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Collaborative Networks: Perspectives from Software Development companies

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Msc Dissertation

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Abstract

For the current fast paced environments, characterized by the profusion of new technologies, businesses and highly competitive markets, organizations face continuous challenges and have to design new organizational forms in order to stay competitive. The trend to collaborative networks of organizations has emerged in the last years, supported by advancements in information and communication technologies, leveraging competitiveness in demanding markets. These new organizational forms induce innovation and the creation of added value propositions, enabled by the development of new ideas.

Although with foreseen benefits, there isn't a wider and generalized adoption of these models, from where a question needs to be asked: "How are Portuguese companies, from the software development industry, willing to join Collaborative Network Organizations?"

The main objective of this dissertation is then to answer this research question, through an exploratory case study approach, with three Portuguese software development companies, applying a qualitative method consisting of interviews to their CEOs. This dissertation has also as objectives to provide answers to the following questions: "How can a suitable collaborative product development methodology be supported?" and "How can the Lead User concept be integrated in collaborative network organizations?"

Derived from the author professional experience and research performed on related literature, an integrative model for collaboration is presented, with the purpose of allowing companies to gradually become more involved in collaborative processes, through engagement in knowledge domains, where Lead Users can perform a significant role, and in the learning or alignment of product development methodologies towards future collaboration processes.

As main conclusions, companies presented a cautious interest in joining collaborative networks, although recognizing value in them, since there are practical concerns such as processes, resources, financing and accountability that need further clarity. Companies have shown a higher interest in joining communities of professionals around specific knowledge domains, where lead users can be integrated, and commonly identified Agile methodologies as the suitable method for most collaborative new product development scenarios.

The interest in the knowledge domain involvement and product development methodologies alignment have proven to be fundamental dimensions of the proposed integrative model, which triggered companies interest for its practical implementation in a near future, as an effective collaboration learning step.

Keywords: Collaborative Network Organizations; Communities of firms; Virtual Breeding Environments; Virtual Organizations; Professional Virtual Communities; Software Development; Agile; Lead User.

Resumo

Para os actuais ambientes altamente dinâmicos, caracterizados por novas tecnologias, negócios e mercados altamente competitivos, as organizações enfrentam desafios contínuos, esquematizando novos modelos organizacionais para se manterem competitivas. A tendência para redes colaborativas emergiu nos últimos anos, suportada por avanços no domínio das tecnologias de informação, alavancando a competitividade em mercados exigentes. Estas formas de organização induzem a inovação e criação de novas propostas de valor, alicerçadas no desenvolvimento de novas ideias.

Apesar dos benefícios identificados, não existe uma adopção generalizada destes modelos, surgindo a questão: "Como estarão as empresas portuguesas, na indústria do desenvolvimento de *software*, dispostas a juntar-se a redes colaborativas de organizações?"

O principal objectivo deste trabalho é responder a esta questão de investigação, numa abordagem exploratória através de casos de estudo com três empresas portuguesas, na área do desenvolvimento de *software*, aplicando um método qualitativo consistindo em entrevistas aos seus responsáveis máximos. Outros objectivos deste trabalho são as respostas às questões "Como poderá ser suportada uma metodologia mais adequada para o desenvolvimento colaborativo de produto?" e "Como pode o conceito de *Lead User* ser integrado em redes colaborativas de organizações".

A partir da experiência pessoal do autor e da pesquisa efectuada na literatura relacionada com o tema, é proposto um modelo integrativo para colaboração, que permitirá às empresas um envolvimento gradual nos processos colaborativos, através da participação em domínios de conhecimento, onde "*Lead Users*" poderão ter um papel significativo, e na aprendizagem ou alinhamento de metodologias de desenvolvimento de produto com vista a processos colaborativos futuros.

Como principais conclusões, é observado que as empresas têm algumas reservas em juntarem-se a redes colaborativas e, apesar de reconhecerem valor nestas, há aspectos como processos, financiamento e responsabilidades que necessitam de maior clarificação. As empresas demonstraram um interesse elevado em fazerem parte de comunidades profissionais em torno de domínios de conhecimento, onde o conceito de "*Lead User"* poderá ser integrado e identificaram as metodologias *Agile* como as mais adequadas para o desenvolvimento colaborativo de novos produtos, na maior parte dos casos.

O interesse na participação em domínios de conhecimento e nas metodologias de desenvolvimento de produto mostraram ser dimensões fundamentais do modelo integrativo proposto, que despertou o interesse das empresas na sua implementação práctica, num futuro próximo, como um passo eficaz no processo da aprendizagem colaborativa.

Keywords: Collaborative Network Organizations; Communities of firms; Virtual Breeding Environments; Virtual Organizations; Professional Virtual Communities; Software Development; Agile; Lead User.

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1 Introduction

1.1 Contextualization

The current study was performed in the context of Master Thesis dissertation project for the *Mestrado em Inovação e Empreendedorismo Tecnológico* at the *Faculdade de Engenharia da Universidade do Porto*, in order to assess the predisposition, motivation and conditions from Portuguese software development companies to become part of collaborative network organizations. It has been organized in three main areas:

- Relevant literature review about collaboration models evolution between organizations, product development methodologies and lead users;
- Integrative model proposal for incremental collaboration mechanisms;
- Three exploratory case studies about companies' predisposition and conditions to collaborate, collaborative product development and lead users involvement within the integrative model;

The identities of the companies as well as interviewees names will not be disclosed due to confidentially agreements.

1.2 Motivation

The importance of knowledge creation and its use to leverage firm's competitiveness in global markets has led to a number of different organizational designs over the past three decades (Snow et al., 2011).

Starting from single firm organizations, where firms relied entirely on their own resources and knowledge to achieve success in the market (Miles et al., 1978), firms evolved to the multi firm network organizations with new adaptive mechanisms such as outsourcing, off-shoring, downsizing (Miles and Snow, 1986) which lead to the establishment of stable networks (Miles and Snow, 1994).

With the increase of markets dynamics, in high velocity environments characterized by newer technologies and businesses, fast paced and highly competitive markets (Brown and Eisenhardt, 1998), firms faced a new challenge and begun to establish or join communities with other firms, in order to enable knowledge sharing through supporting mechanisms and infrastructured services, improving participants' ability to network internally and externally (Miles et al., 2009; Snow et al., 2011).

In the recent years, a large variety of collaborative networks have emerged such as dynamic supply chains, extended and virtual enterprises, virtual organizations and professional virtual communities (Camarinha-Matos and Afsarmanesh, 2006b) supported by advances in the information and communication technologies (ICT) areas (Camarinha-Matos and Afsarmanesh, 2005; Camarinha-Matos and Afsarmanesh, 2006b).

The potential benefits of participating in a collaborative network include higher survival rates for highly dynamic markets, common goals achievement by leveraging individual capabilities, access to new and wider markets, risks and resources sharing and joining complementary competences (Camarinha-Matos and Afsarmanesh, 2005; Camarinha-Matos and Afsarmanesh, 2006b). Besides the agility, the new organization forms also induce innovation and creation of new value (Camarinha-Matos and Afsarmanesh, 2005; Camarinha-Matos and Afsarmanesh, 2006b) enabled by the development of new ideas and processes, new resource and technologies combinations.

Collaboration plays an important role in business performance, which is critical for the current markets dynamism and the hypercompetitive global environments (Todeva and Knoke, 2005).

Evolving to a collaborative environment requires a new organizational culture based on commitment, leadership, trust building, effective communication, global and long-term vision, knowledge sharing and innovation (Romero et al., 2008) in a gradual process implying time, effort and dedication (Romero et al., 2008).

Small to medium sized enterprises (SMEs) in particular need to, and have already begun, to collaborate with other organizations to increase their survival rate in the global competition (Durugbo and Riedel, 2013), but there are still practical issues needing clarification for the widespread implementation of collaborative networks (Durugbo and Riedel, 2013).

Other essential dimension of success and survival of organizations is the new product development especially for firms operating in either fast-paced or competitive markets (Brown and Eisenhardt, 1995; Krishnan and Ulrich, 2001). Across several industries firms able to develop new products meeting customer needs in short times are more prone to succeed (Brown and Eisenhardt, 1995; Brown and Eisenhardt, 1997).

The success of Japanese product development practices in the mid-1980s (Imai et al., 1984; Takeuchi and Nonaka, 1986; Brown and Eisenhardt, 1995) characterized by flexibility to perform at a quick pace and rapidly change direction under uncertain and dynamic environments converged under the designation of "Agile" and spread through different industries, such as manufacturing (Ben Naylor et al., 1999; Christopher, 2000) originating the Agile Manufacturing principle (Kidd, 1995) or the software development industry originating the Agile Software Development methodologies and multiple variants (Schwaber, 1997; Dingsøyr et al., 2012).

Understanding user needs and using them as an input to new product development has long been recognized as a critical success factor (Von Hippel, 1986; Urban and Von Hippel, 1988). However not all users are able to provide enriched inputs, since their insights can be constrained by real life experiences (Von Hippel, 1986; Urban and Von Hippel, 1988). The Lead User concept (Von Hippel, 1986; Urban and Von Hippel, 1988; Von Hippel, 1998) has been a research area for long, identified as a source of novel products, processes or services. These

type of users are characterized by having strong needs that will be only general in the market place months or years in the future (Von Hippel, 1986; Urban and Von Hippel, 1988; Von Hippel, 1998). According to Churchill et al. (2009), lead users can be grouped in three categories: "*a) lead users in the target application and market; b) lead users of similar applications in advanced "analogue" markets; c) lead users with respect to important attributes of problems faced by users in the target market*" (Churchill et al., 2009, p.9).

From this study's author practical experience with traditional collaboration models limitations for new product development, which were essentially based in the multi firm models (Miles and Snow, 1986), the value recognition in collaborative network organizations models (Camarinha-Matos and Afsarmanesh, 2006b), the potential source of new products from Lead Users (Churchill et al., 2009) and to address the practical issues that need clarification for a wider implementation of collaborative networks (Durugbo and Riedel, 2013), an integrative model for collaboration is proposed, following design-science research guidelines by von Alan et al. (2004) through the creation of a meaningful artifact addressing the need for effective implementation of collaboration networks.

The model is based on two dimensions: the knowledge domain and the processes domain, as results from the personal experience in these areas, from the literature review and from the exploratory case study methodology (Yin, 2014) applied. The model proposes two phases: the learning phase, with the alignment of methodologies and knowledge creation or sharing, and the operation phase, where organizations effectively engage in collaborative networks.

The model has been further validated by the companies participating in the study and improved with their feedback (von Alan et al., 2004), from where a starting point has been defined to implement it in practice in a very short time.

1.3 Objectives

The main objective of this study is to provide an answer to the main research question:

- How are Portuguese companies, from the software development industry, willing to join Collaborative Network Organizations?

To answer this research question, an exploratory case study approach has been used, with three Portuguese software development companies, through a qualitative method consisting of interviews to organizations' CEOs and operating within the software development industry.

Related with the main research question, other two are presented:

- How can a suitable collaborative product development methodology be supported?
- How can the Lead User concept be integrated in collaborative network organizations?

Another key objective is the proposal and validation of an integrative model that will allow companies to become gradually involved in collaborative network organizations.

1.4 Dissertation Structure

This dissertation is organized in six chapters, with the current chapter being the introduction, study contextualization, motivation and objectives for the dissertation.

Chapter 2 provides a literature review, with a description of the evolution in organizations collaboration models, an overview over the collaborative network organizations presenting the concepts of Virtual Breeding Environments, Virtual Organizations and Professional Virtual Communities. Relevant literature has also been reviewed for product development approaches, focusing on Agile methodologies, and the Lead User concept.

Chapter 3 proposes an integrative collaboration model and describes the methodology applied in the study, presenting the research design, data collection and data analysis description.

Chapter 4 describes the companies participating in the case studies, discusses the results and the validation of the proposed integrative model.

Chapter 5 provides the main conclusions of this study and identifies future extensions that can be made to address its limitations.

Chapter 6 provides a list of all references used throughout this study.

2   Literature review

This chapter presents the literature review relevant to the current study. The chapter describes the evolution of organizational designs, from the single firm model to the communities of firms model, presents the collaboration models between organizations and the classes of collaboration. The ECOLEAD (European Collaborative Leadership Initiative) project, developed within the Collaborative Network Organizations (CNO) area is presented as a base for a detailed description of the CNOs framework particularly for the Professional Virtual Communities, Virtual Breeding Environments and Virtual Organizations.

Different new product development approaches, with a particular emphasis on Agile methodologies are then described, concluding with the revision of the Lead User concept.

2.1   From single firms to communities of firms

The single firm model

After the World War II and up until the 1970's, firms operated independently and with their own internal resources (Miles et al., 1978), according to one of the four strategic orientations as identified by Miles et al. (1978) in their typology: prospector (firms that continuously developed new products, services technologies and markets); defenders (firms with stable product or service lines that leveraged their competence in developing process efficiencies); analysers (firms that used their applied engineering and manufacturing skills to make a new product better and cheaper) and reactors (firms with no consistent strategic approach and drifting accordingly with environmental events).

The three relevant strategy types from Miles-Snow typology (Miles et al., 1978) were also sources of innovation (Miles et al., 1993) and subsequent empirical research on Miles-Snow typology has shown that, on the several industries landscapes observed in the 1960's-1970's, the prospector, analyser and defender strategies co-existed successfully within the same industries (Shortell and Zajac, 1990; Zahra and Pearce, 1990).

The perspective of producer-centred innovation has also led to governmental laws and incentives, to protect producers from imitators, and granting them an exclusive but temporary control over their innovations (Machlup and Penrose, 1950; Teece, 1986; Gallini and Scotchmer, 2002). With this political approach, it was assumed that losses occurred by intellectual property rights grants would be overcome by gains with innovation investment (Machlup and Penrose, 1950; Penrose, 1951; Foray, 2004).

Post 1970's Market & Technological Demands for new organizational designs

The 1970s brought a changing globalized economy as well as increasingly complex technologies, making large hierarchical companies to struggle with this new scenario and bringing upfront new organizational challenges (Peters et al., 1982). A direct response to these new challenges were the new forms of organizational designs based on outsourcing, offshoring,

downsizing and delayering (Peters et al., 1982; Achrol, 1997) as an attempt to resist the competitiveness decline for many US firms in the 1970's. The large-scale division of labour, brought with Industrial Revolution, was being replaced by specialization and division of business functions (Achrol, 1991).

In the 1980's, a new organizational form emerged: the *network organization* (Powell, 1990) also referred by multi firm network (Miles and Snow, 1986)**.** The rise of the Japanese global enterprise, where key success factors appeared to result from external relations, largely contributed to this new design (Achrol, 1997). Achrol (1997) further defined network organization as: "*a network organization is distinguished from a simple network of exchange linkages by the density, multiplexity and reciprocity of ties and a shared value system defining membership roles and responsibilities*" (Achrol, 1997, p. 59). Other authors, such as Thorelli (1986) explored the definition of a network not only through the positions (strategically occupied by firms) and links resultant from the interaction between positions (Thorelli, 1986), but also in terms of dynamics with the entry, positioning, repositioning and exit processes for network membership (Thorelli, 1986).

Outsourcing as a network organization was related to several industries such as: electronics, biotechnology, automobiles, aerospace, telecommunications, pharmaceuticals, chemicals, healthcare, financial services energy systems and software (Powell et al., 1996; Dahan and Hauser, 2002; Carson, 2007; Hätönen and Eriksson, 2009; Quinn, 2013).

The early multi firm networks aimed the ideal combination of each type of single firm strategy from the Miles-Snow typology: the responsiveness and innovation focus from prospectors, the efficient processes from defenders and resource maximization from analysers (Miles and Snow, 1994).

Although the initial outsourcing strategy seemed to consider cost reduction in order to maximize profits (Hätönen and Eriksson, 2009), Hamel and Prahalad (1990) with the book "The Core Competence of the corporation" (Prahalad and Hamel, 1990) caused a paradigm change so that more strategic functions were outsourced (Quinn, 2013) in order to acquire skills that firms were lacking.

Due to the complexity and ever expanding knowledge in industries such as new materials, biotechnology and information systems, strategic partnerships have presented a substantial growth in the 1980s (Hagedoorn and Schakenraad, 1990; Hagedoorn, 1990). According to Powell et al. (1996), these partnerships evolved to become networks of learning instead of solely being dedicated to compensate lack of skills or based on individual and time limited transactions (Powell et al., 1996).

According to Hagedoorn (1993), strategic partnerships motives at the time were grouped in the following categories: basic and applied research, that could have technological development; innovation processes and market access, with search for opportunities.

Multi firms evolved to strategic partnerships mostly in terms of joint ventures for Research and Development activities in core technologies (Hagedoorn, 2002), which gradually became less popular due to organizational costs of joint ventures in combination with their high failure rate (Kogut, 1988).

The strategy behind still relied in building stable and long term relations to defend a market position or gain competitive advantage (Brown and Eisenhardt, 1998).

