known by all organizational levels. Figure 6, based on [2], shows these four perspectives.
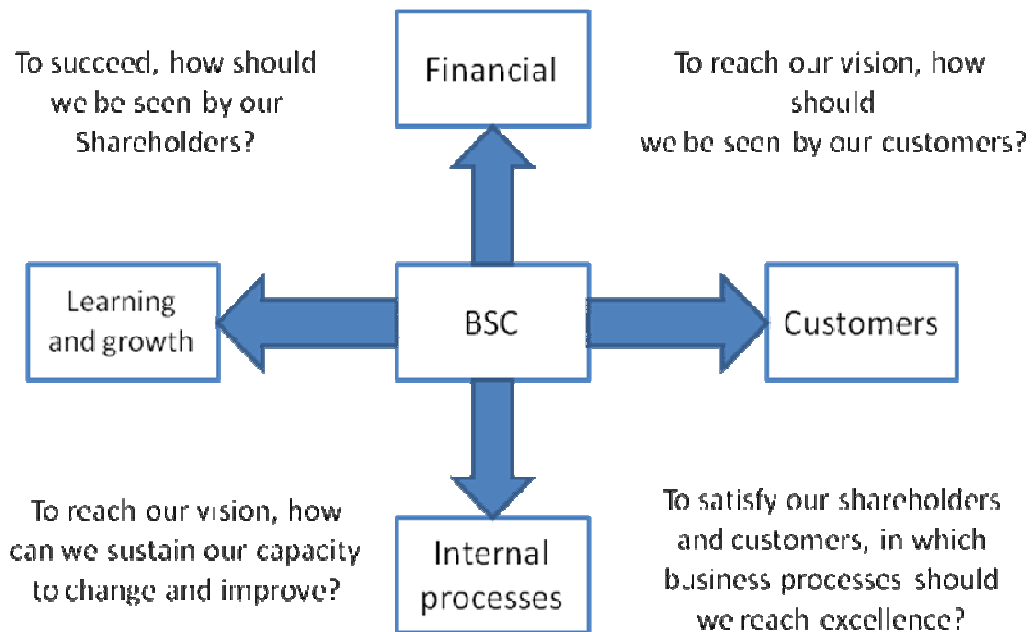
Figure 6. The perspectives of the Balanced Scorecard

Each perspective of the BSC has objectives and measures.

Based on [2], financial objectives and measures indicate if the implantation of strategies is contributing to the improvement of financial results. Thus, the objectives and measures of the financial perspective have two main purposes: defining the desired and expected financial performance and serve as a basis for the objectives and measures of the other perspectives. An example of a financial objective: reducing costs. An example of a financial measure related to this objective: a percentage of costs reduction.

As explained in [2], from the customers' perspective, objectives and measures aim to identify markets and segments in which the organization intends to act so as to increase profitability and growth. This perspective, then, depends on the financial objectives. The basic measures of these perspectives are: market share, customer retention, customer acquisition, customer satisfaction and customer profitability (is the organization focusing on the most profitable customers?). In this perspective, the value to the customer is paramount. In [2], the following attributes are quoted as part of value: product or service (functionalities, features, price, quality); image and reputation (customer fidelity, perception of value, compliance with rules and regulations); customer relationship (the reasons why the customer buys your product and the number of customers that indicate your organization to others).

In [2], the perspective of internal processes is presented as directed to the measurement of the performance of these processes. It not only monitors existing processes, but also sets up an environment for the conception of new process that can anticipate customer needs. As explained in [2], BSC states that the organization must identify new processes so as

36

to reach excellence and achieve financial and customers' objectives. The indicators of this perspective must demand that the organization conceive new products and services capable of meeting emergent needs of current and future clients. According to [2], for some enterprises, the capacity to manage the development of new processes and reach new categories of customers might be more critical than managing existing operations in an efficient and agile way. Last but not least, internal processes encompass three processes: the innovation process (the business unit tries to find out emergent or latent needs and conceives products and services that will meet them); the operations process (the production and delivery of the product or service); the post sales processes (after the product or service is delivered, there might be the need of maintenance, for instance).

As for the learning and growth perspective, [2] describes it as a perspective that incorporates to BSC the context of strategic learning and develops objectives and measures directed to growth and learning. According to [2], creativity and continuous improvement of current processes are essential to the implantation of innovations and additional capacities. The value of the organization is directly related to its capacity do develop human resources, identify and enhance leadership, creating value to customers and improving operational efficiency. As explained in [2], objectives and measures of the customers and internal processes perspectives reveal where the organization must outdo so as to obtain an exceptional performance. However, learning and growth's objectives provide support that enable the achievement of the objectives of the other perspectives. It stresses that it is necessary to invest not only in traditional areas, but also in future, including research and development (R&D), development of new products, systems, procedures, etc.

For building BSC, the first thing is ferreting out the strategic objectives, also known as key objectives. These objectives might be originated from the environmental analysis, explained in section 3.3, as objectives must neutralize threats and weaknesses, potentiating strengths and opportunities. According to [2], these objectives must stress the exclusive abilities of the organization, converting its vision in specific targets, fixing milestones based on which the desired performance is defined and prompting the organization to achieve its results. Strategic objectives are then prioritized and destined to its respective BSC perspectives.

These objectives are presented in a strategic map that assists in the construction of strategic panels. Based on [2], the strategic map is the graphical representation of organizational strategy, enabling the visualization of a cause-effect relation among objectives, meaning the set of prioritized objectives that are part of the strategic map are a integrated set that define organizational strategy. The objectives are shown divided by perspectives in a strategic map. From the perspectives and objectives of the strategic map, performance indicators and goals are identified. Thus, the management of the strategic actions is carried out by the monitoring of these indicators and goals, constituting essential part of the organizational

alignment to the established strategy. These indicators and its goals are exposed and described in a performance strategic panel. As [2] exposes, the measures in the performance panel are directed to articulate enterprise's strategy, communicate this strategy and assist in aligning individual organizational and interdepartmental initiatives aimed at achieving common goals.

It is outside the scope of this work detailing strategic maps and strategic panels, including the construction of these tools and deepening in conceptual issues. Therefore, the scope of this work is restricted to defining and presenting the purposes of these tools.

3.5 Aligning Information Technology and Business Strategy

Based on [21], Information Technology (IT) is a potent strategic business tool. Nevertheless, according to numbers presented in [21], just a small portion of enterprises regard IT as a "strategic weapon". Thus, IT and business strategy seems to be disjunctive things for most of the firms.

In [21], it is explained that currently, IT is seen as a department which produces costs, when it can be actually seen as a department that can contribute to step up profitability. Therefore, instead of running business, IT should transform the business, meaning IT would play a strategic role.

Business Process Management, which will be presented in the following subsection, is one possible way for companies to align IT with Business Strategy and benefit from that.