In the high-velocity environments, where changes occured so rapidly and in a discontinuous process, information was often inaccurate (Bourgeois III and Eisenhardt, 1988; Eisenhardt, 1989b), and strategic resource needs (in terms of new markets, competitors and pioneering technology) and social resource opportunities (management team well connected and with high status) drove the partnerships between firms (Eisenhardt and Schoonhoven, 1996).

In the late 1980's / early 1990's the "Dynamic Network" organization (Miles and Snow, 1994; Miles et al., 1997) emerged as a response to the rapid technological development and market changes which challenged the stable network configuration introducing new partnerships and closing of existing ones, as firms moved in and out of networks and markets (Miles and Snow, 1994).

According to (Fine et al., 2002) a company's real value was creating competency, perhaps its only sustainable one, which might be accumulated from its ability to continuously restructure its value chain (i.e. a network competence (Kakabadse and Kakabadse, 2002).

Rapid change for the 1990s - Communities of Firms for the knowledge age

Miles et al. (1997), envisioned a new organizational form presented as "cellular", where autonomous business units could act independently but also interact with other "cells" and produced added value outputs (Miles et al., 1997). Under the scope of internal organization structure, this concept evolved to the "Federation of firms" (Boudreau et al., 1998; Snow et al., 2011) where firms were linked through contractual agreements such as joint ventures, strategic alliances, minority investments, consortia, coalitions, outsourcing, and franchises (Boudreau et al., 1998).

The concept of *community*

According to (Adler, 2001), besides the market form of organization (price mechanism driven) and the hierarchy form (authority driven) a third organizational form appeared: the community organization form based on principles of shared values and norms where knowledge creation is an important driver for their formation (Adler, 2001; Adler and Heckscher, 2006; Miles et al., 2009). The community appears as an alternative for effective knowledge generation (Powell, 1990; Adler, 2001; Adler and Heckscher, 2006), especially in knowledge intensive industries, such as biotechnology, where the trend to interfirm trust originated multilateral network organization forms (Powell, 1990).

For the innovative knowledge based communities, where firms learn to exploit their existing businesses while simultaneously explore new areas (March, 1991) three models are commonly considered (Paavola et al., 2004): the model presented by Nonaka (1991) focusing on knowledge management that placed a central role in tacit knowledge as a main driver for innovation; the model by Engestrom (1999) of expansive learning contextualizing human behaviour within the sociocultural context and the Bereiter (2002) model of knowledge, stating that knowledge can be systematically produced and shared among members of a community.

The knowledge view of the firms identifies knowledge as the most important and final outcome of internal methods and creative processes within the firms which are hard to replicate (Liebeskind, 1996; McLure Wasko and Faraj, 2000).

The *community of practice* concept (Lave and Wenger, 1991; Wenger, 1998; Wenger et al., 2002) systematizes how groups of people sharing a problem or interest in a certain domain, socially interacting with each other, with the original problem or interest as the connecting link, through a continuous learning process and where process's produced outputs are again applied to their activities (Lave and Wenger, 1991; Wenger, 1998). Knowledge is then a public good for the community that is created, sustained and exchanged within the *community of practice* (Brown and Duguid, 1991; Lave and Wenger, 1991).

2.2 Collaboration between organizations

A core organizational capability acting as key driver for communities of firms is collaboration (Camarinha-Matos and Afsarmanesh, 2006a; Pisano and Verganti, 2008; Miles et al., 2009) and the models where it can be achieved.

Pisano and Verganti (2008) identified two dimensions for collaboration processes: the participation mode (open or closed) and the governance mode (flat or hierarchical).

In the open participation and hierarchical mode, any person can join in and offer ideas, but its the engaging company that defines the problem scope and ultimately selects the adequate solution (Pisano and Verganti, 2008). A typical example of this collaboration model is crowdsourcing (Howe, 2006b; Howe, 2006a), where a call for ideas is launched to a potentially large and unknown population (Surowiecki, 2005; Howe, 2006b; Brabham, 2008; Poetz and Schreier, 2012) as a possibility to successfully generate new products (Jeppesen and Frederiksen, 2006; Piller and Walcher, 2006; Poetz and Schreier, 2012).

For the open participation and flat mode, anyone can request and offer ideas, without later judgment of what is and what isn't a viable solution or innovation (Pisano and Verganti, 2008). Open Source Software (OSS) development is one of the most researched (Lerner and Tirole, 2002) collaboration community with these characteristics (Lerner and Tirole, 2002; Lakhani and Von Hippel, 2003; Von Krogh et al., 2003; Hippel and Krogh, 2003).

In the closed participation and hierarchical mode, the engaging company selects individual participants or groups of participants and decides which ideas will be developed (Sawhney and

Prandelli, 2000; Pisano and Verganti, 2008). Partnering relationships with "*Specialist Knowledge Providers*" (Tether and Tajar, 2008) either privately held or the public science-based (such as universities and government research institutions) (Hertog, 2000; Kuusisto and Meyer, 2002; Tether and Tajar, 2008) are observed in this category. Another collaborative model is the lead-user involvement (Von Hippel, 1986; Urban and Von Hippel, 1988; Olson and Bakke, 2001; Schreier and Prügl, 2008).

In the closed participation and flat mode, the engaging company selects a group of participants where information and intellectual property is shared and commitment for decision making processes are made within the group (Pisano and Verganti, 2008). In this category, examples of industrial consortia to jointly develop a technology are observed (Hagedoorn et al., 2000; Pisano and Verganti, 2008).

Camarinha-Matos and Afsarmanesh (2006b) defined the collaboration as the overall result of three components extension:

- Networking: focusing on the process of communicating and exchanging information, but without any common goal or structure;
- Coordination: involving an alignment in time of activities for increased efficiency but where goals can still be set on individual level and each party uses the benefits independently;
- Cooperation: besides sharing information and aligning activities, resources may be shared in order to reach a common goal, where overall value is obtained by the sum of each individual's contribution.

Collaboration is then result of sharing information and resources in order to jointly plan and execute a set of activities towards a common goal (Camarinha-Matos and Afsarmanesh, 2006b), in a development continuum of building blocks, known as the continuum of collaboration (Romero et al., 2009).

The key driver for collaboration is then the strong belief across different organizations that, within a collaborative network, members can achieve goals that would be out of their reach or would have higher costs if pursued individually (Camarinha-Matos and Afsarmanesh, 2005). In addition, the sustainability of the organizations in complex environments is also increased, through the sharing of risks and resources, access to wider markets and knowledge whilst focusing on core competencies and keeping organizational agility, which leads to the creation of new value through innovation processes throughout the collaboration process (Camarinha-Matos and Afsarmanesh, 2006a; Camarinha-Matos and Afsarmanesh, 2006b; Romero et al., 2009).

Although recognized as an outcome, the value quantification (or the amount of value added by each member) in a collaborative process presents itself as a challenge to define schemas for revenue and liability distribution, more significantly if non tangible goods (services or intellectual

property) are the process outcomes (Camarinha-Matos and Afsarmanesh, 2006a; Camarinha-Matos and Afsarmanesh, 2006b).

2.3   Classes of collaborative networks

Collaborative Networks have been defined as "*a network consisting of a variety of entities (e.g. organizations and people) that are largely autonomous, geographically distributed, and heterogeneous in terms of their operating environment, culture, social capital and goals, but that collaborate to better achieve common or compatible goals, and whose interactions are supported by computer network"* (Camarinha-Matos and Afsarmanesh, 2006b, p. 30).

These collaborative networks can be identified in different forms and a classification model has been proposed by Camarinha-Matos and Afsarmanesh (2006b) distinguishing Collaborative Network Organizations (CNO), which implicitly have an organization with governance rules and roles for its actors, from Ad-Hoc Collaboration where a community collaborates voluntarily for a common goal, but with no plan or implicit structure defined (like a social cause) (Camarinha-Matos et al., 2005b).

Within the CNO's two network types are identified: the goal oriented network, with the purpose of targeting a specific opportunity or have a continuous provisioning of products and services, and the long term strategic alliances where main focus is to provide the infrastructure and conditions for the formation of collaboration networks to target specific opportunities (formation of goal oriented networks) (Camarinha-Matos and Afsarmanesh, 2006b). For a better visualization on CNOs' classification, these are depicted in the Figure 1.

From the goal-oriented networks, two types are of particular significance: the Virtual Organization (VO) and the Dynamic Virtual Organization. The VO is defined as set of legally independent organisations, that share risks and resources in order to reach a common goal (Camarinha-Matos and Afsarmanesh, 2006b) while the Dynamic VO is essentially the same as a VO, but with a shorter life cycle and being dissolved when the market opportunity is fulfilled (Camarinha-Matos and Afsarmanesh, 2006b).
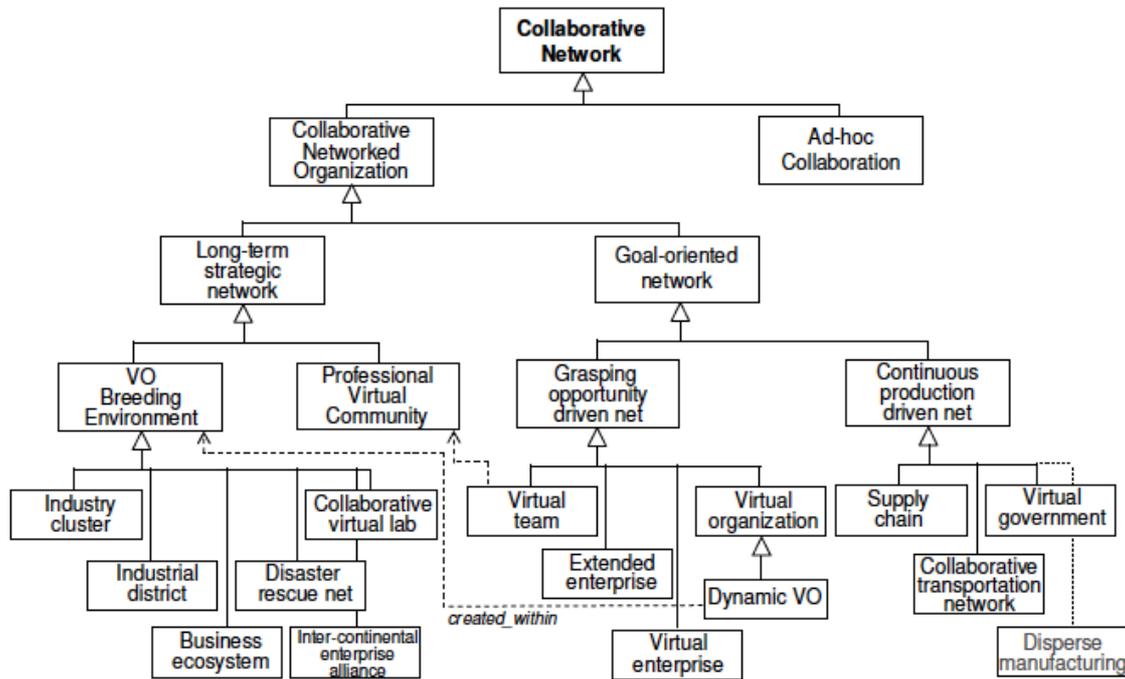
Figure 1 - Collaborative Networks (Camarinha-Matos et al., 2008, p. 10)

For the long term strategic alliances, the concept of Virtual Organization Breeding Environment (VBE) is of particular relevance – VBEs are groups of organizations (an association or cluster) supported by one or more common institutions, willing to collaborate together on the base of common principles and practices from where a subset of these organizations can be selected to constitute a VO when an opportunity appears (Camarinha-Matos and Afsarmanesh, 2005; Camarinha-Matos and Afsarmanesh, 2006b).

Several examples of early VBEs were identified across the globe: IECOS (Mexico); CeBeNetwork (Germany); Helice network (Spain); NetworkA (Finland); Virtuelle Fabrik (Switzerland); Torino Wireless (Italy) (Afsarmanesh and Camarinha-Matos, 2007). These examples were confined to specific geographical region and used little support from ICT tools being categorized as 1st generation VBEs (Afsarmanesh and Camarinha-Matos, 2007).

The ECOLEAD Initiative

Belonging to a network has become a key factor for organizations aiming to achieve competitive advantage, and particularly relevant for small and medium sized enterprises (SMEs) (Camarinha-Matos et al., 2008). To accomplish market demands, either in manufacturing or services industries, competencies sharing and resources collaboration are crucial for success (Camarinha-Matos et al., 2005a; Camarinha-Matos et al., 2008).

Over the last years, a large number of R&D projects pursued the establishment of technological foundations and operating practices supporting Collaborative Network Organizations across several geographical regions (Camarinha-Matos et al., 2005a; Afsarmanesh et al., 2007) particularly in Europe, through European Union's funded programs

(such as ESPRIT, IST, INCO) (Camarinha-Matos et al., 2005a; Afsarmanesh et al., 2007; Camarinha-Matos et al., 2008).

These initiatives produced a large amount of empirical knowledge (Camarinha-Matos et al., 2005a) but very fragmented, dispersed and focused on solving very specific problems without considering broader applicability scenarios (Camarinha-Matos et al., 2008). Research projects such as IST VOSTER (Camarinha-Matos and Afsarmanesh, 2004), THINKcreative (Camarinha-Matos, 2004) and VO Map (Camarinha-Matos and Afsarmanesh, 2004) targeted both knowledge consolidation, with the development of a systematic approach for Virtual Organizations theoretical foundation and an holistic approach to this concept (Camarinha-Matos et al., 2008).

The European Collaborative Networked Organizations Leadership Initiative – ECOLEAD - was launched (Camarinha-Matos et al., 2008) as an outcome from the adoption of key results of European roadmap initiatives such as VO Map (Camarinha-Matos and Afsarmanesh, 2004), COMPANION, CE-NET, and ROADCON (Camarinha-Matos et al., 2008),

The project lasted for 51 months, from March 2004 until June 2008, involving 28 partners from industry and academic. A total of 14 countries (12 in Europe and 2 in Latin America, where some of its constituents were already end-user networks (Virtual Breeding Environments and Professional Virtual Communities) acting as real-world validation of project results (Camarinha-Matos et al., 2008).

The ECOLEAD vision was stated as (EU, 2008):

"In ten years, in response to fast changing market conditions, most enterprises and specially the SMEs will be part of some sustainable collaborative networks that will act as breeding environments for the formation of dynamic virtual organizations."

ECOLEAD overall main goal was to create the necessary foundations and mechanisms for establishing a network based industry society (Camarinha-Matos et al., 2008), addressing the three fundamental and inter-related dimensions: Virtual Breeding Environments, Dynamic Virtual Organizations and Professional Virtual Communities - which are known as the three fundamental pillars, their inter-relationships and horizontal ICT support infrastructures and theoretical foundation for Collaborative Networked Organizations (Camarinha-Matos et al., 2005a; Afsarmanesh et al., 2007; Camarinha-Matos et al., 2008),

ECOLEAD also produced formal approaches to characterize and model value systems and models for the network benefits in a VBE (Abreu and Camarinha-Matos, 2008).

Professional Virtual Communities

One of the three fundamental pillars of the ECOLEAD project, Professional Virtual Communities combines the concepts of Virtual Community and Professional Community (Camarinha-Matos et al., 2005a; Afsarmanesh et al., 2007; Camarinha-Matos et al., 2008).

Virtual Communities are characterized as social network systems of individuals sharing common interests such as sports, science, professions and whose relationships are enabled a diversity of internet technologies (such as online social networks, newsgroups, messaging services, document technologies) sharing and creating knowledge, originating value from their activities (Camarinha-Matos et al., 2008).

Community of Practice (Lave and Wenger, 1991; Wenger, 1998; Wenger et al., 2002) describes groups of people sharing a problem or interest in a certain domain, socially interacting with each other with the original problem or interest as the connecting link, in a continuous learning and knowledge sharing process that leads to the creation of new knowledge (Lave and Wenger, 1991; Wenger, 1998).

When these communities adopt practices and tools from Virtual Communities, they become Professional Virtual Communities (Camarinha-Matos et al., 2008) which is characterized by a group of professional individuals prepared to engage in a collaboration process initiated by a business opportunity, through the creation of Virtual Teams (Afsarmanesh et al., 2007; Camarinha-Matos et al., 2008) sharing a common body of knowledge from their professions and working cultures, problem solving techniques and professional values (Camarinha-Matos et al., 2008).

Professional Virtual Communities, when part of a VBE, can further explore skills from its members which may not be required to the core business of the organizations but can however generate new business opportunities for the benefit of all (Camarinha-Matos et al., 2008).

Virtual Organization Breeding Environments (VBEs)

Virtual Organization Breeding Environments are defined as "*an association or pool of organisations and their related supporting institutions, adhering to a base long-term cooperation agreement, and adoption of common operating principles and infrastructures, with the main goal of increasing both their chances and their preparedness towards collaboration in potential Virtual Organizations*" (Camarinha-Matos and Afsarmanesh, 2006b, p. 32). For a viable business opportunity identified by a member (*broker*), an assessment of existing collaborating organizations is performed in order to select a suitable subset of organizations to form a Virtual Organization, to address the opportunity.

Typical example of VBEs include: Industry Clusters - where a group of companies operating in a common business sector establish connections to increase competitiveness through supply chain relationships, technologies or distribution channels; industrial districts – a similar concept to Industry Cluster, but that can cover more than one specific business sector; business ecosystem – which covers a specific region main business sectors and local attributes such as culture and traditions, benefiting from public incentives in many situations (Camarinha-Matos and Afsarmanesh, 2006b).

VBE members must then recognize common interests and agree on the VBE's Working and Sharing Principles (Galeano et al., 2005; Irigoyen et al., 2006) which can be categorized under

five perspectives (Afsarmanesh and Camarinha-Matos, 2005; Romero et al., 2007; Romero et al., 2009): Organisation - VBE's players and responsibilites, and the inherent structure and governance model; Business process - the VBE lifecycle; Resources – assets management; Value system and business model membership; Interactions: - Virtual Organization creation process and external interactions.

The main VBE elements (Afsarmanesh and Camarinha-Matos, 2005) include the VBE Members which are the organizations registered at the VBE or supporting institutions; the Roles performed within the VBE such as the VBE Member, VBE administrator, Opportunity Broker, VO Planner and VO coordinator; the Life Cycle which identified the stages the VBE follows and the Assets representing the tangible and intangible outputs of the VBE life cycle.

Virtual Organization Creation

The main reasons for a VBE existence (Camarinha-Matos and Afsarmanesh, 2007b) have been identified has: establishing the underlying trust mechanisms for VO generation; assisting in the creation, agreement and contract negotiation for establishment of VOs; reducing the time to find compatible candidates for the VO and assisting the dynamic VO reconfiguration process. The overall purpose of a VBE is then to gather and process adequate information about organizations competences and preparedness for rapidly engaging in a VO creation process (Camarinha-Matos and Afsarmanesh, 2006c; Camarinha-Matos and Afsarmanesh, 2007b), to target the existing business opportunity.

According to (Camarinha-Matos and Afsarmanesh, 2006c; Camarinha-Matos and Afsarmanesh, 2007b), four phases for a Virtual Organization creation process are foreseen: Planning phase – with the collaboration opportunity characterization and an initial estimate on the VO structure; a consortia formation phase – involving the process of searching and selecting suitable organizations, negotiation between involved parties and the VO composition definition; VO launching phase with the detailed VO planning and the formalization of contracts and agreements between all parties; VO Setup – where effectively the newly formed VO starts operation. Each phase must be supported by adequate ICT tools in order to track on going processes and provide data for post creation VO performance assessment and future process improvements (Camarinha-Matos, 2005; Camarinha-Matos and Afsarmanesh, 2006c; Camarinha-Matos and Afsarmanesh, 2007b).

Joining Virtual Breeding Environments

A critical condition to successful collaborative network organizations is to identify potential members which are prepared to engage in the dynamics of a Virtual Organization Breeding Environment (Romero et al., 2009). The cost of not finding the right partners is the reduced or inexistent agility thus compromising the Virtual Organization objectives (Camarinha-Matos and Afsarmanesh, 2006c).

Assessing the collaboration readiness for potential VBE members willing to engage in posterior Virtual Organizations becomes then a key evaluation factor, so that organizations are

able to understand their stage of preparedness and to implement the necessary changes when failing to fulfil the established requirements (Romero et al., 2008; Romero et al., 2009).

In order to understand if an organization is *ready* to collaborate, two concepts must be defined: *readiness*, which means a state of preparedness, promptness, aptitude and willingness (Romero et al., 2008; Romero et al., 2009) and *collaboration readiness* as the reflection of readiness in providing resources (financial, staff, infrastructure) and assets (technology) to support collaboration across organisational boundaries (Romero et al., 2008; Romero et al., 2009).

Rosas and Camarinha-Matos (2009) identified as key factors for *collaboration readiness* not only more tangible factors such as competence or technology fit but also less tangible factors such as behaviour, ethic, value system and specially trust (Rosas and Camarinha-Matos, 2009).

Although extensive research has been done in what comes to assess readiness from holistic views regarding product and service systems (Durugbo and Riedel, 2013) to contribution of 'soft' and 'hard' organizations skills (Rosas and Camarinha-Matos, 2009), three key scenarios are identified where readiness should be asserted: *readiness* for VBE applicants to become VBE member (Romero et al., 2008; Romero et al., 2009); after becoming part of a VBE, the *readiness* of VBE members to form Virtual Organizations (Romero et al., 2008; Romero et al., 2009); and VBE members continuous improvement for future VO partnering opportunities (Romero et al., 2009).

For the initial stage, where organizations want to become part of a VBE, the readiness assessment focuses on three key dimensions: corporate governance, enterprise architecture and past collaboration performance (Romero et al., 2008; Romero et al., 2009).

The applicant's corporate governance assessment should identify common interests between VBEs overall strategy and the applicants strategy, a process defined as "*strategic fit*" (Romero et al., 2009) where by means of explicitly sharing common goals, levelled expectations can be settled and more successful outcomes expected (Romero et al., 2008; Romero et al., 2009).

The enterprise architecture of the applicant is assessed in terms of their market, processes, resources, organization and knowledge contributing for changing rapidly for mutating environmental conditions, for generating results in a short period of time and in the ability to generate solutions in a problem-solving approach for a Virtual Organization (Romero et al., 2008; Romero et al., 2009).

The third key dimension for the VBE Membership applicant is the previous experience in collaborative models (Romero et al., 2008; Romero et al., 2009) such as subcontracting, licensing, cooperatives, join ventures or other types as classified by (Todeva and Knoke, 2005), where organizations more prone to collaborate already have a proven collaborative success history (Romero et al., 2009).

The final outcome of this stage is then admitting the applicant, if this has proven to provide value to the VBE or identifying the gaps between the VBE network architecture requirements and the applicant's organizational assets, which can be later used to improve the applicant's capabilities towards a successful admission (Romero et al., 2008; Romero et al., 2009).

After the successful admission into a VBE, members are subjected to a second stage of evaluation, with the purpose of engaging in Virtual Organizations targeting a specific collaboration opportunity (Romero et al., 2008; Romero et al., 2009).

To identify the state of *readiness* to become a VO partner, a competency based approach (Boucher and Lebureau, 2005; Ermilova and Afsarmanesh, 2006) is used to identify members with the most suitable set of competencies, capacities, capabilities and availability to deliver the required product or service, under the inherent constraints of time, cost and quality while keeping the agility to undergo with transient or more permanent market opportunities (Romero et al., 2008; Romero et al., 2009). Another dimension for evaluation is performance assessment of the possible VO partner past VO's collaboration activities, within the VBE (Romero et al., 2009).

Being a VBE member and engaging in VO collaboration opportunities shouldn't contribute to a static membership state (Romero et al., 2009). The third readiness evaluation assessment is the state of remaining ready to collaborate where VBE and VBE's members work together either to continuously improve member's preparedness by internally improving their self-learning capabilities or VBEs perform thorough evaluation of collaboration processes to address new areas for improvements (Romero et al., 2009). VBEs can also proactively explore new markets and business models(Loss and Crave, 2011) , and identify potential members with the adequate set of competences or train existing members to acquire and develop the missing ones (Romero et al., 2009).

2.4 New Product Development

Product development has long become a critical competitive advantage factor for firms across the several industries (Brown and Eisenhardt, 1995) and have evoked the interest of many researchers for the last decades (Cooper and Kleinschmidt, 1986; Zirger and Maidique, 1990; Clark and Fujimoto, 1991; Brown and Eisenhardt, 1995; Krishnan and Ulrich, 2001). The ever-changing technologies and market environments have also led to associate product development to deep organizational changes towards the firms efforts to stay competitive in these conditions (Brown and Eisenhardt, 1995).

Brown and Eisenhardt (1995) were amongst the first to review and organize the vast empirical literature within a time span ranging from 1969 to the 1990s, with the purpose of identifying crucial factors affecting the success of product development. As result from their study, Brown and Eisenhardt (1995) have classified the product development successful practices into three categories: "*product development as rational plan, communication web, and disciplined problem solving*" (Brown and Eisenhardt, 1995, p. 344).

The "rational plan" perspective advocated that success inherent to product development was related to an extensive and careful product planning for an attractive market, the plan execution by skilled and coordinated cross-functional teams and the support of top management (Cooper and Kleinschmidt, 1986; Zirger and Maidique, 1990; Brown and Eisenhardt, 1995). The authors further stated "*intrinsic value of the product, including unique benefits to customers, high quality, attractive cost, and innovative features, was the critical success factor*" (Brown and Eisenhardt, 1995, p. 351).

The "communication web" approach, favoured both internal and external communication as critical to the product development successful outcome (Brown and Eisenhardt, 1995). The better the project participants communicated between themselves and with key external agents, the more successful the product would be (Brown and Eisenhardt, 1995). The communication with external key agents was also identified by Von Hippel (Von Hippel, 1986; Urban and Von Hippel, 1988; Von Hippel, 1998) as a critical factor to enhance product success.

The success of Japanese product development practices in the mid 1980s (Imai et al., 1984; Quinn, 1985; Takeuchi and Nonaka, 1986) originated the "problem solving" approach, based on problem solving activities underwent by a sufficiently autonomous team combined with the discipline imposed by the presence of a strong leader and the continuous support of senior management who established the product vision (Takeuchi and Nonaka, 1986; Brown and Eisenhardt, 1995). The final result was a "*fast, productive development process and a high-quality product concept.* "(Brown and Eisenhardt, 1995, p. 359). The pace for product development was enhanced by allowing overlapping developing phases, through the cross-functional teams, with high communication flow along teams (Takeuchi and Nonaka, 1986; Clark and Fujimoto, 1991; Brown and Eisenhardt, 1995; Eisenhardt and Tabrizi, 1995).

A good product is not good enough

Having a successful product through a pre-established innovation and development process was one of the perspectives for product development (Imai et al., 1984; Quinn, 1985; Takeuchi and Nonaka, 1986; Clark and Fujimoto, 1991; Brown and Eisenhardt, 1995; Eisenhardt and Tabrizi, 1995).

Another essential perspective studied by researchers was the pace of product development and how this induced adaption in the organization to cope with technology and market changes (Brown and Eisenhardt, 1995; Eisenhardt and Tabrizi, 1995; Brown and Eisenhardt, 1997).

In another pioneering study, Eisenhardt and Tabrizi (1995) analysed the product development pace of 72 projects from European, Asian and US computer firms comparing two development models: one experiential, based on flexibility, real-time experience and improvisation for an uncertain process. The other assumed a well-known rational process and relies on shortening or blending the several sequential steps in a "compression" practice.

The compression strategy of clearly defining and planning every step of the process, involving suppliers to simplify execution (Imai et al., 1984; Clark and Fujimoto, 1991), reducing

each step execution time adding overlapping development steps (Clark and Fujimoto, 1991) and providing rewards for "on time" developments proved to accelerate developments for industries that were already mature (Eisenhardt and Tabrizi, 1995).

Eisenhardt and Tabrizi (1995) concluded that fast and successful product development for high velocity environments (Eisenhardt and Tabrizi, 1995; Iansiti and MacCormack, 1996; Iansiti, 1998; MacCormack et al., 2001), characterized by emergent technologies and varying markets surrounded by uncertainty, was linked to an experiential and iterative with frequent testing product development strategy (Quinn, 1985), involving cross-functional teams and strong leadership (Sethi et al., 2001).

The experiential practice as a successful product development practice for high velocity and uncertain environments was further extended by a number of other authors in the literature (Iansiti and MacCormack, 1996; MacCormack et al., 2001), addressing the flaws of the sequential project "stages" separated by a milestones called "gates" (e.g. the stage-gate model (Cooper and Kleinschmidt, 1993; Ulrich, 2003).

Becoming Agile

The flexibility to perform at a quick pace and rapidly change direction under uncertain and dynamic environments converged under the designation of "Agile" and spread through different industries, such as manufacturing (Ben Naylor et al., 1999; Christopher, 2000) originating the Agile Manufacturing principle (Kidd, 1995) or the software development industry originating the Agile Software Development methodologies (Schwaber, 1997; Dingsøyr et al., 2012).

Based on the article published by (Takeuchi and Nonaka, 1986) "*The New Product Development Game*", Sutherland and Schwaber (1995) jointly presented a new software development methodology, based on the scrum description from Takeuchi's article, and in the principles of Object Oriented software design and development.

Schwaber (1997) presented a formal practical framework to address the complexity of system development processes where a high degree of flexibility is needed to cope with unpredictable project developments – the scrum methodology.

One of the main principles for the scrum methodology is the flexibility of the product delivered where content is set according to the environmental variables such as time available, competing products, cost of production and functionality (Schwaber, 1997).

Key aspects of the scrum methodology include market intelligence, close and constant customer feedback and team's cross-functional competences. Addressing the uncertainty, frequent adjustments to delivered outputs can occur during the project (Schwaber, 1997).

The Agile Software Development practices led to the Agile Manifesto (Beck, 2001), where a group of influent practitioners not only from the scrum methodology but also from other Agile practices such as eXtreme Programming (XP), lean software development, feature-driven

development (FDD), and crystal methodologies (Dingsøyr et al., 2012) defined the Values and Principles of Agile Software development.

Agile Software Development has gained increasing interest from the research community, since the Agile Manifesto statement in 2001, through the growing number of scientific publications, the popularity in scientific forums and the countries' wide footprint in Agile research (Abrahamsson et al., 2009; Dingsøyr et al., 2012).

2.5 Lead Users

To face the problem of lack reliability of user needs for new products or product categories changing rapidly in time (Von Hippel, 1986; Urban and Von Hippel, 1988), Von Hippel presented his theory of "*Lead User*" defining them as "*users whose present strong needs will become general in a market place months or years in the future*" (Von Hippel, 1986, p.791). Von Hippel claimed that regular users selected for marketing research were constrained by their limited usage needs and thus not likely to reach beyond and generate new products ideas (Von Hippel, 1986). Taking a step further and in order to fill the existing need, a lead user may develop prototype products or services to benefit before they are commercially available (Von Hippel, 1986; Churchill et al., 2009).

Proceeding in his research, Von Hippel (1986) also found that in the areas of scientific instruments and in the electronics industry on the previous years to his research, a large percentage of innovations were coming from the users with advanced needs (Von Hippel, 1986). Other technology intensive industries such petrochemical, computer and CAD systems have confirmed the high percentage of innovations (Urban and Von Hippel, 1988; Lilien et al., 2002; Lüthje, 2003; Franke and Hippel, 2003; Lüthje et al., 2005)

To complete his theory, Von Hippel (1986) proposed a Lead User market research method (Von Hippel, 1986; Urban and Von Hippel, 1988) that has been applied through several experimental practices to confirm the initial model: one such case was Hilti AG's new pipe hangers system where the new product concept development time was reduced by half (Herstatt and Von Hippel, 1992). The most representative example is the 3M's IGLU (Idea Generation with Lead Users) research project (Von Hippel et al., 1999) that resulted in projects with higher degree of novelty, addressing more newer customer needs, forecasted market share and sales significantly higher than the projects being funded at the time (Von Hippel et al., 1999; Lilien et al., 2002).

The Lead User theory has been also studied outside the firm's innovation processes from technologically intensive industries and extended to other areas such as outdoor consumer sports and extreme sporting communities where the innovations applied by this key group of users can significantly improve current equipment designs or create new ones (Shah, 2000; Franke and Shah, 2003; Lüthje et al., 2005; Franke et al., 2006; Schreier et al., 2007). Lead users may act still as opinion leaders and contribute significantly to the diffusion and adoption of new products, due to their status within the community of related field (Schreier et al., 2007).

The Lead User method

The Lead User method for market research study involves four essential steps (Von Hippel, 1986; Urban and Von Hippel, 1988; Churchill et al., 2009) that can be described in four steps: "*(1) Specify the characteristics a Lead User will have in the product/market segment of interest; (2) Identify a sample of Lead Users who fit these Lead User criteria; (3) Bring the sample of Lead Users together with company engineering and marketing personnel to engage in group problem-solving; (4) Test whether concepts found valuable by Lead Users will also be valued by the more typical users in the target market.*" (Herstatt and Von Hippel, 1992, p. 5).

According to Churchill et al. (2009), lead users can be grouped in three categories: "*a) lead users in the target application and market; b) lead users of similar applications in advanced "analog" markets; c) lead users with respect to important attributes of problems faced by users in the target market*" (Churchill et al., 2009, p. 9).

Identifying Lead Users

Since Lead Users are not "regular" types of users, it is important to characterize what describes this type of users: field-dependent characteristics (consumer expertise and use experience) as well as field-independent variables (locus of control and innovativeness) are key attributes to narrow the scope and improve the search process (Schreier and Prügl, 2008).