3.5.1 Business Process Management (BPM)

3.5.1.1 What is BPM?

In the literature, there are several definitions for Business Process Management. Some definitions, extracted from

[16][19][20][21], are:

- BPM is a management discipline and a set of enabling technologies;

- BPM is a continuous set of processes focused on process management;

- BPM includes modeling, analysis, design and measurement of business processes in an organization;

- BPM describes capacities and technologies that enable organizations to model, analyze, automate, manage and optimize business processes, improving the IT structure

Thereby, BPM is a managerial discipline, not an IT tool. As [20][21] stresses, it is "more than just software", "more than just improving o reengineering your processes – it also deals with managerial issues", "it is an integral part of management" and "it is more than modeling".

IT can be seen in this context as a part of BPM, which provides support to the implantation of business process management throughout an organization. This is made clear in

[16], when it is stated that BPM is comprised by eight sub disciplines: Modeling, Analysis, Design, Performance Management, Transformation, Organization, Organizational Processes Management and Technology.

According to

[16], a business process is an end-to-end work that delivers value to customers. The expression "end-to-end" means that it involves all the efforts necessary to deliver value to customers, no matter if functional borders need to be crossed. From this point of view,

[16] then affirms in other words that BPM is an approach directed to identify, design, execute, document, measure, monitor, control and improve business processes (either automated or not) to reach desired results that are consistent and aligned to the strategic goals of the organization. Therefore, it makes clear that BPM aims to be aligned with business strategy.

In [20], it is said that "processes are not and end in themselves, but rather a means to achieve a business objective. The selection of a business objective and the approach to achieve that objective is the strategy of the organization". This way, [20] complements that business processes support or contribute to the fulfillment of the organizational objectives. Figure 7, based on [20], show the relation between processes and strategic objectives.
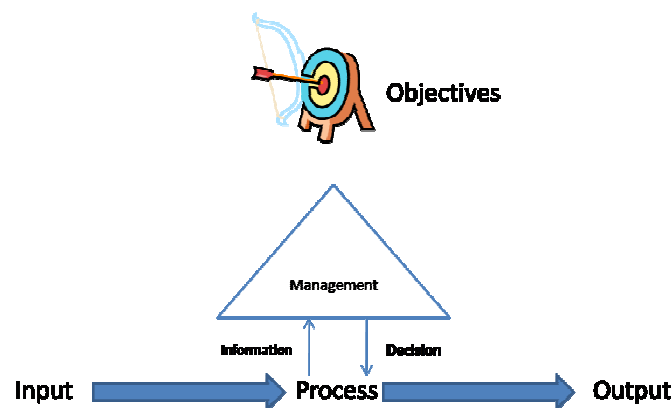
Figure 7. The relation between processes and business objectives

As [20] warns, the strengths, weaknesses, opportunities and threats involving a process must be taken into account, as they can heavily impact on the achievement of the strategic objectives. As explained in section 3.3, strengths, weaknesses, opportunities and threats are related to SWOT, meaning the analysis of the environment is influenced by business processes, contributing or not to the achievement of organizational objectives and consequently, impacting

on Balanced Scorecard and organizational strategy in general. Thus, BPM is important for an organization to successfully accomplish its objectives.

3.5.1.2 Business Process Management Notation (BPMN)

As explained in 3.5.1.1, BPM is a discipline that is comprised by 8 sub disciplines: Modeling, Analysis, Design, Performance Management, Transformation, Organization, Organizational Processes Management and Technology. In this work, due to the context of Software Ecosystems, exposed in chapter one, and due to scope constraints, we will focus on Modeling and slightly on the influence it has on Technology and Organizational Process Management.

Business Process Management Notation (BPMN)

[16][17] is a relatively new notation for modeling business processes. It was developed by The Business Process Management Initiative (BPMI).

According to [17], the core BPMN elements are exposed in Figure 8, extracted from [17].
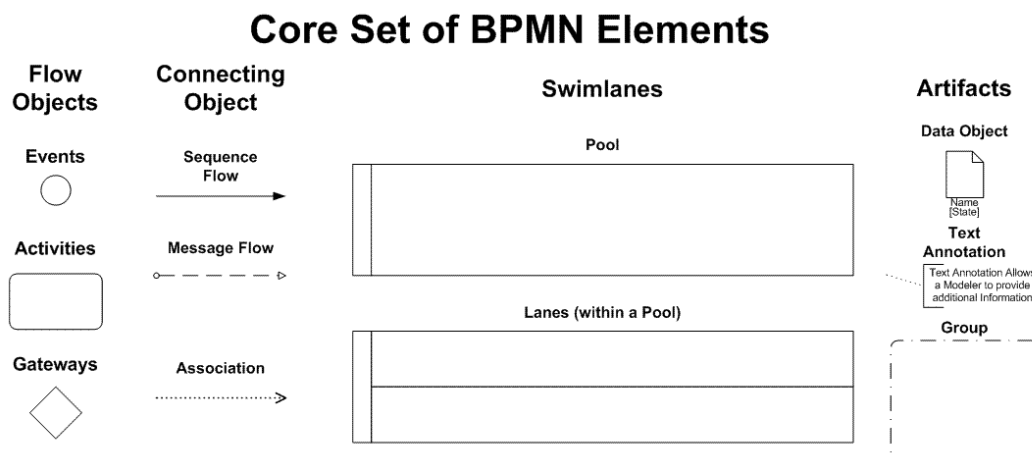
Figure 8. Core Set of BPM Elements

- **Events:** an event is something that happens during the course of the business process. Events affect the flow of the process and usually have a cause (trigger) or in impact (result)" [17];

- **Activities**: an activity is some work the company carries out. It can either be a task or a sub process;

- **Gateways**: a gateway provides convergence and divergence in a flow;

- **Sequence flow:** a sequence flow indicates the order in which activities will be executed;

- **Message flow:** a message flow shows the flow of messages between process participants, that are represented by pools;

- **Association:** an association shows inputs and outputs of activities;

- **Pool**: a pool represents a process. It can also group activities;

- **Lane:** a lane is a subpart of a pool. It normally represents an actor in the process;

- **Data object:** a data object shows data that are needed or generated by activities;

- **Group:** a group does not interfere in the sequence flow. It is used for documentation or analysis purposes;

- **Annotations:** an annotation is used when additional information needs to be inserted in a diagram

A diagram in BPMN would be used to model the interactions among an organization, its partners and customers. It enables the organization to understand the way it interacts with other organizations in a SSN/SECO by modeling these interactions as a business process. Moreover, with the proper IT infrastructure, a bigger project would be designed, so that the set of activities in a SSN would be automated. The scope of this work does not include analyzing this possibility.

When compared both modeling techniques, the one presented in chapter two and BPMN, they share one common feature: both represent the organizations involved in SSNs/SECOs and the way they interact. Actually, BPMN is even clearer in this sense, as it makes explicit each activity that is performed in the network, making clear which SSN/SECO participant is responsible for each activity.

One main difference is that the modeling technique presented in chapter 2 can also show SECO participants that do not necessarily interact with the lead firm (take the case of a service provider that provides services independently without even the lead firm knowing about that, for instance), what is not true for BPMN: BPMN is restricted to the actors that interact directly. On the other hand, as BPMN models SSNs/SECOs at an activity level, it is more detailed and by using BPMN, it is possible to model a SECO in a generic way that encompasses several identified SSNs comprised by the SECO. That is hard to obtain in the other modeling approach, as it does not provide a generic approach for modeling SECOs/SSNs.