Applying a technique named as "Pyramiding" (von Hippel et al., 2009), where instead of asking individuals to identify others that possess equal knowledge of the desired attribute, asks people for references of others that know more of that attribute, until the top of the pyramid is achieved (von Hippel et al., 2009), has resulted in higher levels of lead user identification have been obtained (Von Hippel et al., 1999; Olson and Bakke, 2001; Lilien et al., 2002; von Hippel et al., 2009).

Follow up on Lead User method implementation

Although the "Lead User method" has proven good results in terms of product innovations and commercial acceptance (Herstatt and Von Hippel, 1992; Von Hippel et al., 1999; Lilien et al., 2002), there are also other researched situations where the adoption of Lead User methods in New Product Development failed to have a continuous implementation (Olson and Bakke, 2001). Although initial successful new products concepts and ideas were generated and the cross functional routines for team work, the follow up performed afterwards revealed that management abandoned the Lead User process due to lack of time and resources (personnel turnover). Olson and Bakke (2001) in their analysis, concluded that the reasons presented are in fact the result of "*poor organizational learning caused by a desire to avoid ambiguity, compartmentalized thinking and inertia*" (Olson and Bakke, 2001, p. 395). The authors also argued that Lead User method can be time consuming and resource intensive being this a severe obstacle for firms to overcome (Olson and Bakke, 2001).

3 Methodology

The previous chapter presented the literature review on areas pertinent to this study: evolution of organizational designs, collaboration models between organizations and the classes of collaboration. Different new product development approaches, with a particular emphasis on Agile methodologies have been described, concluding with the revision of the Lead User concept.

This chapter proposes an integrative collaboration model and describes the methodology applied in this study with research design, data collection and data analysis performed.

3.1 Motivation

Research methods are considered the basis of knowledge production for all areas (Dubé and Paré, 2003). The increase of different research methods and specifically of qualitative methods appear as a result of different philosophical perspectives and different trends in research topics (Dubé and Paré, 2003). From the different qualitative research methods available (Berg and Lune, 2004), case studies are the most frequent (Piekkari et al., 2008).

According to Eisenhardt (1989a), case study research can be defined as "*a research strategy which focuses on understanding the dynamics present within single settings.*" (Eisenhardt, 1989a , p.534). Yin (2014) describes case study research as an empirical process of investigating a phenomenon that occurs in real life and especially when the boundaries between the phenomenon and context are not clear. Case study research becomes appropriate when a phenomenon is complex and wide, an overall comprehension and investigation are needed and when it's not possible to study it outside the bounding context (Dubé and Paré, 2003; Yin, 2014), such as organizational and management processes (Yin, 2014).

According to Yin (2014), case study research should be used when the purpose is to answer questions such as "how" or "why", when investigator has little or no possibility to control the events and when the phenomenon is to be studied in a real-life context. The research questions to be answered in this study are related to this method:

- *How are Portuguese companies, from the software development industry, willing to join Collaborative Network Organizations?*
- *How can a suitable collaborative product development methodology be supported?*
- *How can the Lead User concept be integrated in collaborative network organizations?*

Still according to (Yin, 2014), three different types of case study research can be identified: Exploratory case studies, which are conducted to define research questions and hypotheses; Explanatory case studies that seek establish a link from an event with its effects, suitable for investigating causality and Descriptive case studies used to illustrate events and their specific

context. Each of these types can be analysed in single or multiple cases, by explaining changes within cases over time or explaining differences between cases (Yin, 2014).

Most of the research efforts require multiple case study analysis (Yin, 2014), since the dependence of a single case may not allow the generalization of conclusions (Dubé and Paré, 2003) and therefore case selection must be performed to maximize what can be learn throughout the available time for the study (Dubé and Paré, 2003). Cases should then be selected by their significance or theoretical relevance (Ragin, 1999), since case research is not presented as sampling research (Yin, 2014).

The research strategy proposed by (Yin, 2014) will be the primary research strategy for this study, following a multiple case study and exploratory methods addressing the fundamental research questions.

From author's experience and from the literature review, a gap was identified in the collaborative network processes. As a result, an integrative model is proposed, combining the collaboration, product development and lead user involvement dimensions, in order to address this problem in its business environment.

The design-science research guidelines from (von Alan et al., 2004), where the objective is to obtain knowledge and comprehension of a problem within its context, through the creation and application of a designed artifact to address the identified business needs, will be the strategy applied for the integrative model validation.

The study will consist of the following phases: Proposal for an Integrative Collaboration Model, Research Design, Data Collection and Data Analysis (Dubé and Paré, 2003), each described in the following sections.

3.2 Proposal for an Integrative Collaboration Model

The literature reviewed in the areas of collaborative network organizations presented models and frameworks in detail (Camarinha-Matos and Afsarmanesh, 2006d; Camarinha-Matos and Afsarmanesh, 2006b; Camarinha-Matos and Afsarmanesh, 2007a) as well formal assessment of organizations to engage in such networks (Romero et al., 2009) with the corporate governance and enterprise architecture of each organization being thoroughly assessed (Romero et al., 2009).

If organizations recognize value in belonging to a collaborative network organization such a Virtual Breeding Environment, the reciprocal is also applicable where it is fundamental to the VBE to become attractive for other organizations to join thus enlarging both in size and in competences.

There isn't however a clear notion of how organizations should be prepared to join a collaborative network organization, being assumed that an existing VBE will present the requirements to the applicants (Afsarmanesh and Camarinha-Matos, 2005) through a true or false process: either fits or not.

Joining a VBE will then become a disruptive process, where besides assessment of benefits, risks and impacts in organization strategy there is uncertainty about how to perform changes and what will be the final collaborative environment in terms of potential partners (Durugbo and Riedel, 2013).

From the literature review and from the author's experience, prior to any formal application, there should be a staging scenario, where organizations adhere to common interest domains, which should be aligned with the overall vision of the VBE, allowing organizations to gradually perform internal structural changes (if needed) and to establish informal relations between each other (Lawson et al., 2009). This scenario can be used prior to VBE engagement or after VBE engagement, for collaboration mechanisms improvement towards preparedness's for the forthcoming (Romero et al., 2009)

An integrative model for preliminary collaboration is proposed, following the design-science guidelines from von Alan et al. (2004), depicted in Figure 2, where the business need to collaborate, and the impediments in effectively doing so, consist the environment of the problem space. The proposed model intends to address these problems (von Alan et al., 2004) and the design presented should be evaluated in an iterative and incremental process, in order to be adjusted to the business need from where problems emerge and to be added to the knowledge base (von Alan et al., 2004).
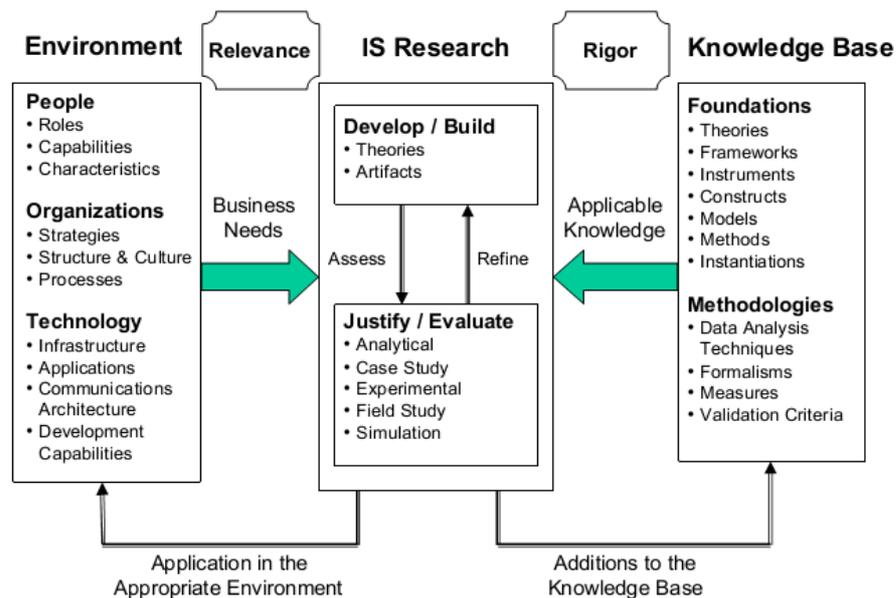
Figure 2 – Information Systems Research Framework (von Alan et al., 2004, p. 9)

The proposed model applies specially to the industry of software development, approaching collaboration between organizations on the life cycle perspective and on two collaborative organizations' dimensions – structural and componential (Camarinha-Matos and Afsarmanesh, 2006b). The integrative model is depicted in Figure 3, identifying the structural dimension's actors and relationships (Camarinha-Matos and Afsarmanesh, 2006b): organizations, knowledge domains, process domains, lead users involvement, customers, as well as relations

between them. The componential dimension is identified through the common ICT supporting the knowledge and processes domains.

The market dimension is also depicted, as part of the external interactions described in (Camarinha-Matos and Afsarmanesh, 2006b), especially in what concerns interactions with customers, since these are a fundamental aspect of the development methodologies (MacCormack et al., 2001), in order to have a faster feedback and guide developments towards customer's needs.

The life cycle perspective, as described in (Camarinha-Matos and Afsarmanesh, 2006b), consists in four stages: Creation; Operation; Evolution and Metamorphosis / Dissolution. From the reviewed literature, and under the current study scope, the "Creation" phase, which has been renamed to "Learning", and the "Operation" stages, are described for the proposed integrative model.

The proposed model can be interpreted depending on a VBE existence in the following perspectives:

- If not existent, it could be a preliminary phase for organizations to learn the future relationships establishment within the VBE and perform the necessary changes to fit the overall strategy;
- If existent, it can be also a preliminary stage for organizations willing to be part of a VBE, but that have failed to fit the readiness assessment as described by (Romero et al., 2009).
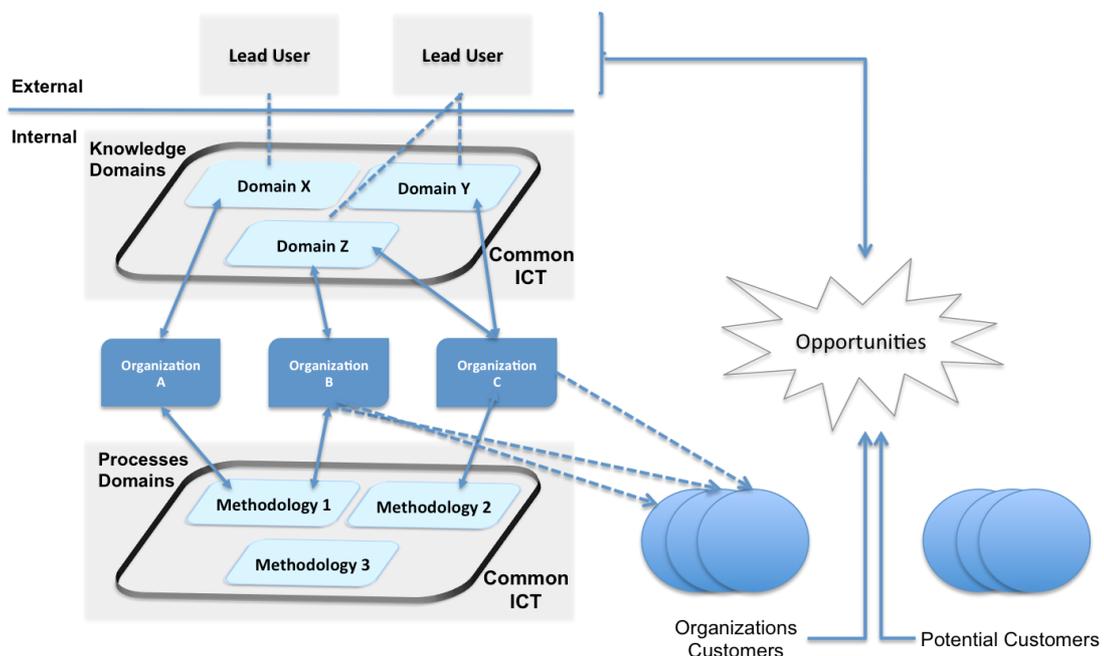

Figure 3 - Integrative Model: Learning phase

3.2.1 Learning Phase

Figure 3 depicts the final stage of the "Learning Phase", however intermediate steps to reach it are envisioned.

As an initial VBE pre-formation, organizations would initiate a learning process across two domains: the knowledge domain and the processes domain.

Knowledge Domains

Knowledge domains enable organizations to increase their knowledge either in their specific domain or allow cross-domain access (as the case of Organization C in Figure 3). This cross-domain access can be used to assess trends or developments that can be applied to the core domain of the organization, since organizations would not be limited to a specific domain, an approach related to the category of Lead User in similar analog markets (Churchill et al., 2009).

These domains are enriched in two ways:

- Internally, in close relation with the existing or future Virtual Breeding Environment, where organizations, besides capturing knowledge, contribute to its expansion;
- Externally, where other participants, such as lead users, knowledge domain reference persons or communities, can contribute to knowledge base in one or several domains. The external participation would be controlled by the VBE and information visibility could be restricted.

The Knowledge Domain, with the bi-directional internal interactions between organizations and the domains, with the external interactions with Lead Users or referenced experts, would consist overall the Professional Virtual Community as described in (Camarinha-Matos and Afsarmanesh, 2006b; Camarinha-Matos and Afsarmanesh, 2007a) and where innovation or business opportunities may arise (Camarinha-Matos and Afsarmanesh, 2006b; Camarinha-Matos and Afsarmanesh, 2007a; Churchill et al., 2009; Lilien et al., 2002).

Processes Domains

For a higher probability of collaboration success, organizations should have similar product development methodologies. The VBE, or future VBE, can also establish what methodologies should be practiced by organizations willing to be part of it.

For each dimension, an ICT infrastructure is needed, as part of the componential dimension of a future Collaborative Network Organization (Camarinha-Matos and Afsarmanesh, 2006b).

Market Dimension

From the proposed model, market opportunities are generated by three distinct sources:

- As an external business opportunity, presented by potential customers that is target through the collaborative network;

- As a business opportunity that emerges from the widened contact's network triggered by the existence of different organizations, depicted by the relations between organizations B and C to customers;
- By following the Lead User needs, through the innovation opportunities that may appear with the involvement of this group.

3.2.2 Operation Phase

The main purpose of this study is to assess the predisposition of companies to integrate collaborative environments prior to engaging in practical collaboration opportunities, however, for clarity purposes, the operation of a Virtual Organization adopting the proposed model is depicted in Figure 4, identified as "Operation" phase.

This phase implies that the organizations readiness assessment either to potentially join a VBE or to integrate a Virtual Organization is accomplished (Romero et al., 2008; Romero et al., 2009).

Pre-Conditions

Organizations ready to form a Virtual Organization have been exposed to a wide knowledge base in their specific domain, or domains, and have identified which external sources e.g. Lead Users can be contacted to test and provide feedback on their developments.

These organizations have also adopted and implemented common product development methodologies enabling the tight alignment and dependency mapping of the forthcoming developments. This common methodology can also be used as an accountability assignment method for a clear scope of each organization responsibilities.

A project coordination team should be in place, responsible for project follow up in two dimensions:

- Vertically: identifying the knowledge domains and related sources (internal or external), suitable methodologies and responsibilities assignment;
- Horizontally: deliverables quality and alignment with customer's requirements and customer interaction.

Execution

The common development methodologies applied by each organization produces modular outputs that must be combined through the usage of an integrative ICT framework.

Combination of the several outputs into deliveries visible to the customer is a key activity and must be followed up closely by the project coordination team. Proper communication channels must be established allowing for clear information flow between organizations and the project coordination team.

Depending on the methodology (Eisenhardt and Tabrizi, 1995; Krishnan and Ulrich, 2001; Ulrich, 2003), feedback to or participation from customer may occur with frequency. Especially

in Agile methodologies, these type of interactions are of considered of great value, since they allow to have a "fail fast" approach (Eisenhardt and Tabrizi, 1995; Schwaber, 1997; Beck, 2001; MacCormack et al., 2001) enabling change implementation for ongoing developments thus adjusting them to fully suit customer needs (Schwaber, 1997; Franke et al., 2006).
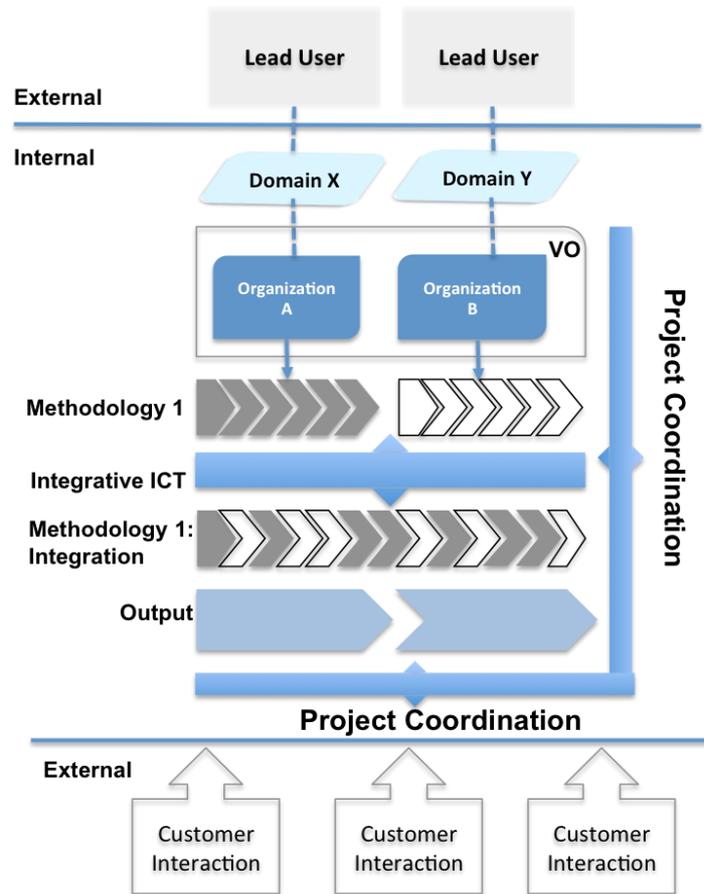
Figure 4 - Integrative Model: Operation Phase

Expected results

Before reaching the practical results intended, the design model has to be evaluated, following the observational method from von Alan et al. (2004), by a case study where the artifact's behaviour is studied in depth in the business environment.

Through the combination of several domains of expertise and with the proper alignment of development outputs and interactions with relevant players in the process, such as the lead users and customer, faster product developments are expected and even more important, more suited to fit customer needs, by presenting an increased value proposition or by presenting innovative solutions to the market, ahead of competition.

With effective collaboration processes in place through Virtual Organizations, different and wider markets can be reached thus enabling more business opportunities for engaging organizations.

3.3 Research Design

According to Yin (2014) the Research Design phase consists of a general preparation with the preliminary theory and structure of the study, the understanding of the importance of the subject being studied, opting between the explanatory, exploratory and descriptive designs, case selection and the level of generalization of the study results. Other authors such as Eisenhardt (1989a) outline, the initial starting, case selection and crafting instruments and protocols form the research design phase.

For an exploratory case study research, clear research questions are one of the most important steps (Eisenhardt, 1989a; Dubé and Paré, 2003; Benbasat et al., 1987). The "how", "what" and "why" questions are likely to be the most appropriate (Yin, 2014), which have been used in this study.

For the integrative model design evaluation, an observational method as proposed by von Alan et al. (2004), based on case studies, where the design is studied in depth in its business environment will be applied.

Exploratory research should have a clear purpose and present the success criteria for evaluation (Yin, 2014). The current research main objective is to assess the predisposition, motivation and conditions from software development companies to become part of collaborative network organizations such as Virtual Breeding Environments and engagement in temporary forms of collaboration for a specific market opportunity (Virtual Organizations). As secondary objectives, it should be assessed what is the most appropriate collaborative product development methodology and what could be the role of Lead Users in a collaborative environment.

For a successful outcome, the motivation to join collaborative network organizations should be concluded and the integrative model should be evaluated for the collaborative process, including the product development and lead user involvement.

The absence of hypotheses and theory under consideration have the effect of not biasing the findings (Dubé and Paré, 2003; Eisenhardt, 1989a). Following this orientation, questions have been formulated in order to obtain a correlation between the literature, author's experience and the business needs from companies which can support or disregard integrative model proposed dimensions.

Cases were selected due to their substantive significance (Ragin, 1999), selecting the right participants for the purpose of this study and criteria was established in order to qualify as interviewee (Shaw, 1999). The criteria was based on the size of the company, common organization host with links to university and having more than 2 years of existence, but less than 5 and having personal and business relations with the author. The study subjects are then three Portuguese companies, having no formal collaborative or business relations between them. To all participants, confidentiality and anonymity was assured.

The unit of analysis is a key factor for the research design (Yin, 2014; Dubé and Paré, 2003; Shaw, 1999). If not properly chosen it may affect the results by not providing feasible results or by not setting the boundaries of a theory and therefore the limitations in its applicability (Dubé and Paré, 2003). In the present study, the unit of analysis were companies as a whole, by directly contacting their CEOs. Due to the size of companies, the CEO individual perspective expresses the company's strategy or activities as whole, where "CEO" and "company" will be used interchangeably.

For highly exploratory researches, a pilot case may help to identify the proper unit of analysis, re-evaluate data collection processes and directly expose the researcher to the subject being investigated (Dubé and Paré, 2003; Yin, 2014). A pilot case was performed with one sample company – Company A, which allowed the removal of ambiguity from the interview questions for the following interview processes.

The integrative model design, has followed the information systems research framework research (von Alan et al., 2004) where the available knowledge base from the design-science research in terms of foundations and methodologies has been applied to design an artifact – the integrative model – which will be evaluated by its application on the organization's environment, in what comes to people, other organizations and technology (von Alan et al., 2004) through an observational design evaluation method.

The present study was conducted from December 2013 to September 2014, with the data collection process being performed between July and August of 2014, and each case study was processed independently.

3.4 Data Collection

Data Collection phase consists in the study conduction through case study protocol and evidence collection (Yin, 2014) and field entering (Eisenhardt, 1989a).

In the case study research design, interviews provide the researcher a suitable instrument to gather knowledge about the participants proximity (Yin, 2014; Kvale and Brinkmann, 2009). This has been the instrument for qualitative data collection used in this study, and no other instruments have been used.

An interview script (provided in Annex A – Interview Script) was developed beforehand to ensure a structure comprising different types of questions e.g. introducing questions, direct questions and specifying questions (Kvale and Brinkmann, 2009) and allowing and extra degree of interactivity (Eisenhardt, 1989a).

The interview script was based in the VBE's members readiness assessment (Romero et al., 2009), for the "Past Collaboration Performance" and "Corporate Governance" dimensions. The "Enterprise Architecture" dimension (Romero et al., 2009) has not been considered, since this is an evaluation criterion of organizational adaptability evaluated by the VBE administrators on applicants (Romero et al., 2009), while the scope of this study is to assess the companies'

predisposition and motivation to potentially join a VBE. The other dimensions of the interview - "Collaborative Product Development" and "Professional Virtual Communities and Lead Users" - have been based in the studies of (Brown and Eisenhardt, 1995; Schwaber, 1997; Camarinha-Matos and Afsarmanesh, 2006a; Churchill et al., 2009). The interview questions are also related with the proposed integrative collaboration model dimensions, so that a link to its validation can be established.

The interviews were conducted in person and in the companies' premises, being recorded and transcript upon permission of the interviewees, with a duration of approximately 60 minutes each, previously announced to the interviewees also to reduce bias (Saunders et al., 2003).

All interviews were conducted by a single interviewer, this study's author, to reduce interviewer biasing (Lowes and Prowse, 2001). The interviews were conducted in interviewees mother tongue, Portuguese, and hence a translation process had to be applied which may induce loss of information in the transcription to this document (Larkin et al., 2007).

Questions were formulated in a neutral way to avoid biasing the interviewee into a specific direction (Smith et al., 2009). The guidelines by Berg and Lune (2004) have been considered for hearing awareness and follow up on monosyllabic answers.

Multiple sources of evidence are considered an important factor for case study results accuracy, through a triangulation process (Dubé and Paré, 2003; Yin, 2014). Throughout this study, besides the collected data through interviews also observed data from the direct contact with the companies has been used, enriching the study outcomes.

3.5 Data Analysis

Data Analysis consists of analysing within the case, searching for cross patterns, revisiting hypothesis and comparing with the relevant literature for Eisenhardt (1989a) and for (Yin, 2014) the analysis can rely on the theoretical propositions or in the case description, through a pattern-matching, explanation building or time series analysis and analytic techniques.

Data analysis overlapped with data collection process by analysing and interpreting the views of the interviewees. This overlapping was important since it allowed adjustments on data collection mechanisms and to verify the applicability of this study author's ideas with simultaneous collection of data (Shaw, 1999).

An inductive data analysis process was applied, following the recommendations of the relevant literature (Shaw, 1999; Marshall and Rossman, 2010) involving the reading of the transcripts and field notes, the comparison of the categories identified with the data collected and with concepts suggested by the literature (Eisenhardt, 1989a; Dubé and Paré, 2003) and the search for relations within the categories of data. Quotes have been used in order to allow the reader to reach an independent judgement beyond the analysis performed (Yin, 2014).

A review on results has also been solicited to the research participants in order to validate the validity of interpretations and findings (Dubé and Paré, 2003; Yin, 2014).

For the integrative model, an evaluation process was requested to the companies, following the design-science research guidelines from (von Alan et al., 2004) namely the design evaluation, research contribution, search process and communication of research.

4 Case Studies results and model validation

The previous chapter presented an integrative model and described the methodology applied, with the research design, data collection and data analysis description.

This chapter presents the companies subjected to the case studies and discusses the results through an inductive data analysis process and comparing with relevant literature.

The integrative collaboration model results from organization's evaluation completes the chapter.

4.1 Case Studies

Three Portuguese companies, are the subject of the case study, operating in the field of software development but relying on different technologies and value propositions. All companies have less than five years of existence with different levels of organizational development. These companies and their CEO's are part of this study's author personal and business relations, from where the mutual interest in participating in this study arose.

4.1.1 Company A

Company A is an company founded in 2010, developing software solutions in the middleware and data storage fields, providing software development training regarding technologies, frameworks and methodologies such as Agile. Although currently these are not considered core business, some projects have been performed in the areas of multimedia productions such as video and photography.

The company traces back its roots to 2004, when the CEO started professional activity as a freelancer, having its first international software development project for a large retail company in 2007, from where the need to adopt form a company arose. After the legal constitution of the company, the first employee started activity in 2011 and the company had a maximum of 5 employees, which have then been reduced due to market conditions. With a forecast of financial losses, the company strategy changed, as the owner decided to engage in projects directly with customers, while keeping some parallel internal development and training projects, thus having the number of employees reduced.

Most of the software products developed were tailored to customer's needs and hence not available to general market. Leveraging the knowledge obtained with this direct exposition to customers, internal software frameworks have been developed, with the purpose of being re-used in other projects, or to evolve up to a stage where they can be presented to the market as a product. However, due to the lack of resources, this last objective has been postponed.

The target market of Company A is the national market, in the segments of mid to large non IT based companies such as retail, banking or telecom through direct application to potential

customers and with no distribution channels except the web, where a blog is kept to expose knowledge in software development domains.

Financial information has not been disclosed, however the company's CEO has referred the figures as positive.

4.1.2 Company B

The company B was founded in 2010, specifically to develop a software application for online surveys, within the national market. Currently the company's core businesses are development outsourcing for IT organizations and developing Software as a Service Applications. It has two associates (having the CEO as the largest shareholder), where the CEO has been interviewed and has currently five employees with a tendency to increase.

The company's core competences rely on the extensive knowledge of web applications, cloud computing and software as a service based on technologies such as Java, Javascript, NodeJs, MongoDB, Redis, ElasticSearch and Wordpress. In the processes area, company B is highly experienced in the Scrum framework (an Agile Software development methodology).

Value proposition resides on jointly developing high quality software solutions for other company's outsourcing customers and in creating breakthrough products in the Software as a Service area, which can be unique and compelling. Currently it has one patent application in the USA, for an internally developed technology.

The company has two Software as a Service products under development and has established strategic partnerships with other companies from different domains and with a renowned Portuguese University.

The target markets of Company B are Universities (extending to the Technology Transfer Departments) and IT Companies, placing the products in the market especially through web marketplaces.

In the outsourcing business area, marketing strategy consists on attending industry meetings and gatherings, while in the Software as a Service Applications, Company engages potential customers through social networks, web marketing campaigns and by sponsoring industry meetings.

Financial information has not been disclosed, but the company's CEO refers them as positive.

4.1.3 Company C

Four associates formally launched company C in 2012, after previous shared work experience for several years. The focus of company C is to develop and deliver best of class software applications, applying the best software engineering practices and totally suited to customer needs. As part of the company's culture, an exemplar ethical posture and straight

business ethics are identified as fundamental, and these are publicly explained to customers and partners.

The company has two founding managing partners and two partners. In 2013 a large IT Systems development organization become a key shareholder. Currently has ten employees with a tendency to increase until the end of 2014.

Core competences rely on extensive knowledge on software development technologies such as Microsoft frameworks and Java, database systems and development methodologies such as Agile. A strong emphasis on User Experience and "Design Thinking" approaches are also part of the core assets of the Company.

The value proposition resides on providing software solutions faster and with a lower price, but keeping high standards of quality with the development of re-usable components through a "software factory" process. A collaborative platform of knowledge for direct communication with customers and partners is also part of company's value.

Although having an internal software development product available, for a very specific niche market, a formal product development is not part of the company's current strategy. However, if an opportunity to develop an internal product comes to reality, this will be considered.

The IT Systems development organization that become an associate of Company C is a key strategic partner, since joint projects involving resources from both entities have been implemented and this collaboration has also been applied to other organizations.

As target markets, after a previous consolidation period for resources and experience, company C targets especially North America and Northern Europe countries, in a short to medium term timelines.

Marketing strategy consists in essentially two dimensions: an active and direct promotion - through active participation in Open Source development projects and technical events attendance - and online promotion through a knowledge website.

Financial information has not been disclosed, but has been referred as positive.

4.2 Results and model validation

For simplicity of analysis, a summary of results is presented in Table **1**, whereas the full case studies results transcription are presented in Annex B – Interview Results. The column "Area" identifies both the interview topic and its relation with the integrative model dimensions and domains.

Dimension	Area	Company A	Company B	Company C
Past Collaboration Experience	Previous Collaboration *Integrative model's structural dimension - relationships*	- Subcontracting; - Market Relations.	- Direct subcontracting and subcontracting through joint ventures; - Market Relations.	- Subcontracting; - Strategic cooperative agreements; - R&D Consortia.
	Unsuccessful factors *Integrative model's structural dimension - relationships*	- Inexperience; - Lack of knowledge about market.	- Deviations from initial strategy definition.	- Cultural / ethical differences; - Currency exchanges; - Business strategies.
	Success factors *Integrative model's structural dimension - relationships*	- Competences mapping and limitations awareness; - Common shared values.	- Existence of an aggregative institution; - Involvement from companies' key responsibles.	- Competences mapping.
	Risks *Integrative model's structural dimension - relationships*	- Financial: budget availability and on time payments; - Political issues in customers.	- Financial: budget availability and on time payments - Unclear scope of activities that affects overall development pace; - Dominance from large organizations	- Informal vs. formal relation distinction; - Divergent business ethics and values
	Benefits *Integrative model's structural dimension - relationships*	- Learning and knowledge sharing; - Stability through guaranteed funding from large organizations / institutions.	- Learning and knowledge sharing; - Guaranteed funding from large organizations / institutions; - Visibility; - Funding for internal projects development.	- Synergies created through collaboration; - Added value to customer; - Learning and knowledge sharing.
	Relation Persistence *Integrative model's structural dimension - actors*	- Yes, except for relations where no common values were shared	- Yes (may refuse new due to strategy changes)	- Yes
Corporate Governance	Inter-Organization Value *Integrative model's structural dimension - organizations*	- Experience sharing; - Diversified skill set that can open new market or support more complex projects.	- Not clear (needs practical examples);	- New business opportunities; - Internal and external networking; - Added value to customers.
	VBE application *Integrative model's structural dimension - organizations*	- Introspection; - Company's detailed analysis.	- Company's visibility and scale factor ; - Market opportunities; - Changes needed in the company to apply.	- Availability; - VBEs Values; - VBE's members commitment
	Value from VBE *Integrative model's structural dimension - actors*	- Knowledge base; - Experience sharing.	- Scale;	- Financial; - Knowledge base; - Experience sharing.
	Value to VBE *Integrative model's structural dimension -actors*	- Technical knowledge; - Business knowledge.	- Technical knowledge; - Market contacts;	- Technical knowledge; - Business knowledge; - Added value to customers.