Actually, both modeling techniques may coexist. The first one, presented in chapter 2, is aimed at enabling a first glance about the environment of a SSN/SECO. The second one, which is BPMN, for being more detailed, enables a better analysis and provides much information about decisions to be made. Both can be used in a complementary way to enable an understanding of the SECO in which the organization is involved.

Figure 9 is an example of a business process for providing software, modeled in BPMN.
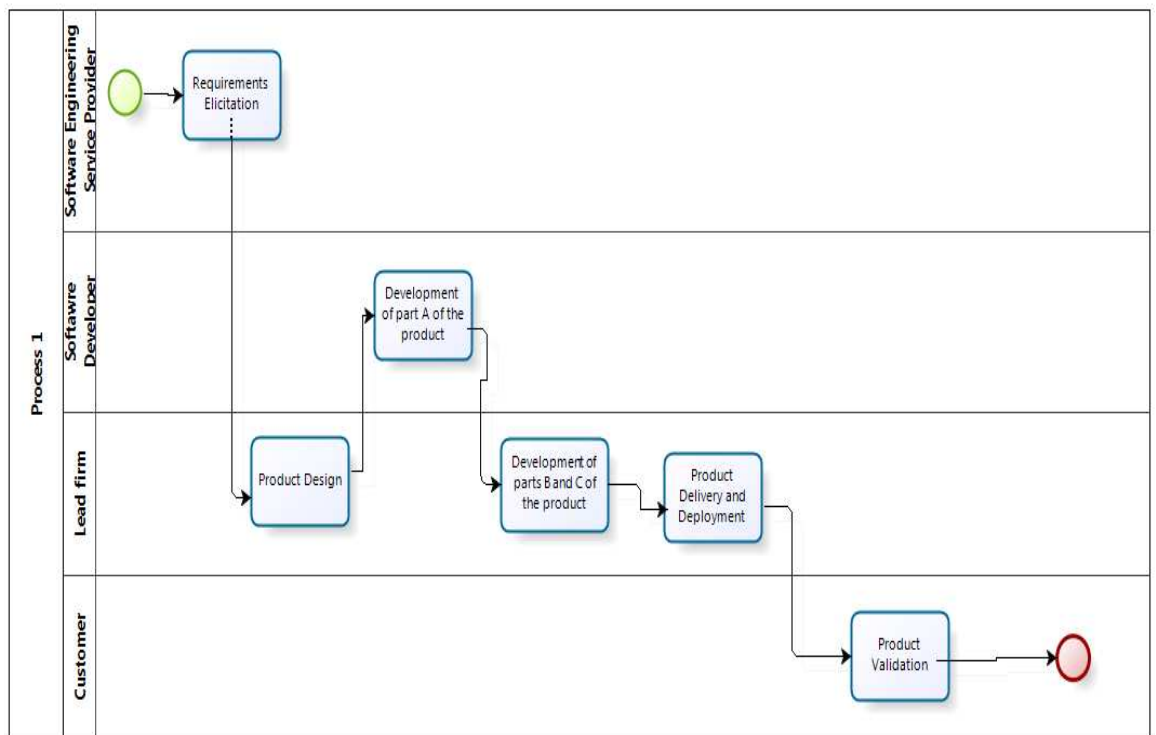
Figure 9. An example in BPMN

In figure 9, there is a lead firm, a software developer, a software engineering service provider, a lead firm and a customer. These terms are used according to the ones presented in chapter 2, for Software Supply Networks. The requirements elicitation process was outsourced. The product is designed by the lead firm, based on the requirements elicitation results. The product has three parts: A, B and C. Part A was outsourced. The lead firm developed parts B and C and was responsible for joining these pieces and deploying them to the customer, who validates the product. This example is simplified just for showing how a BPMN diagram looks like.

From this BPMN diagram, it is possible to analyze part of the lead firm's environment and how it influences its strategy. This issue will be discussed in more details in the next chapter.

4 ANALYSING A SOFTWARE ECOSYSTEM IN THE CONTEXT OF A PROJECT MANAGEMENT SOFTWARE

In this chapter, we will present a real SECO, which is involved in the context of a Project Management Software. The context will be briefly explained and the corresponded SECO will be modeled according to the proposal presented in [6] and explained in 2.1.3. Furthermore, the BPMN notation will be used as well. Besides, the influences on the strategy of the lead firm will be explained, as well as the relation between SECO and Strategy will be made explicit based on the presented example.

4.1 The context of a Project Management Software

4.1.1 An overview of project management software in enterprises

In several market sectors (IT, Civil Engineering, Telecommunications, etc), enterprises work with projects (either internal or external) and the demand for project management arises. For assisting in this sense, there are some software tools, such as Microsoft Project [22] – MS Project, which belongs to Microsoft and Primavera [23], which belongs to Oracle.

These software support several project management areas presented in [24], such as costs, schedule and scope, for example. By using Primavera or MS Project, it is possible to schedule projects, reschedule them after they have started, calculate performance indexes, assign resources, etc.

MS Project and Primavera can be installed either as a standalone application or in client-server architecture. In the first case, each user installs the software on its computer in a way that one user does not have access to the content of the other. In the second case, there is a central database, installed on a server, which is accessed by client applications. By adopting a client-server architecture, the firm might have a corporative project management, as the data is available to the users who have the required permissions. This is applicable when there is a medium to large company and project portfolio demands.

A company which adopts a project management software has many needs, such as:

- **Installation and configuration:** in a corporative approach (client-server installation), it is necessary to have a database and configure it to be used by the client applications. That includes the creation of tables in the database and the configuration of the server that hosts this database. This server might either belong to the company or to another organization;

- **General use and technical support:** the functioning of a project management software might not be trivial in some aspects. This way, users need support to assist in the use of the tool as well as technical support;

- **Specific support:** different economical sectors mean different projects. IT projects are different from civil engineering projects, which are also different from electrical projects or oil projects. There are some particularities depending on the sector and some specific doubts might arise. Therefore, there are specific market demands for advisory in project management depending on the market segment;

- **Customizations:** due to the specificity quoted in the last item, different customers might need customizations in the software. The project management software might need to interact with other software (an ERP, a costs system, etc) or managerial reports might be generated differently from the standard that the software provides, for instance.

Several customers may have different needs. This way, to supply a project management solution and meet customers needs, each situation represents one distinct reality. One customer may need installation and configuration assistance, while another one would need not only installation and configuration, but also general use and technical support. Another would have these two needs as well as specific support ones and so on. In this configuration, service, software and hardware suppliers would interact in different ways to meet customer needs.

To summarize, in order to support Project Management in enterprises, there are two main software and each one is involved in a Software Ecosystem to meet customer needs. In this work, due to time and scope constraints, only one ecosystem involving one of the solutions must be chosen. The option is made explicit and justified in 4.1.2.

4.1.2   The option for Primavera

The Software Ecosystem concerning Primavera was chosen as a practical example for illustrating the concepts presented in chapters 2 and 3. This subsection is aimed at justifying the choice.