Dimension	Area	Company A	Company B	Company C
	Strategy Fit *Integrative model's structural dimension - organizations*	- Depending on change impact and cost-benefit analysis; - Willing to change, if positive.	- Depending on cost-benefits analysis; - Willing to change, if positive.	- Depending on cost-benefits analysis - If positive, willing to change
	Willingness to apply *Integrative model's structural dimension - organizations*	- Yes, with conditions.	- Yes, with conditions.	- Yes.
Collaborative Product Development	Methodologies *Integrative model's structural dimension – process domain*	- Agile; - Lean processes.	- Agile	- Agile - Waterfall, for highly complex projects.
	Key factors *Integrative model's componential dimension*	- Central coordination team; - Common ICT Infrastructure; - Frequent communication, and favouring personal contacts.	- Central coordination team, for responsibility and accountability definition; - Common ICT Infrastructure; - Careful dependency mapping; - Funding.	- Focus on core competences from each organization and alignment.
	Methodology fit in internal processes *Integrative model's structural dimension – process domain*	- Best practices assessment; - Methodologies should be in place, prior to collaboration start.	- Methodologies should be in place, prior to collaboration start.	- Methodologies should be in place, prior to collaboration start.
Professional Virtual Communities and Lead Users	Innovation / New product Development *Integrative model's structural dimension – knowledge domain*	- Customer needs; - Trend adoption in local market.	- Customer needs; - Different approach to problem with existing solutions;	- Customer needs; - Previous exposure to Lead User project.
	Trend identification *Integrative model's structural dimension – knowledge domain*	- Online information (blogs, online news, technical articles) in the area.	- Online information (blogs, technical articles) in the area; - Trend assessment in other technology areas.	- Online information (blogs, technical articles) in the area.
	Joining PVCs *Integrative model's structural dimension – knowledge domain*	- Already member of virtual communities; - Willing to join others of interest; - Community recognition of company's expertise	- Already member of virtual communities; - Willing to join others of interest; - Community recognition of company's expertise.	- Already member of professional communities; - Willing to join others of interest; - Community recognition of company's expertise.
	PVC Impediments *Integrative model's structural dimension – knowledge domain*	- Time; - High fees.	- Time; - Unbalanced contributions; - Community interest decrease in time.	- Time.

Table 1 - Summary of results

4.2.1 Past Collaboration Experiences

Within the scenario of assessing readiness to become a member of a collaborative network such as a VBE, the past collaboration performance is a key dimension to be evaluated (Romero

et al., 2008; Romero et al., 2009). These collaborative models include subcontracting, licensing, cooperatives, joint ventures and other types as classified by (Todeva and Knoke, 2005).

All the companies studied have previous collaboration experiences having the subcontracting (Todeva and Knoke, 2005) from a business partner organization as common model, where resources are integrated in partner's internal teams and projects. Other collaboration model has been the product development tailored to customer needs, in a market relations (Todeva and Knoke, 2005) model where the customer issues the requirements and the product is developed in a near-shore (Meyer, 2006) approach until the needs are fully covered.

Company B has had collaboration models conceptually similar to Virtual Breeding Environments (Camarinha-Matos and Afsarmanesh, 2006b), either by jointly developing solutions for an existing opportunity or by belonging to a non-profit institution, having access to European Union funded projects lead by larger organizations.

The strategic cooperation agreement and R&D consortia (Todeva and Knoke, 2005) have been another collaboration models experienced although in an initial phase, which enriches the organisations visibility of the benefits and risks of collaboration and allowed organizations jointly develop a product that couldn't be developed individually (Romero et al., 2009).

For the few unsuccessful collaboration experiences described, Company A identified the inexistent company's knowledge about market conditions and prices which led to lower contract values, and that can be viewed as a consequence of the customer bargaining power (Porter, 1985). Company B has also identified that deviations between companie's strategy and the fit to the overall strategy caused some to leave the projects. This last aspect can be seen as a risk related to Corporate Governance, discussed in the next section, where the VBE's strategy and applicants strategy should be aligned in a "*strategic fit*" (Romero et al., 2009). Company C highlights the different cultural values, when collaborating with organizations in other continents, and has initial signs of warning for collisions that may appear from different approaches to business(Abreu and Camarinha-Matos, 2008).

Overall, all companies consider their previous collaboration opportunities successful, and consider that the understanding of each companies' competences and limitations, a common set of shared values such as respect, honesty and transparency (Romero et al., 2007; Abreu and Camarinha-Matos, 2008; Rosas and Camarinha-Matos, 2009), the human commitment towards the project and the support of an aggregation institution as key success factors. The shared values such as behaviour, ethic and especially trust have been identified by Rosas and Camarinha-Matos (2009) as key factors for collaboration readiness. The competence fit is of additional importance, since this will allow closing competence gaps existing in the VBE (Romero et al., 2009).

The three companies identify risks in collaborative projects, being the financial risk at the top of the interviewed CEOs concerns. For very small companies, the narrow budgets imply that

tight payment timings must be applied, in order to fund the next developments. This tight budgeting may also affect the pace that each company can apply to the project.

The amount of value added by each member presents itself as a challenge to define schemas for revenue and liability distribution, especially when non tangible goods (services or intellectual property) are outcomes (Camarinha-Matos and Afsarmanesh, 2006a; Camarinha-Matos and Afsarmanesh, 2006b).

The risk of not having a clear definition of what company should do and the, when larger organizations collaborate, where the pursue of a dominant role for the project puts at stake the success of the overall opportunity, by adopting rivalry behaviours (Porter, 1985).

Ethical values alignment and a diffuse combination of informal social relations and formal business ones are risks also considered by company C, which can benefit relations between organizations (Lawson et al., 2009) but should be clearly separated from formal relations.

In terms of benefits, the learning process and knowledge sharing through the collaboration process (Lawson et al., 2009; Snow et al., 2011), the stability of working with larger organizations or institutions with prospects of guaranteed funding and the access to otherwise inaccessible markets are identified (Camarinha-Matos and Afsarmanesh, 2006b) as the main benefits of collaboration experiences. Company B further adds that part of the income can then be used for the internal products and projects development, being thus the collaboration model a source of revenue (Camarinha-Matos and Afsarmanesh, 2006b).

Most of the past collaborations experiences from all companies have perdured in time, and in the cases where that hasn't happened it was due to divergent set of values (Abreu and Camarinha-Matos, 2008; Rosas and Camarinha-Matos, 2009), thus proving in practice to be a key factor for collaboration success.

4.2.2 Corporate Governance

Another key dimension in assessing one possible applicant's is the "strategic fit" (Romero et al., 2009) where common interests between the applicant's strategy and the overall's collaborative network strategy by sharing common goals and levelled expectations (Romero et al., 2008; Romero et al., 2009).

Companies identify value in inter-organization collaboration, where the experience sharing between members of a VBE and an increased skill set which allows for more complex products (Camarinha-Matos and Afsarmanesh, 2006b; Camarinha-Matos and Afsarmanesh, 2007a; Snow et al., 2011), which can open new markets or provide sustainability for longer projects. For Company B, the value is not so immediate, since although conceptually it should function, only the practice should confirm it, with practical issues needing clarification (Durugbo and Riedel, 2013).

The possibility to join a collaborative network such as a Virtual Breeding Environment, would have to be preceded by an analysis on different dimensions such as cost vs benefits, the

visibility small companies could have to other larger organizations, with the opportunities that may arise, and the accessibility to new markets (Afsarmanesh et al., 2009) would be conditions to potentially join a VBE. The evaluation of the VBE's Values and Principles (Abreu and Camarinha-Matos, 2008; Romero et al., 2009; Rosas and Camarinha-Matos, 2009) and the commitment applied by organizations for engaging in collaboration would have to be carefully assessed.

Value from the VBE could be extracted is seen commonly in the knowledge and experience sharing (Camarinha-Matos and Afsarmanesh, 2006b; Camarinha-Matos and Afsarmanesh, 2007a; Afsarmanesh et al., 2009), where this could be more natural in a more entrepreneurial-like environment. Concerns about what could expected in return are demonstrated, since scarce resources could be misused. Scale is the key factor for Company B, since belonging to a VBE would allow smaller companies to approach otherwise unreachable markets (due to their size), supported by an aggregation institution (Camarinha-Matos and Afsarmanesh, 2006b).

Technical competences are identified by all companies as value that could be placed into the VBE (Romero et al., 2008; Romero et al., 2009; Adner and Kapoor, 2010), while Company A also identifies the previous project management experiences and Company B identifies the internal organization contact's network that could be shared with the VBE or could approach potential customers by describing the VBE to which it would belong (Romero et al., 2009; Rosas and Camarinha-Matos, 2009). Company C refers to the fact of organizations within a VBE becoming known by providing solutions to customers, by forwarding the opportunities internally when they can't address them by themselves (Camarinha-Matos and Afsarmanesh, 2006b; Camarinha-Matos and Afsarmanesh, 2007a; Afsarmanesh and Camarinha-Matos, 2007).

The "strategic fit" to a VBE overall strategy can imply changes in an organization strategy (Romero et al., 2009). The resistance to change (Lines, 2004) is a concept that all CEO are familiarized and the cost-benefits analysis should compensate the risks implied to change and the disruption to the company's routines. However, all companies are aware that change is easier in smaller companies and should be performed in order to increase the possibilities of survival in competitive markets.

Overall, Companies are willing to potentially join a collaborative network such as a VBE, although some clear notion of the costs and benefits is required. Based on their previous collaboration experiences, which have been mostly successful, and potential opportunities that can arise from belonging to a VBE, these companies are more prone to collaborate, as stated by Romero et al (2009) but concerned with practical feasibility of the concept (Durugbo and Riedel, 2013).

4.2.3 Collaborative Product Development

In what comes to methodologies for collaborative product development, all companies have identified the Agile product development methods (Sutherland and Schwaber, 1995; Schwaber, 1997; Beck, 2001) as the better adequate to most projects, especially the ones with high

uncertainty and thorough experiential approaches, as studied by Eisenhardt and Tabrizi (1995). The iterative approach employed by these methodologies results in earlier availability to have customer feedback and changing direction quicker if there is the need to do it (Schwaber, 1997; MacCormack et al., 2001). Company A still adds the Lean methodologies as to reduce the "waste" to minimums, thus optimizing the development process. From their experience, companies are also aware that depending on project's size, complexity and customer requirements, other methodologies may also be applicable (Krishnan and Ulrich, 2001; Ulrich, 2003).

As key success factors, companies A and B identify the need for a central coordination team for project managing, a role identified in the VE context as VO Coordinator (Camarinha-Matos and Afsarmanesh, 2007b), posing as an overhead to the project, but needed in order to assure project guidance, a collaborative working culture and clear communication channels, which have been identified in the literature as the "communication web" approach (Brown and Eisenhardt, 1995).   Company B lays further emphasis on the project guidance, since a clear responsibility and accountability must be in place, to avoid grey areas or the overtaking of tasks by an organization. Company C expresses a similar perspective, where for increased success probability, focus should be placed on core competences, thus individually contributing to the overall result, which is identified as a role for a VO planner or business integrator (Camarinha-Matos and Afsarmanesh, 2007b).

A common ICT infrastructure is needed either for establishing communication channels, which is one of the basis for collaborative networks such as the ones in ECOLEAD model (Camarinha-Matos, 2005; Camarinha-Matos et al., 2005a; Afsarmanesh et al., 2007; Camarinha-Matos et al., 2008), which can be virtual (but personal contact, where possible should be favoured), within the organizations belonging to the collaborative project or, as highlighted by Company B, to assure seamless integration of the different outputs coming as result of the different organization's tasks. Still related with the results integration, Company B still refers the need to have clear delivery milestones and dependencies mapping between organizations, so that the tasks alignment and syncing is performed, avoiding placing timings at risk.

It is a common reflection across all companies under study that the product development methodologies, when different from existing, should be implemented prior to joining a collaborative project. Learning what methodologies are in place across the VBE, having with positive results following an implementation within each organization will decrease the change resistance and better understanding of the alignment between tasks. Customers may require that a specific methodology is in place and this may still be used as a selection criterion for VO Planners (Camarinha-Matos and Afsarmanesh, 2007b).

4.2.4 Professional Virtual Communities and Lead Users

Professional Virtual Communities have an important role in Collaborative Network organizations, through the knowledge that can be share by the participants and the potential source for innovations or new business opportunities (Camarinha-Matos and Afsarmanesh, 2005; Afsarmanesh and Camarinha-Matos, 2005; Camarinha-Matos and Afsarmanesh, 2006b; Camarinha-Matos and Afsarmanesh, 2007a; Camarinha-Matos et al., 2008).

Regarding innovation opportunities, companies have targeted them by developing products addressing a specific customer need e.g. market pull (Brem and Voigt, 2009) either by implementing a trend already existing in international markets or by approaching an existing problem, with already available solutions, with a different perspective. The customer need and involvement is a common trigger for new innovation (Schwaber, 1997).

The companies studied keep up with technological trends especially through on line information: technical blogs, news feeds or technical magazines. Particularly in the case of Company B, there is the action of trying to apply knowledge from other domains to the company's business area and to actively participate in events with key reputed speakers. This approach of Company B is similar to the Lead User concept application (Churchill et al., 2009), by identifying who are experts in a specific domain, even if that domain is not related with the one where the company operates. Company C has had also an approach to the Lead User concept (Churchill et al., 2009) through their founder's professional experience.

All companies belong to some kind of virtual community, and they are further willing to join other PVCs within their technical areas. Company A considers even more beneficial to belong to such community than to a VBE due to the knowledge that could be shared among professionals. Company C's managing partner is part of a community of professionals that periodically gathers to discuss technology trends.

As a common remark for all companies, the time available to dedicate to such a community would be an impediment. Lack of time would lead to unbalanced contributions and later on to a decrease in the PVC activity and consequently to the interest in that PVC. Since small companies have limited budgets, if there were a high fee to be paid, Company A would not consider the PVC application.

Belonging to a Professional Virtual Community and contributing actively can increase the external awareness of the expertise present in the organization. This can act on individual level e.g. by an organization's member that stand outs in the community through blog posts, articles, books written and will relate the organization with that level of expertise – a matter of status (Lerner and Tirole, 2002; Adler and Heckscher, 2006), thus possibly opening new opportunities.

The organizations scanning for technological trends in other domains, that can be applied in their own domain and the inherent objective to become an reference in their particular domain can trigger the Lead User process, as described by (Churchill et al., 2009). Company C has had a close contact with a Lead User project, although not recognizing at the time what it was.

4.2.5 Integrative Model Validation

The proposed integrative model was presented to the companies subject to the case studies, following the design-science guidelines from (von Alan et al., 2004), where artifacts (the purposely built integrative model) is evaluated in order assess its capability of addressing the existing business need.

Companies recognized applicability in the model, identifying aspects of the model in the "Learning" phase that should be designed with more detail such as the ICT support for the knowledge and processes dimension where its ownership, implementation and maintenance should be clearly defined in order to preserve information and provide access control mechanisms.

As a common observation, it is fundamental that these domains can be used by initial collaborating organizations and also for the ones to engage assuring a continuous enlargement and enrichment, whereas the more the domains, the more overhead on management and communication is needed, which may imply costs. This last aspect is fundamental, since these companies have their budgets very controlled.

The evaluation of the knowledge and processes domains on who is responsible for assessing an organization evolution in specific process learning: other partner organizations or the supporting institution. This is particularly relevant for organizations acquiring new skills, which will later on allow collaboration targeting business opportunities.

From the fact that the Lead Users concept is generally unknown, there is the need to identify who these could be, for their specific domains and who should mediate the interaction with them, either each organization individually or the supporting institution. If innovation opportunities are created, originating products, practical issues such as revenue distribution are organization's immediate concerns.

For the "Operation" phase, companies recognize the project coordination as a critical aspect, and that should be formed by involved organizations members and possibly by the supporting institution delegates, not focused on technical aspects (which may be out of its reach), but on the establishing clear communication channels.

Overall, companies have the common comment that collaboration requires the establishment of relations built on common values sharing on a gradual process. The model has practical applicability and should evolve from relatively simple events such as workshops or presentations on specific subjects, allowing participants to connect and get to know each other, until a more structured interaction can be achieved.

5 Conclusion

In order to increase competitiveness in high velocity and complex markets, organizations need to continuously re-invent themselves and implement new organizational forms. Evolving from the initial single firm model and passing in multi-firm models with arm's length relations, organizations have reached the stage where new forms of collaboration are an essential dimension of their strategy, converging to the communities of firms models (Snow et al., 2011).

One of the main objectives of this study was to assess the predisposition, motivation and conditions to collaborate, from the exploratory case study research with three Portuguese software development companies, in different models than multi-firms, by presenting them a collaboration framework based on Virtual Breeding Environments and Virtual Organizations as researched by Camarinha-Matos and Afsarmanesh (2006b). Predisposition to collaborate precedes the readiness to collaborate state, this last state as researched by (Romero et al., 2009).

The perspective adopted in this study and exploratory case studies methodology was to expose collaboration concepts and assess its attractiveness in companies and not imposing modes of collaboration, for a proper understanding of where these companies are in terms of collaboration, how they could evolve, if they are willing to and under what conditions.

The companies had successful past collaboration experiences, commonly in the forms of subcontracting, market relations (Todeva and Knoke, 2005), but also some more evolved such as R&D consortia and strategic cooperative agreements, which have contributed to a high degree of awareness of inter-organizations relations benefits as well as to risks.