The first reason for choosing Primavera and not MS Project is due to the consequences of the acquisition of Primavera by Oracle, as Primavera formerly belonged to Primavera Systems. Until now, Oracle does not have enough expertise and organizational structure to provide support and customizations to its customers worldwide. Then, they count on partnerships to assist customers, while focusing on development, commercial and customer relationship issues. They provide courses as well, through Oracle University [23]. In South America, an enterprise named Verano [25] is an Oracle partner, reselling Primavera and providing many services: use and technical support, training courses and customizations. Verano knows very deeply Primavera, as they were long-term partners of Primavera Systems and so, they have established a comfortable market position in Project Management and

Primavera consultancy. As no other company in South America has such a deep know-how in the tool, Verano is the only Oracle partner for Primavera in the region. Oracle and Verano have a very close relationship, although Verano is not an exclusive Oracle partner, as Verano also works with Microsoft. This reality clearly shows the existence of a Software Ecosystem and the interactions among SECO participants.

The second reason lies in the fact that Oracle explicitly fosters the existence of Software Ecosystems by encouraging companies to become their partners, as exposed in [23]. In addition to it, in Oracle's website [23], there is an attempt to make clear that Oracle's products a can be integrated to other software, even if they are developed by a competitor. This specific case is intimately related to Software Ecosystems as well.

The third reason is related to the software itself. Although the scope of this work does not include a comparison between MS Project and Primavera, there are some resources Primavera has that MS Project does not have or does not make clear whether it has or not. In Primavera for instance, Project Portfolio Management and a complete Earned Value Analysis [24] can be carried out [23]. It is not clear if MS Project also supports these two items.

4.2   The Primavera Software Ecosystem

As explained in the last section, Primavera is involved in a SECO. As customers have different needs, the reality of each customer can be seen as a Software Supply Network and by gathering these SSNs, the Primavera Ecosystem is formed. In this section, these SSNs are described and the Primavera Software Ecosystem or simply Primavera Ecosystem is modeled so that further analysis is possible to be made.

4.2.1   The Primavera Software Ecosystem described in scenarios

Before modeling and trying to figure out anything about a SECO, the first step is describing the SSNs that comprise the SECO and assuming that each SSN is a scenario. As there would be many possibilities of SSNs, the Primavera SECO might be very complex and large to model. We will focus in three particular real scenarios, which are:

- Scenario 1 - The customer acquires and uses Primavera as a standalone application. This customer might also need general use and technical support services. This customer can install and configure the tool and he/she is not concerned about specific support. Moreover, he/she does not need any customizations;

- Scenario 2 - The customer acquires Primavera, but uses that in a corporative approach, meaning Primavera must be implanted in a client-server architecture. The customer has support (for doubts in the use of the tool) and customization

demands, but its own IT team can install it and configure whatever is necessary for Primavera to work out. We assume this customer uses Oracle database;

- Scenario 3 - Just like the previous case, the customer adopts a client-server architecture. In spite of having the infrastructure to implant Primavera in a corporative approach, its IT team does not have the expertise to set up whatever is necessary for Primavera to work out. We assume this customer uses Microsoft SQL Server database.

4.2.2 Modeling the Primavera Software Ecosystem from the scenarios

After describing the scenarios, the Software Ecosystem can be modeled. There are two techniques that can be used respectively: the one presented in 2.1.3 and the BPMN.

Using the modeling proposal presented in 2.1.3, the Primavera Ecosystem would look like in Figure 10.
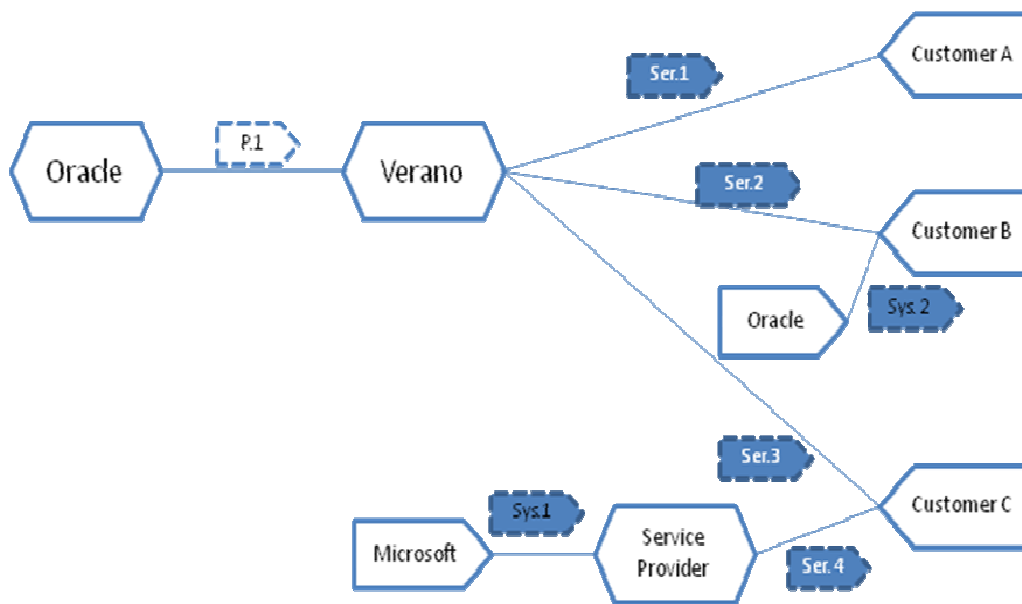
Figure 10. The Primavera Software Ecosystem

To obtain Figure 10, it was used an incremental approach: firstly, it was modeled the first SSN (referring to the first scenario), so that it was generated a first version of Figure 10; secondly, the second SSN (referring to the second scenario) was modeled and added to the previous version of Figure 10; eventually, the third SSN (referring to the third scenario) was modeled and added to the figure, so that we obtained Figure 10 the way it is presented in this work.

From Figure 10, it is possible to see that Oracle is the Lead firm and has its product resold by Verano, which acts as a reseller and service provider. Verano might provide several services, as seen before (use and technical support, customizations and training). In Figure 10,

Verano resells Primavera and provide services to customers. Customer B's IT team installs Oracle database, provided by Oracle and make the efforts so that Primavera is installed and runs properly. In this specific case, Oracle appears twice because it not only develops Primavera, but also supplies Oracle Database. Eventually, customer C not only buys Primavera from Verano and uses its services, but it also uses the services of another supplier, which sets up the infrastructure with a database supplied by Microsoft. For customer A, B and C, Verano might also provide customization services as well.

Figure 10 shows the Primavera Ecosystem, making explicit, as explained in chapters 2 and 3, the organizations that take part in the SECO and broadly speaking, the work they perform in the SECO (providing software, providing service, etc). It also makes explicit the relationship among the participants in the SECO: Microsoft and Oracle, for instance, are part of this SECO, but they do not have any direct relationship. This is not true when it refers to Oracle and Verano, which act in union to meet customer needs. It also makes explicit the degree of dependence between two or more firms. For example, in Figure 10, it is clear that Oracle is very dependent on Verano.

At a first glance, modeling the SECO using the technique used in Figure 10 seems reasonable, as it is aimed at enabling the organization to first analyze the entire environment and its participation in the SECO and the interactions that take place among the organization and other firms.

For exhibiting firms' participation in the form of activities and consequently model the SECO in details, it is possible to use a BPMN diagram. Building a BPMN diagram is easier after the scenarios are described and Figure 10 is built and understood. Figure 11 shows how the ecosystem would look like in a BPMN diagram.
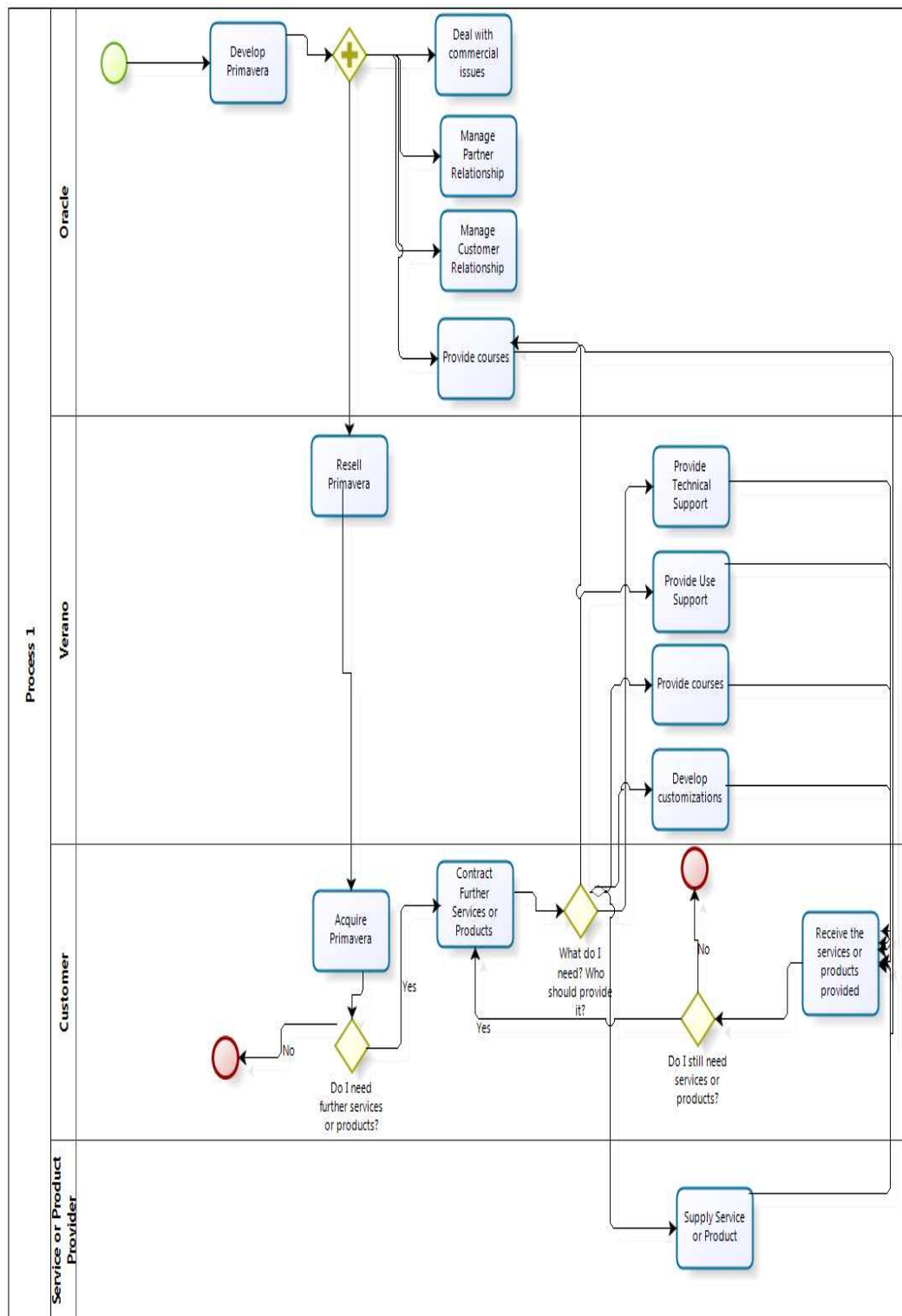
Figure 11. The Primavera Ecosystem in BPMN

For simplifying the diagram, there are four actors, which are: Oracle (as Lead Firm), Verano (as a strategic reseller and service provider), the Customer and a Service or Product Provider (for example: a third part supplier who sells a product or service Oracle and Verano do not).

In Figure 11, it is clear that Oracle develops Primavera. The activity "Develop Primavera" includes all the Software Engineering activities, from requirements elicitation to testing. That is a continuous activity, as new versions of Primavera are developed throughout its life cycle. In parallel with the reselling of Primavera, performed by Verano, Oracle deals with commercial issues (contracts, patents, licenses), manages its relationships with partners and customers and provides courses. Verano resells Primavera to the customer, who might or not need additional services or products, such as Technical Support, Use support of the tool, customizations and courses. Other products and services might also be supplied by another organization. This is an iterative process, as new demands can arise at any moment and the customer might need to contract Oracle, Verano or a third part supplier.

As it is possible to observe, differently from the modeling technique exposed in the second chapter, BPMN provides a generic overview of the activities in a SSN or SECO. Instead of modeling several SSNs, a single generic BPMN might show several possibilities. When several interactions are possible, as it happens in the Primavera Ecosystem, a generic overview might be suitable for one firm to analyze its participation and infer some factors, such as opportunities, threats, etc. However, it does not mean the other modeling technique shall be discarded. As explained in chapter 4, they can coexist. A good approach for building a BPMN diagram for modeling a SSN or SECO would be first modeling it as it was made in Figure 10, so as to understand the SECO. Then, it is advisable to build the BPMN diagram.

From Figure 10 and Figure 11, it is possible to make some observations about the Primavera SECO:

- In a Software Ecosystem, competitors might coexist. In Figure 10, customer C uses a database developed by Microsoft to work with an Oracle product. Suppose a customer already uses a database system or simply prefers that. It would be an enormous inconvenience and very risky for the customer to change that for an Oracle database if Primavera only functioned with that. According to Oracle [23], its products are designed to function well with software developed by third-parties, no matter if this software belongs to a competitor. So, its products are "available outside the organizational boundary" [3];

- Due to Verano's know-how in Primavera, they have no competitors in South America, meaning most of the services related to Primavera are provided by

them. In [23], it is made clear that this is in consonance with Oracle's policy with regard SECOs participation, so that partners are close to customers, having some high degree of independence and Oracle simply orchestrates the SECO;

- Oracle does not make clear if the development of Primavera is totally carried out by them or if they outsource part of the development;

- In a SECO, there might be the participation of unknown firms, which contribute to add value to customers and let them satisfied. This is the case of Service or Product Provider, for example, shown in Figure 10 and Figure 11.