Companies have demonstrated a cautious interest in joining collaborative networks, in the form of Virtual Breeding Environments. Even envisioning benefits such as an increased skill set through the combination of competences of all organizations, experience sharing, new markets to explore and a factor of scale to address larger and possibly more complex projects, there is uncertainty of how collaboration could be implemented effectively and how risks experienced or identified in previous collaborations could be avoided, which confirms the literature researched (Durugbo and Riedel, 2013).

Project financing and tight resources is at the top of the list for hesitations regarding the collaboration networks. While it is expected that organizations, specially micro, small and medium sized enterprises, should benefit the most with collaborative networks (Camarinha-Matos and Afsarmanesh, 2006b), it is a paradox that their inherent limited resources availability ad tight budgets can inhibit their participation. For cases where these factors would not be impediments, an alignment between organizations for financing capabilities is needed, and failing to do so would imply different development paces with added difficulties in their alignment. Other companies' conditions involve a clear definition of every organization role and

expected outputs during the collaboration in order to have deliveries aligned and to avoid an overshadow effect by larger organizations.

Companies are clear in what comes the value they could bring to a collaborative network such a VBE: their expertise and competences as well as their contact networks and are willing to share them with other potential partners, for the overall mutual benefit while expecting the same in return.

Despite the cautious interest in joining a collaborative network such as a VBE, companies have demonstrated the openness to adapt or even change their strategy for a proper collaborative fit e.g. strategic fit (Romero et al., 2009), by taking advantage of their relatively light weighted structure, and by keeping present that changing and adaptation are essential for high levels of competitiveness.

Based on their practical experience, companies have provided a clear insight on how a possible collaborative product development methodology should be. An Agile development method would be the most suitable for nearly all projects due to the inherent flexibility and change awareness to converge developments to customers' needs. An emphasis is placed on the method support: a common ICT infrastructure for proper developments (Camarinha-Matos et al., 2008) alignment and a central coordination team responsible for establishing the communication channels between organizations and with the other stakeholders such as customers or the VBE responsible.

Another conclusion is that methodologies should be already practiced by organizations before engaging in a collaborative development project. Not following this would bring greater disruption to established processes and more resistance to change, which could translate in additional difficulties for the project.

While more clarity is needed in what comes to VBEs for posterior Virtual Organizations formation, when it comes to Professional Virtual Communities, the interest is much higher. Companies are predisposed and motivated to belong to such communities with few conditions, recognizing the knowledge that could be accessed or created and how that would positively influence new product developments or even origin innovation opportunities. In fact, all companies already belong to some kind of virtual organization, although in a semi-structured and scattered approach.

Being part of a Professional Virtual Community could also be the step to establish first contacts and informal relations with other organizations that could potentially join a VBE and engage in Virtual Organizations, as a preliminary stage to a VBE formation (Lawson et al., 2009). The status quo (Adler and Heckscher, 2006) reached by belonging to these communities e.g. being recognized as experts within certain knowledge domains, is a highly attractive factor.

While in research studies Lead Users are recognized as a valuable source of knowledge and possibly innovation opportunities (Churchill et al., 2009), companies are not aware of its potential. Companies studied have a trend to follow specific references within their domains or

even to apply learning's from other domains to their own, but not relating this to a formal "Lead User Process".

Another main objective from this study, resulting from the gap in the literature reviewed and from author's experience in standard collaboration models, provided the motivation for an integrative model proposal, based on two domains: the knowledge domain, where organizations contribute to and seek knowledge from one or several domains, either through internal or external perspectives, and the processes domain, where organizations are exposed to development methodologies, either to learn them completely from scratch or to optimize existing processes.

 This model envisions to reduce the barriers to collaboration processes, allowing incremental collaboration processes through its structural and componential dimensions. The market dimensions is also identified, since interactions with customers are fundamental for product development success.

This model and related dimensions consist a "Learning" phase, a stage required before a practical Virtual Organization formation, where competences and methods are aligned for an easier alignment in future collaborative developments. This stage can also be used to improve existing collaborative processes so that future opportunities can be addressed more efficiently.

For the Virtual Organization itself, a simplified approach was presented, for an "Operation" phase (Camarinha-Matos et al., 2008), reflecting the critical points identified by companies for collaborative processes, such as the strict project coordination needed, internal communication channels between organizations, external communication with key stakeholders such as customers and the tight alignment of developments from each contributor.

The model has been further subjected to the companies' review following the design-science guidelines from (von Alan et al., 2004) to evaluate if it provides a valid solution for the existing need. Although there are some concerns about how the knowledge base can be effectively put to practice and on how to preserve and share the acquired knowledge across the organizations willing to collaborate, the intent to put it to practice is dominant.

5.1 Future Works

Results from this study provide an initial insight on where the studied Portuguese companies are placed in what comes to collaborative network organizations and the required preliminary stages before engaging in more elaborate collaboration mechanisms. The fact that all companies operate in the software development domain should not be disregarded and the scope of the study should be extended to other industries.

The current study was limited to the case study research of three Portuguese companies and the further quantitative extension of this study to a wider number of organizations should be applied. All companies studied are classified as Micro-Enterprises (Commission, 2005) and this extension should also consider companies with larger dimensions.

The positive feedback gathered from the companies regarding the integrative model, lead to its implementation, although there are some practical aspects to be defined such as the ICT infrastructure and the knowledge base persistence.

A step-by-step approach will be performed, where organizations will participate initially in knowledge sharing sessions, in different domains, aiming to address common problems and to leverage individual competences. From here, regular assessments will be performed, in order to proceed in the integrative model implementation and evaluation.

The estimated period for the integrative model evaluation is between November 2014 and February 2015.

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Annex A – Interview Script

Willingness to join Collaborative Network Organizations

FEUP – MIETE Msc Dissertation Interview Script

Confidentiality Statement

This questionnaire is solely for Msc dissertation purposes. Interviewees identity will be kept anonymous and confidential in all times and without direct relations or references.

Disclaimer
Do you accept the recording and transcription of the interview?
YES / NO
Date:
The answers to this interview will be recorded on audio and transcripted for analysis.

Objectives

The main purposes of this interview are:

- Assess if an organization is willing to join a Virtual Breeding Environment;
- Identify product / service develoment mechanisms;
- Assess the role of Lead Users in the process of innovation / new product development.

The interview is divided in the following categories

- Organization Profile: Identity, Assets, Strategy and Market
- Past Collaboration Experiences: previous collaborations, success factors, risks, direct and indirect benefits
- Corporate Governance: motivation to potentially join a VBE
- Product Development approaches
- Lead Users as the source of knowledge and innovation

Interview

Organization Profile

Interviewer: Perform an evaluation of:

- Identity
    - o Brief history (date of foundation, context)
    - o Mission Statement and Values
    - o Structure (owners, administration,departments, total employees)
    - o Key financial figures since beggining (financial turnovers; sales)
- Assets
    - o Core competences: knowledge, technologies, processes
    - o Intellectual Property: patents, researches
    - o Value propositions

- Strategy
    - o Product Development
    - o Strategic partnerships
- Market
    - o Target Markets
    - o Distribution Channels
    - o Marketing Strategy

Past Collaboration Experiences

1. Has your company collaborated with other companies in any kind of inter-organizational relations (refer to annex A for clarification)
2. How do you consider that collaboration?
    a. If not successfull, why?
    b. If successfull, why?
3. Do you identify risks in this type of collaboration?
    a. If yes, how do you think these risks can be overcome?
4. Do you identify benefits in this type of collaboration?
    a. If yes, what type of benefits (e.g. financial, knowledge, market opportunities, networking)?
5. How have these relations perdured in time?
    a. If not, is there any particular reason or reasons?

Corporate Governance

1. As the company leader, do you recognize value in inter-organization collaboration? *(if needed, describe the concepts)*

Virtual Breeding Environment

An association or pool of organizations and their related supporting institutions, adhering to a base long-term cooperation agreement, and adoption of common operating principles and infrastructures, with the main goal of increasing both their chances and their preparedness towards collaboration in potential Virtual Organizations. (Camarinha-Matos & Afsarmanesh, 2006)

Virtual Organization

A temporary alliance of organizations that come together to share skills or core competencies and resources in order to better respond a collaboration opportunity, and dissolve when their goal has been achieved. (Camarinha-Matos & Afsarmanesh, 2006)

Collaboration

Sharing risks, resources, responsibilities and rewards among organizations acting as a joint entity (e.g. a virtual organisation), in order to achieve a common goal that would not be possible, or would have higher cost, if attempted individually (e.g. a collaboration opportunity). Collaboration is widely recognized as a mechanism for leveraging competitiveness and thus increasing survivability in turbulent market conditions. (Romero et al, 2009)

2. How would you assess the possibility to join such an environment? *(risks / benefits)*
3. What value, if any, do you think your company could extract from a VBE?
4. What value, if any, do you consider your company could add to a Virtual Breeding Environment (VBE)?
5. How could that be obtained?
6. Would you be willing to perform changes within your company strategy to fit the VBE network strategy?
7. Overall, would you be willing to candidate for a VBE?

Collaborative product development

1. What would be the most suitable methodologies, in your opinion, for collaborative product development?
2. What would be the key factors for different organizations successfully develop a new product? (Common ICT infrastructure, communication channels)
3. How could this fit into the internal organization product / service development methods?

Professional Virtual Communities and lead users

1. How are innovation / new product development opportunities identified within you organization? *(internally from management, employees; relations with customers; contact with research programmes)*
2. For a specific technology or industry domain, how would you assess the technical evolution trend? (scanning for other companies, scanning for experts, scanning for similar patterns)
3. Would you be willing to join a community of professionals, within an area of expertise, and share a common body of knowledge?
4. What could prevent you from joining such a community? (lack of time, uncertainty about what would be done with the knowledge, IPR, unbalanced contributions)

Support Information

Inter-organisational Relationship	Description
Hierarchical Relations	Through acquisition or merger, one firm takes full control of another's assets and coordinates actions by the ownership rights mechanism.
Joint Ventures	Two or more firms create a jointly owned legal organisation that serves a limited purpose for its parents, such as R&D or marketing.
Equity Investments	A majority or minority equity holding by one firm through a direct stock purchase of shares in another firm.
Cooperatives	Coalitions of small enterprises that combine, coordinate, and manage their collective resources.
R&D	Consortia Inter-firm agreements for research and development collaboration, typically formed in fast-changing technological fields.
Strategic Cooperative Agreements	Contractual business networks based on joint multi-party strategic control, with the partners collaborating over key strategic decisions and sharing responsibilities for performance outcomes.
Cartels	Large corporations collude to constrain competition by cooperatively controlling production and/or prices within a specific industry.
Franchising	A franchiser grants a franchisee the use of a brand-name identity within a geographic area, but retains control over pricing, marketing, and standardized service norms.
Licensing	One company grants another the right to use patented technologies or production processes in return for royalties and fees.

Subcontractor	Networks Inter-linked firms where a subcontractor negotiates its suppliers' long-term prices, production runs, and delivery schedules.
Industry Standards Groups	Committees that seek the member organisations' agreements on the adoption of technical standards for manufacturing and trade.
Action Sets	Short-live organisational coalitions whose members coordinate their lobbying efforts to influence public policy making.
Market Relations	Arm's-length transactions between organisations coordinated only through the price mechanism.

Table 1 - Inter-organisational Relationships Classification by Todeva & Knoke (2005)

Annex B – Interview Results

Company A

Past Collaboration Experiences

The Company A' past collaboration experiences consisted in either working directly for a client, by integrating the client's development teams through subcontracting or direct market relations, where a whole product was developed according to client's requirements and orientation, in a near-shore strategy. In either cases, the final products weren't property of Company A, but entirely owned by client.

According to the CEO: "*although recently becoming more successful, the initial experiences were not, mainly due to my lack of awareness of the market and in the terms of how companies behave with suppliers, since I never worked directly, in my professional life, for a large organization*".

For the unsuccessful relations, the main motives "*lack of awareness*" of the market, especially the value of work delivered against market average values and lack of knowledge about the formal and informal interaction processes, that medium to large companies apply with their suppliers, are pointed as a key factors. These factors have been improved over time, by a self-made "*learning path*" leading to more fruitful relations.

For the successful relations considered, the understanding of each organization benefits and limitations, which directly translated to the value delivered and how that could be fully used, as well as values of respect, honesty and transparency shared by both parts were fundamental. The absence of the latter induced crucial changes resulting "*in the unwillingness of doing work or to accept existing or forthcoming risks*" by the other participants in the customer side.

For the Company A CEO, these types of collaboration schemes imply risks, with the largest being in financial terms: "*I've always been self-financed, and the developed work paid for the forthcoming, especially where I've had to provide an initial quote which later became short for the overall project needs*". As another risk, the political issues in larger companies lead to uncertainty in terms of project continuity in terms of "*the deadlines as expected by the client company being very different for the deadlines I could realistically accomplish with my team, limited by the initial low budget, and how this was accepted depending on the contact inside the client*".

In terms of benefits, mainly two are identified: the learning process, which caused a continuous evolution of the organization's skills, in order to become more and more efficient, due to the lack of resources and the need to be on the edge of differentiating technologies. The other benefit highlighted is the stability: "*working with large companies in projects that had a medium to long duration allowed for stability which became important for a structured work*".

Almost all inter-organization relations have perdured in time, with a regular contact by initial clients either by maintaining support to the existing projects but also by interest in Company A

availability to engage in new projects. Although generally recognized as a previous work positive evaluation CEO states "*on the other hand brings some dissatisfaction since I'm not able currently to address those opportunities, since I'm totally focused in a few key customers.*"

The only case where relations have not been maintained in time was for a very short timed project, where there was not enough time to establish deeper relations and where the values presented by the other party were not according to Company A's: "*values, respect and awareness of each other situation are fundamental to maintain relations (...) as a small company, I can't have regular payment times such as ninety days and this needs awareness and the responsibility it brings to the client*".

Corporate Governance

The Company A CEO recognizes essentially two dimensions of value within Virtual Breeding Organizations and Virtual Organizations: "*experience sharing, with the possibility of longer existing organizations acting as mentors for younger companies in product and business development, and a diversified skill set which can produce larger and more complex products or engage in more demanding projects*". According to the CEO, this diversity can then target new markets or sustain longer projects that could be more difficult to execute with single companies.

For the Company A CEO, the possibility to potentially join a Virtual Breeding Environment would have to be preceded by an introspection and analysis phase: "*I need to understand where I stand at the moment, think about company's positioning, market, strategy and benefits that it could bring*". This possibility is viewed positively since it would widen the networking among other companies and establish new potential relations even a medium to long term basis: "*the fact of being in contact or share experiences with these organizations would be very beneficial*".

The Company A CEO perspective on value from Virtual Breeding Environments relies essentially on the knowledge and experience that could be shared, enabling younger companies to better understand and overcome the challenges faced: "*ask advice to an external entity willing to share it would avoid many repeated errors. I believe that entrepreneurs should naturally engage in such network and willing to share their experience. Other established companies may want to grab everything that appears*". On the hand as identified risks:" *I would need to clearly assess also what would be expected in return, since due to my scarce resources there is the risk deflecting focus from current priorities*".

As value that Company A could bring to a Virtual Breeding Environment, CEO highlights the knowledge and experience in developing and managing especially software development projects. For "*a set of organizations willing to collaborate in a more technical domain, or wanting to develop projects in a common domain, our technical experience would be of value. Eventually some degree of business knowledge, at least of the lessons I've learn in the past, could be of guidance to project development, highlighting risks that I've already faced and caused me problems*". In order to provide this knowledge, the Company A CEO recognizes the

necessity to be available to communicate with other companies responsible to provide his feedback.

In terms of changing or adapting internal organization strategy to a proper fit with the VBE's network strategy, the Company A CEO consider a fact of "resisting change": "*there is always resistance and people leading a company must assess what is the overall purpose of the VBE and verify if strategy fits or if there is the need to change in order to have a better fit. There is a risk of affecting work already developed and wariness is needed to confirm if those possible contradicting approaches are justifiable.*" In the CEO's opinion it will depend mostly of the values presented by the VBE or those that will be integrated and that must be clearly stated before the decision to apply. The size of the organization is also of importance since smaller companies tend to implement changes easier, if that need comes. The prospect of what can be done joining a VBE versus what has been done as a measure of success can contribute to the decision making process.

Overall, the Company A CEO would consider joining a VBE: "*Possibly... at the moment, the current strategy that I apply is tailored to a type of work that doesn't require much collaboration, but as future prospect it could be very interesting to participate and collaborate in such environments. It's a matter of perspectives and strategies – reflecting on what we're doing, if this is the way I want to follow and if not what other possibilities exist*".

Collaborative Product Development

In terms of collaborative product development, Company A CEO's consider that Agile and Lean methodologies are very appropriate for most situations, in terms of work structuring by understanding customer's needs, being able to correspond to them iteratively and also by distributing responsibilities by the several teams or organizations: "*each organization in their own area of expertise, can introduce their value in the assigned tasks and overall adding of contribution will allow to develop the product with better quality and less waste.*"

As key factors for better collaboration, the CEOs identifies the need for a central coordinating team, responsible for work tracking and proper communication, which can be formed by members of several organizations or belonging just to one: "*coaching, evaluation and follow up should be done by this group of people, responsible for the overall project orientation, and for communicating with the assigned teams the values and for establishing a collaborative working culture*".