4.3   The Primavera Software Ecosystem and the strategy of the lead firm

As explained in subsection 2.1.3, by analyzing a SSN or a SECO, it is possible to indentify the role each business plays on the network, indentify risks, devise the architecture of the product so as to maximize profitability and consider business issues in general. As shown in chapter 2, for a firm to have this information, it is important to model the networks in which it is involved. Thereby, after modeling, as carried out in section 4.2, it is possible to focus on factors such as organizational strategy. In this section, it will be shown how the Primavera Ecosystem can influence the strategy of its lead firm, Oracle.

4.3.1   The Competitive Strategy Management and the Primavera Ecosystem

In section 3.2, some characteristics of the Competitive Strategy Management are presented. It is possible to relate some of them to the context of a SECO. Table 3 shows the relation that can be made between the characteristics of the Competitive Strategy Management and the Primavera Ecosystem from Oracle's point of view.

Characteristics of the Competitive Strategy Management	The Primavera Ecosystem
Global Acting	Oracle is a Global Enterprise. It acts in SECOs throughout the world. This is also true for the Primavera Ecosystem. Although acting globally can be a challenge, it represents a broader customer base.
Proactive attitude	To succeed in the Primavera Ecosystem, Oracle as well as the other participants must be aware of its roles and of the environment in which they are involved. A proactive attitude might be the use of organization's strengths to get benefits from opportunities. This has to do with the SWOT Analysis, which will be further

	contextualized.
Incentive to creativity	As the whole scenario is dynamic and changes, Oracle has to be capable of dealing with the mutability of the environment. That involves emphasizing the strengths of the firm and focusing on orchestration efforts so as to provide better solutions to customers.
Control with BSC	The four perspectives of the BSC are related to a SECO. As explained in section 2.2, in a SECO the participants strive for: • Increasing return on investment – financial, internal processes; • Increasing customer base – external customers; • Sharing costs of innovation – internal processes, learning and growth; To obtain these 3 items mentioned above, the company must be internally strong to take advantage of opportunities and neutralize threats.
Organization in strategic units	In South America, Oracle is present in several countries. It is not present in every city. In Brazil, for instance, most of its staff is placed in São Paulo. This evidences a particularity of a SECO: partners that represent Oracle might be seen as business units, as they make part of the efforts Oracle would do if it was not in a SECO.
Emphasis on alliances	For doing more with less, concerning not only technical but also business and legal activities, Oracle invests on strengthening its alliances with its partners, like Verano. Otherwise, it would have to set up and maintain its own organic structure to perform all the tasks.
Sustainability	The win-win approach is one of the ideas behind a SECO. Companies interact so that all of them get benefits from this interaction. That is also true for the Primavera Ecosystem. As exposed in chapter 2, in a SSN, the participants strive for creating competitive advantage for themselves and for others.
Continuous Learning	As explicated in the literature, by joining efforts in a network, the involved enterprises learn and strengthen

	their market positions [12] [13].

Table 3. The Competitive Strategy Management and the Primavera Ecosystem

4.3.2 The analysis of the environment of the Primavera Software Ecosystem

As it was shown in section 3.3, the SWOT analysis is one of the strategic tools for analyzing the environment of an organization. The external environment is comprised by threats and opportunities, while the internal one is comprised by strengths and weaknesses. For identifying strengths, weaknesses, opportunities and threats involving the participation of Oracle in the Primavera Ecosystem, we will analyze the models in Figure 10 and Figure 11.

4.3.2.1 The external environment of the Primavera Ecosystem

To begin with, we are going to analyze the external environment. As shown in subsection 3.3.1, the external environment is formed by two environments: the general and the sector. The general environment cannot be analyzed from Figure 10 and Figure 11, as it is related to the society in general. For extracting opportunities and threats from the general environment, it is necessary to obtain relevant external data, like the GPD growth expectation, political issues that can influence the company (if there is any), the tendency about customers in several economical sectors investing in project management, etc. In this work, the focus in the South American market. Furthermore, as we cannot infer so much information outside the models presented in section 4.2, because it would demand an extensive market analysis, we will focus on the sector environment. However, some information such as the tendency for companies to invest on Project Management might be considered an opportunity from the general environment.

As shown in subsection 3.3.1, the analysis of the sector environment is assisted by the Five Forces Competition model. Table 4 shows the five competitive forces and the observations we can make. Some of these are based on Figure 10 and Figure 11.

Competitive Force	The Primavera Ecosystem
Existing competitive rivalry between suppliers	The models in subsection 3.3.1 do not make explicit competition. This is a limitation. This information must be obtained from external sources. In this case, particularly, the main competitor of Oracle is Microsoft.
Threat of new market entrants	The models in subsection 3.3.1 do not make explicit this, just like the previous item. However, the degree of complexity involved in a Project Management Software and the know-how to assist customers in the field is a barrier to entry. Primavera has a big set of

	functionalities Project does not have. The fact that Oracle is in an Ecosystem enables them to keep high customer satisfaction, as it has a network targeted to meet customer needs. This way, it is possible prevent new firms from competing in this market.
Bargaining power of buyers	As Primavera is a complex and complete solution and in addition to it, Verano is an exclusive reseller in South America, there is not much what buyers/customers can do. The most they can do is negotiate better prices for buying several licenses.
Power of suppliers	As far as we know, Oracle does not depend on suppliers to develop Primavera. It if does, it does not divulge it.
Threat of substitute products	The observations in this item are the same for "Threat of new market entrants"

Table 4. The five competitive forces and the Primavera Ecosystem

By analyzing Figure 10, Figure 11 and Table 4 and some external observations, some opportunities and treats can be presented, as it is shown in Table 5.

Opportunities	**Threats**
1) The growing trend for companies to invest on Project Management, needing a Project Management Software; 2) Oracle's relationships in SECOs.	1) High software piracy levels in Brazil and South America; 2) The fact that Oracle depends strongly on Verano; 3) The fact that Verano, an strategic Oracle partner, is also a Microsoft partner; 4) Oracle's relationships in SECOs.

Table 5. The external environment of the Primavera Ecosystem

The following observations are made concerning the items in Table 5:

- Opportunity 1: no additional considerations to make;

- Threat 1: as piracy levels increase, Oracle loses revenues and incomes. That is specially critical in emerging countries, like the ones in South America and Asia;

- Threat 2: the strong dependence on Verano is visible in Figure 10 and Figure 11. Actually, Verano is the only Primavera reseller in South America and

provides services not even Oracle does, such as customizations and support. What if Verano ends the deal with Oracle or goes bankrupt?

- Threat 3: Verano is a strategic Oracle partner, but it also a Microsoft partner. Microsoft is Oracle's main competitor in the Project Management Software market. What if Microsoft acquires Verano? Oracle would then depend on its main competitor;

- Opportunity 2 and Threat 4: Oracle's relationships in Software Ecosystems may represent both a threat and an opportunity. By acting in a SECO, Oracle may increase its customer base without needing to spend resources to grow organically: it can reach more customers without needing to increase its structure (local offices, hiring staff, etc). On the other hand, if a partner let the customer unsatisfied, Oracle's reputation might be damaged.

4.3.2.2 The internal environment of the Primavera Ecosystem

As for the internal environment, it is not possible to analyze that from the models in Figure 10 and Figure 11, as the models focus on showing interactions among enterprises, meaning they are more related to the external environment. Furthermore, for precisely identifying resources, capacities and competencies of Oracle, that would be necessary to get direct information from them, what is not even available, as it is part of their strategy.

Nevertheless, it is possible to conduct some analysis in this sense that is relevant to the context of the Primavera SECO based on available information. As for resources, the following considerations can be made:

- The Oracle brand is an intangible resource. Verano would probably not have the same position in the market if it was not working with a product developed by a known and respected organization. Furthermore, the reputation of Oracle leads other organizations to be interested in joining them;

- Oracle's customer base is a tangible resource they are always seeking to increase, as Oracle is a global enterprise. Acting in a SECO might be way of increasing this resource, as more customers can be reached;

- Oracle fosters partnerships and their partners are tangible resources, as they are seen as a means of Oracle achieving its goals.

In order to successfully manage these three Oracle's resources, increasing the availability of these resources, one capacity can be indicated: the capacity to lead a SECO. By being able to lead a SECO, Oracle attracts more partners and increases it customer base. It can also make its brand become more respected, as more organizations might be in contact with Oracle. This capacity is:

- **Valuable:** by having a respectable brand, increasing customer base and fostering win-win partnerships, Oracle increases opportunities and neutralize threats;

- **Rare:** although Oracle's partners might be available to its competitors, Oracle works for keeping them close in a SECO and the fact that its product is so sophisticated allied to its brand puts Oracle in a good position;

- **Hard to imitate:** the capacity to lead a SECO is also true for Microsoft. However, so far Microsoft did not manage to use that for being exclusive in the market of project management solutions;

- **Irreplaceable:** this competence cannot be replaced by others that lead to the same results and enable a good management of the resources.

Therefore, according to subsection 3.3.2, if a capacity is valuable, rare, hard to imitate and irreplaceable, it can be considered an essential competence. Based on that, after identifying resources, a capacity and an essential competence, some strengths and weaknesses can be inferred, as presented in Table 6.

Strengths	Weaknesses
1) Oracle is a global company, with high financial availability to struggle in the market, no matter who its competitors are; 2) Oracle's brand is highly respected; 3) Oracle can establish close and strong partnerships and has the competence to lead a SECO; 4) In spite of the costs, Primavera is a complete, complex and hard to develop solution.	1) Oracle does not have alternative distribution channels, as Verano is its exclusive reseller in South America (possible to infer from Figure 10 and Figure 11); 2) Primavera is an expensive solution, not being accessible to small businesses.

Table 6. The internal environment of the Primavera Ecosystem

4.3.2.3 The environmental analysis and the impacts on strategy

By joining Table 5 and Table 6, the SWOT matrix is generated, as presented in Table 7.

Strengths	Weaknesses
1) Oracle is a global company, with high financial availability to struggle in the market, no matter who its competitors are; 2) Oracle's brand is highly respected; 3) Oracle can establish close and strong partnerships and has the competence to lead a SECO; 4) In spite of the costs, Primavera is a complete, complex and hard to develop solution	1) Oracle does not have alternative distribution channels, as Verano is its exclusive reseller in South America (possible to infer from Figure 10 and Figure 11); 2) Primavera is an expensive solution, not being accessible to small businesses.
Opportunities	**Threats**
1) The growing trend for companies to invest on Project Management, needing a Project Management Software; 2) Oracle's relationships in SECOs.	1) High software piracy levels in Brazil and South America; 2) The fact that Oracle depends strongly on Verano; 3) The fact that Verano, an strategic Oracle partner, is also a Microsoft partner; 4) Oracle's relationships in SECOs.

Table 7. The SWOT Matrix of the Primavera Ecosystem

The opportunities and threats presented in Table 7 are intimately related to the context of the Primavera Software Ecosystem, meaning this part of the environmental analysis is very influenced by the context of a SECO. As Oracle is involved in this context, the external environment cannot ignore the opportunities and threats a SECO might represent.

After having the external environment analyzed, with opportunities and threats identified and listed, then the internal environment will list strengths and weaknesses of the organization. This part of the environmental analysis is also related to the SECO context: the analysis of the internal environment will assist in determining if the strengths and weaknesses of the organization enable it to neutralize threats and take advantage of opportunities.

Some observations can be made based on Table 7, concerning some relations between the internal and the external environment.

- Strengths 1, 2, 3 and 4 can assist Oracle in taking advantage of opportunities 1 and 2;

- Oracle can defend from threats 3 and 4 due to strengths 1, 2 and 3;

- Weakness 2 puts Oracle in a vulnerable position with regard to threat 1. Actually, it's really hard to Oracle to defend from piracy in South America;

- Weakness 1 lets Oracle vulnerable to threats 2 and 3.

Thus, a simplified overview of the SWOT diagnosis would look like in Table 8.

	Opportunities	Threats
Strengths	Strengths 1, 2, 3 and 4.	Strengths 1, 2 and 3.
Weaknesses		Weaknesses 1 and 2.

Table 8. The SWOT Diagnosis of the Primavera Ecosystem

According to Table 8, most of Oracle's strengths put Oracle in the first and second quadrants of the SWOT diagnosis, enabling Oracle to take advantage of the identified opportunities and defend from some threats. As for the weaknesses, none of them put Oracle in the third quadrant, although they put Oracle in the vulnerability quadrant, incapable of defending itself from some threats. That means Oracle should look for alternative distribution channels, in order to reduce its dependence on Verano and eliminate some vulnerabilities. It would also attempt to figure out strengths for defending from software piracy.

As it was presented in 3.4, the SWOT matrix is one of the inputs of the Balanced Scorecard for defining strategic objectives that will be further prioritized and destined to the suitable BSC perspective. Therefore, if the SECO influences the SWOT matrix, it influences BSC and consequently, organizational strategy.

Last but not least, by using BPM not only for modeling, but also for devising business processes that support the several activities inherent to Software Supply Networks, enterprises would have these business processes as strengths so as to take advantage of opportunities and consequently, enable the firm to reach its organizational objectives. This would be a way of aligning IT with organizational strategy. Although this topic would be interesting, deepening an analysis on this approach is not in the scope of this work.

5 Conclusions and Future Work

This work aimed at presenting general concepts, definitions and particularities of Software Ecosystems and related issues, showing how the configuration of a Software Ecosystem might influence the strategy of the Ecosystem Leader. By using BPM, a recent topic in academic research, it is possible to assist in the analysis of this influence.

Strategy was shown from the perspective of the Competitive Strategy Management school of strategic thinking, focusing on the SWOT matrix and indicating that it influences the Balanced Scorecard and consequently, strategy. Software Ecosystems were presented in chapter 2. Organizational strategy and BPM were presented in chapter 3. Then, chapter 4 aimed at showing by a practical example how Software Ecosystems relate to strategy and how BPM can be used to give some assistance in establishing the relationship between SECOs and Organizational Strategy. The practical example involved Primavera, a project management software which is commercialized and developed in a SECO.

It is possible to observe that several characteristics of the Competitive Strategy Management are applicable to the reality of Software Ecosystems, like incentive to creativity, emphasis on alliances, sustainability, continuous learning, etc. In SECOs, companies make alliances to join their efforts, so that everyone gets benefits from that and learn continuously. Furthermore, the SECO environment might bring opportunities and threats, so that organizations' strengths and weaknesses can dictate if they will seize the opportunities and neutralize the threats or not. Therefore, a SECO might influence a SWOT matrix and by influencing a SWOT matrix, a SECO influences Balanced Scorecard as well, meaning it impacts on organization's strategy.

The first step for an enterprise to understand its participation in a SECO is by modeling it and trying to identify its role and finding out threats and opportunities. There are two modeling approaches that complement each other and that assist in this process, which is the one exposed in 2.1.3 and the BPMN. After modeling the environment and collecting some external information (concerning sociopolitical, economical, demographic and technological issues), it is possible to analyze the environment in which the organization is involved, leading to the construction of a SWOT matrix. This matrix assists the organization in evaluating if its strengths and weaknesses enable it to take advantage of opportunities and neutralize threats in the SECO it participates.

However, both the modeling techniques presented in this work have limitations, as they cannot represent competitors in their models and they do not represent the internal environment of the organizations, meaning a SWOT matrix needs information that is not in the models to be built.

The main challenges of this work were:

- The lack of extensive literature about software ecosystems, as it is a recent topic in academia;

- The lack of literature concerning the relation between SECO, strategy and BPM;

- The existence of few studies showing how to model a SECO and how to evaluate the environment from the model;

- The low number of literature on business issues focused on the particularities of software companies;

- The lack of detailed information about the chosen organization to be analyzed, as most of the desired information is not publicly available to the general public.

To face most of these challenges, this work needed to look for several references about Software Ecosystems and Organizational Strategy, which are the main topics of this work, proposing ways of relating them, as the references normally expose these topics as independent ones. The use of BPMN for modeling a SECO and enabling a strategic analysis, for instance, is an example of a means of relating organizational strategy to SECOs, what was not found in the literature.

As for the lack of detailed information about Oracle, it prevented this work from conducting a deep strategic analysis in chapter 4.

As BPM and SECO are recent fields in the academic world, there is a wide variety studies to be considered. When it refers to relating either of these topics to organizational strategy, it is hard to find studies approaching this issue. So, this makes ground for researches that encompass many points of view, not only relating to business but also to technical issues. Therefore, some suggestions of future work would be:

- Combining modeling techniques and ferreting out ways of complementing them so that they enable a full and complete strategic analysis, even it is necessary to apply external resources and concepts to the models, including a case study to validate the proposal;

- Conducting case studies that show evidence of organizational strategy being influenced by Software Ecosystems. In a case study, the concerned organizations would collaborate with more information that would enable a deeper strategic analysis;

- Study the impact of SECOs on organizational strategy, considering technical aspects that are influenced by strategic decisions that suffered impact from the SECO configuration;

- Study how BPM from the perspective of process management would assist an organization in succeeding in a SECO. There would be two possibilities in this case: a study targeted to the Organization and Organizational Processes Management disciplines of BPM; or a study focused on Technology, meaning how to build an IT infrastructure and development efforts so as to implement BPM and succeed in a SECO.

REFERENCES

[1] Warren, K. **Competitive Strategy Dynamics.** Willey, 2002.

[2] Lobato, D., Filho, J., Torres, M., Rodrigues, M. **Estratégia de Empresas.** Publicações FGV Management. 9ª Edição, 2009.

[3] Bosch, J. **From Software Product Lines to Software Ecosystems.** Thirteenth International Software Product Line Conference, 2009.

[4] Jansen, S., Brinkkemper, S., Finkesltein, A. **Component Assembly Mechanisms and Relationship Intimacy in a Software Supply Network.** Fifteenth Annual EuroMA Conference, 2008.

[5] Jansen, S., Finkesltein, A., Brinkkemper, S. **A sense of community: a Research Agenda for Software Ecosystems.** International Conference on Software Engineering, 2009.

[6] Jansen, S., Brinkkemper, S., Finkesltein, A. **Providing Transparency in the Business of Software: a Modelling Technique for Software Supply Networks.** IFIP Working Conference on Virtual Enterprises, 2007.

[7] Foss, N. **Networks, capabilities and competitive advantage.** Scandinavian Journal of Management. Elsevier Science Ltd., 1998.

[8] Alves, C., Pereira, S., Valença, G., Pimentel, J., Andrade, R. **Preliminary Results from an Empirical Study in Market-Driven Software Company.** Tenth Workshop on Requirements Engineering, 2007.

[9] Sommerville, I. **Engenharia de Software**. Addison Wesley. 8a. Edição, 2007.

[10] Cusumano, M. A. **The changing software business: Moving from products to services.** IEEE Comp., 41(1): 20-27, 2008.

[11] Jansen, J., Rijemus, W. **Balancing total cost of ownership and cost of maintenance within a software supply network.** In proceedings of the IEEE International Conference on Quality Software, pages 154-161, 2004.

[12] Lambert, D. M., Cooper, M. C. **Issues in supply chain management**. In Journal of Industrial Marketing Management, 2002.

[13] Vilminko, S. Kinnula, M. **Managing the Software Market Evolution – a Network Approach to Value Creation in Software Business.** Proceedings of the Frontiers of E-Business Research Conference, 2005.

[14] Farbey, B., Finkelstein, A. **Exploiting Software supply chain business architecture: a research agenda.** In proceedings of 1st Workshop on Economics-Driven Software Engineering Research, 1999.

[15] Sturgeon, T. **How do we define value chains and production networks.** In IDS Bulletin, vol 32(3): 9-18, 2001.

[16] **Guia para o Gerenciamento de Processos de Negócio – Corpo Comum do Conhecimento – COBoK.** Association of Business Process Management Professionals. Versão 2.0, em português, 2009.

[17] **Business Process Modelling Notation – BPMN.** Official website of Object Management Group/Business Process Management: http://www.bpmn.org/. Last access: 04/10/2009.

[18] Porter, M. **Competitive strategy – techniques for analyzing industries and competitors.** New York: Free Press, 1980.

[19] Paim, R., Cardoso, V., Caulliraux, H., Clemente, R. **Gestão de Processos – Pensar, Agir e Aprender.** BookMan Editora, 2009.

[20] Jeston, J., Nelis, J. **Business Process Management – Practical Guidelines to Successful Implementations.** Elsevier. Second Edition, 2008.

[21] Neemuchwala, A. **Evolving IT from "Running Business" to "Changing Business".** White Paper from Tata Consulting Services, available at the URL http://www.tcs.com/resources/white_papers/Pages/EvolvingIT.aspx. Last access: 04/10/2009.

[22] **Official website of Microsoft Project**. URL: http://office.microsoft.com/pt-br/project/FX100487771046.aspx. Last access: 21/10/2009.

[23] **Official website of Primavera.** URL: http://www.oracle.com/primavera/index.html. Last access: 21/10/2009.

[24] **Um Guia do Conjunto de Conhecimentos em Gerenciamento de Projetos – PMBoK Guide**. 3ª Edição, em Português.

[25] **Official Website of Verano**. URL: http://www.verano.com.br/. Last access: 22/10/2009.