Communication infrastructures, for meetings or direct contacts, is another key factor that should be in place and can be enhanced by virtual mechanisms, however the personal contact should be promoted, so that ongoing experiences and obstacles can be shared so that these can be cleared. The communication processes should be established often and should regularly include the follow up of milestones: "*quick feedback is very important, since it allows small changes of course and hence less abrupt impact. As the entity grows, communication channels expand and this may be present as difficulty to the process.*"

For these methodologies integration in a collaborative project, Company A CEO's considers that there should be an assessment of the current practices by each organization and from those, which could be considered best practices and further applied by other organizations, towards the overall project success: "*the process to be adopted should already exist, even if in different modes or concepts, so that resistance to adopt it is decreased. Among the collaborative organizations these processes should be common. This is important especially for teams where work must be aligned*".

Professional Virtual Communities and Lead Users

In the Company A, new products were identified based on projects being developed for specific customers. An existing international trend in the area of online training, triggered a solution development for a large national organization trying to reduce costs in staff training: "*previous exposure to customer needs in other projects highlighted the need to a specific solution for that domain that would also fill an existing gap in the internal market*". CEO states that when a gap like this is identified, there is an intent to develop a solution to fill it. At the time, the product was totally new in the internal market and in the Portuguese speaking countries, thus proposing itself as an innovation opportunity, but the concept of Lead user wasn't recognized as a trigger for this development.

Regarding technological trends, the CEO considers to be outside the group of leading people and companies that creates new technologies such as hardware or software frameworks and tries to keep up these trends via media such as internet in reference blogs, online news, technical magazines as much as possible what is on the edge and what is expected to come next: "*I try to understand if these trends will fill any need that I have or extra value to our activities, and if yes I try to grasp as quickly as I can in order to maximize the value I can bring... I'm not in Silicon Valley, but I try to use that knowledge as much as I can.*"

The Company A CEO is already member of virtual communities and would be willing to join other Professional Virtual Communities, where great benefits are envisioned, due to current activities and work developed. CEO still considers that: "*it would be even more beneficial to belong to such a community now than to a VBE. I don't feel the need to change my strategy or collaboration models, but I feel the need to be in contact with professionals in the same or related domains to enable knowledge and experience sharing.*"

Another important aspect highlighted by the CEO is the personal brand around a specific domain, where there is the recognition in the community about the high expertise of certain individuals: "*people who write books, articles, blog posts tend to be the references in that domain and that can bring value to the individual... of course people have to be careful not to reveal confidential information but that doesn't mean they can't still publish their perspectives on a subject*".

As impediments that could prevent Company A to join such a community would be the total lack of time to dedicate to such a community; the inaccessibility to contact the group, although

this is greatly mitigated by virtual communication processes or a high fee (if required) to belong to such a community.

Company A CEO, as an open source sponsor is not very much concerned with IPR, or what could be done with it, since there is an implicit respect and value sharing in people with similar backgrounds (on open source) not to take unethical advantage of since the knowledge obtained. Also, as technical articles publisher, there is a critic analysis of what can be publicly disclosed: "*usually this is information with no confidentiality agreements and is a result several sources of knowledge of the systematization that anyone can learn by himself. I'm just giving them a push*".

Company B

Past Collaboration Experiences

The Company B past collaboration experiences were based in two different models: one consisting in the joint developing of software solutions for a specific opportunity and the other through subcontracting. In the joint development model, two projects have been executed: one with the creation of an online survey application for a marketing company, which has come to a halt without being released, and a social / collaborative online platform for researchers related with a major Portuguese university.

In the subcontracting also two different types are performed: in one type the relation with a non-profit association for cloud based services has allowed access to European projects lead by larger companies, which then subcontract smaller companies, while the other consists in the direct placement of development resources in customer projects. According to the CEO: "*belonging to this cloud services association triggers the networking and opens access to these European projects, with more opportunities appearing*".

The Company B CEO considers, although not being exposed directly to unsuccessful projects, having contact with some, identifying: "*problems between organizations within the consortia, due to different conceptions of what should be the project direction, lead to organizations premature leave. Organizations with different strategies or changing the overall strategy while project is ongoing lead to dissatisfaction of some organizations and to their abandoning of the project*".

As for the successful projects, the CEO highlights especially the European projects where: "*the existence of an aggregative institution that combined the larger organizations capabilities with smaller organizations that implemented project's components*". A key factor for success is identified in the people behind organizations: "*these kind of projects involve people from different organizations, different countries, different languages, and the alignment of strategies and close involvement from all these intervenients is fundamental to keep projects going*".

As for the risks, Company B CEO identifies that with the large organizations involvement in the project, each one tries to pull the credits to themselves and to be the dominant player or

strategy definer: "*it's like having Microsoft and Google in the same project and then the politics to define which one of them speaks higher*". Another identified risk is the timing that each organization can apply, where some can apply a quicker pace and others can't keep up and thus become a bottleneck. One very important risk is related to finances and the payment times: "*increased payment times originated by delays in the consortium to pay to subcontracting companies and most of the times there is the need to have the deliverables before the payment*".

For Company B CEO, the risks such as payment can be mitigated by in advance payments, even before the first deliverables. For timings and the pace that each organization can apply, CEO considers that a clear definition of what is needed to be done is essential: "*European projects have Work Packages where each organization assumes a responsibility and in some cases it's not clear if they should or not get involved. Organizations need to learn that they should also be aware and involved in these work packages*".

Company B CEO identifies benefits in this type of collaboration, highlighting that in the European projects, where the funding and payments can be guaranteed: "*organizations can invest more in a specific project knowing the existence of guaranteed funding, with a diminished risk*". Another benefit is the developments acceleration by aligning what is the technical knowledge required to develop the application with the business domain knowledge. For the social / collaborative online academic platform, the CEO states: "*people directly leading with technology transfer, IPR, understand much better the existing needs and what a researcher is usually searching and allow us to design a solution towards those needs*".

External awareness obtained by working with such an organization is another major benefit: "*it's different saying – I, Company B, have this application than saying – we, Company B and a major Portuguese university, have developed this product. Direct contacts can be made with other institutions through the university networking*".

For other outsourcing projects, the income obtained from these areas allows Company B to develop the internal products: "*since organization has two main areas, the funding from these outsourcing projects allows a re-investment in the internal developments*". For other types of collaboration, such as joint developments the benefits of sharing knowledge and market access are fundamental for a successful outcome.

Most of the collaboration relations have perdured in time for Company B, however changes in the organization strategy throughout time may pose as impediments to continue or resume collaboration with previous partners: "*when too much things are being done, something will break. The focus changes overtime and if currently my outsourcing and consulting businesses are working, this is what I have to prioritize. Other projects such as the internal product development have come to an impasse, waiting from customer's decision and thus lowered priority for me*".

Corporate Governance

Company B CEO is reticent in what comes to collaboration value in Virtual Breeding Organizations and through Virtual Organizations: "*while in practice I don't have that experience, in theory it should work and provide value. When our supporting institution (UPTEC) presents itself to other markets such as Brazil and if any opportunity arises, it will be forwarded to the appropriate organization. In another case of my knowledge, the "Atlantic Near Shore" project, for outsourcing activities, there was a big discussion about this collaborative model and the existence of a supporting institution that combines the several organizations towards a specific opportunity.*"

Company B CEO would assess joining a Virtual Breeding Environment, considering visibility and possible market opportunities: "*how could I reach a larger organization or other markets by myself? May be with other organizations by my side it would be easier*". A thoughtful weighting of the implications the collaboration would bring to the organization, in terms of financial and resources, would have to be performed previously.

In terms of value that Company B could take from the VBE, it would mainly consist in terms of scale: "*if a supporting institution, aggregating smaller ones, deals with large organizations, it would allow access in a faster and more straightforward way, than by having each organization going there independently.*" Company B CEO demonstrates by a practical case where three virtual hosting organizations have come to an agreement and offer almost unlimited resources to customers, while by presenting themselves alone, they would not be able to present such value proposition to the market. This mechanism allowed competing even with large players in the market, such as Amazon, and targeting widened markets.

Company B value to the VBE would consist mainly in technical knowledge and the already established market contact's, which would widen the opportunities for the whole VBE. This value provided by Company B would be presented to the VBE by a comprehensive description of the core competences and market contacts in an explanatory way: "*these are our services and contacts and they can be used within this context*" but also in a more proactive manner: "*I would approach my contacts, describing the VBE and the existing competences and what could be done for them*".

When it comes to changing or adapting Company B strategy to fit VBE, this would require a careful cost-benefit analysis but with a margin to change internal strategy: "*if this comes as a good opportunity yes. If a small organization doesn't re-invent itself, then it won't survive longer*".

Overall, Company B CEO would be willing to apply for a VBE due to the visibility and possible market opportunities attractiveness, and based on a previous knowledge and positive results of a similar project such as the "Atlantic Near Shore".

Collaborative Product Development

Company B CEO considers Agile methodologies the most appropriate to collaborative product development, based on experience and organization's main business domain (software

development): "*Agile methodologies allow for a faster customer feedback and the assessment of which developments are following the right direction*". CEO also highlights the project management overhead, especially when several organizations are involved: "*besides the methodologies, the supporting project management tools would have to be clearly adapted to this*".

The key success factors to develop a new product identified by Company B CEO, would consist in clear responsibility and accountability: "*there are always those grey areas of who does what and if responsibilities are clearly defined everyone knows what they have to do*". The absence of this clear definition may lead to organizations trying to do something that is out of their responsibility, in order to have a larger share of the final outcome.

The common ICT infrastructure is also fundamental since different organizations may use different technologies and this may pose as a risk for the integration of each organization's contribution: "*if interfaces are not very well defined, this will be a problem and we should know the infrastructure to be used prior to the project beginning.*" Another essential factor is the delivery milestones and the dependencies existing between organizations outputs, where a thorough alignment and syncing is needed so that timings are not at risk.

According to the CEO, one factor that shouldn't be disregarded is the project funding: "*some organizations will move further only when they have budget, while some other can invest themselves and these different promptness levels can affect the project's pace and project deliveries*". CEO considers the need for a project co-ordinator that identifies organizations that need funding and others that don't so that expectations are levelled: "*without this project funding availability some organizations can think – Why am I going forward and others aren't?*"

Company B CEO considers that if a development methodology to be used is not actually in place, it will face resistance by people. CEO considers that "*if VBE methodologies are proven to be positive, then the ideal would be to apply these to the organization as well, in advance*". CEO also considers that in some cases, the customer may impose a certain methodology and this should be already a selection criterion for the organizations collaborative development.

Professional Virtual Communities and Lead Users

Company B CEO identifies innovation opportunities through a wide analysis over daily needs. "*These things happen in an informal manner... we need to have a critical view over our day to day routines. As I engage in different experiences, with different needs, I try to understand if there is a solution to these needs or if the existing fits my needs*". This same approach has also been the trigger to Company B internal products e.g. develop something that didn't exist or by addressing a problem posed by a potential customer in a different approach e.g. the existing solution didn't fit the customer needs and shouldn't be developed in the conventional ways.

For technology evolution trends assessment, Company B CEO betakes himself through online information such as technical blogs that identify new trends early and also through

concepts that are applied in other domains that can be used in organization's ones: "*I try to see things in other areas, and think on how I can apply those approaches closer to my domain [...] a lot of innovation can occur by cross-applying principles to my areas of knowledge*". Another approach by Company B CEO is the active participation in events, with an attitude to absorb information: "*things I've never heard of and wouldn't know if I didn't attend to those events*".

Company B CEO is already a member of several virtual communities, and would be willing to join Professional Virtual Communities for knowledge sharing. As an advantage to the organization, participating in such a community and achieving a community's recognition of expertise would add consistency and market awareness of knowledge in that domain for the organization, expressed through the products delivered.

As factors of impediment to join a Professional Virtual Community, Company B CEO identifies the unbalanced contributions but especially the activity maintenance through time: "*in the beginning there is always that interest for a new thing, which tends to disappear over time. In some communities people are more interested in getting their questions answered than actually helping others*". Time to dedicate to these communities is also to be taken into consideration, according to the CEO.

Company C

Past Collaboration Experiences

Company C's past collaboration experiences consisted in three different models: near-shore subcontracting, in terms of direct placement of organization's resources in customer's projects; strategic cooperative agreements, with the IT Systems development shareholder and with a South America organization, for South American markets, and R&D Consortia with national organizations.

From the collaboration experiences, Company C's CEO considers the strategic cooperative agreement with the South American organization as the one with more margin to improve: "*there is a cultural issue blocking our collaboration: their methodologies are very different from ours – they present opportunities as in need to be done in instant times, then the importance slows down until it stops. Our rhythm is different since when things need to be done, we don't stop. We question the leads that appear through this partner, since there is never a continuity assured. The currency exchanges have also not been favourable to proceed in these collaborations*". Also the R&D consortia, although in an initial stage, has given origin to some friction between the organizations, due to the different business approaches followed by each: "*this is our first time, in this model of collaboration, and when there was an engagement, a collision between organizations business models happens. There must be a common approach and our expectations were different from our partners.*"

Except for the previous examples, the other collaboration experiences have been successful, with the increase of resources through the subcontracting model and in the strategic cooperative agreement with the IT shareholder. The key factors for these successful

collaborations are identified as: "*in the subcontracting, the expertise and skills our resources have showed are crucial. Even our South American partner provides the same feedback for our skills.*"

With collaboration models that need more involvement from the organization's responsibles, the greatest risk identified by the CEO is relationship deterioration: "*while interactions remain in an informal networking, relations goes fine. When it advances to the business dimension, it becomes more difficult to separate what is business from what is an informal relation. Our organization's values in terms of ethics not always are fully apprehended by our partners and probably due to our national cultural practices*". CEO envisions that targeting other markets, with cultural and ethical values aligned with Company C's could overcome these risks.

The main benefit highlighted by the Company C CEO are the synergies through the collaboration and the added value to the customer: "*with our R&D consortia we will be able to provide a solution to our customer that by ourselves wouldn't be possible*". Experience sharing and learning are other indirect results of collaboration: "*when I was working for other companies, the relations I built with other people, even without commercial relations, proven to be very fruitful in terms of experience sharing. Currently, even in subcontracting, we have partners whose development models are very adequate and having our resources there provides opportunities for learning*".

Collaboration relations have perdured in time for Company C and even from founder's previous professional projects: "*even with our south American partner, where relations are a bit colder, we still have frequent contacts.*"

Corporate Governance

As the leader, Company C's CEO recognizes value in inter-organization collaboration, especially in what concerns new businesses opportunities and in the contact establishment with internal VBE's organizations or to external ones. The widening and re-direction of contacts that may give origin to business opportunities are a current experience for CEO: "*it has happened more than once that we've been approached by other organizations with opportunities, but we recognize that other organizations within our environment are more suitable and we forward these solicitations to them. Being part of a VBE is fundamental to gain access to these opportunities*". The CEO also highlights how these collaborations can result in better solutions, with the contribution of each organization, using a cultural analogy: "*for instance, Israelis are known for organizing and coordinating different companies to address specific markets in order to provide a better solution for their customers*".

For Company C's CEO, belonging to a VBE requires time and involvement and this would have to be thoughtfully assessed. The networking opportunities and events that can be promoted require time, which may not be available.

The overall VBE's values and reflection of these in its members would have to be carefully assessed - referring to the national market, the cultural symptom of not willing to share poses to

the CEO as a risk: "*I've come to the knowledge of a company that deliberately refuses more work due to their lack of resources and I question: why do you do that? Are you afraid of losing your customers? Won't you lose them anyway by not providing solutions?*". Also the commitment from the organizations has to be levelled: "*if there are only a few organizations more active, seeking opportunities, while other sit and wait for opportunities to fall on their lap, it won't work.*" CEO would assess the type of events, which may not necessarily outcome in new business opportunities, but more related with knowledge sharing as a positive argument for a VBE application.

Company C's CEO identifies the financial inputs from potential opportunities and the knowledge and experience sharing as the most important valuable assets to extract from a VBE. The provisioning of solutions for potential customers, even from organizations not contacted initially, are important values: "*if I'm limited in my resources and can't answer a challenge from a customer, when I forward it to other partners organizations, I'm collaborating and I'm still providing a solution to my customer which will come to me again.*"

As value to be provided to the VBE by Company C, the CEO highlights the technical competences and experience sharing, which will enable partners to grow their skills and will produce positive referrals by partners and customers: "*my organization will then be recognized as having high expertise in our technical domains*".

In terms of strategy alignment of Company C with the VBE strategy, the CEO follows a careful approach and would have to understand clearly what this would imply: "*if VBE strategy is also aligned with ours or if the strategy in the long term seems suitable, in the major dimensions, we could do that. Being still a small enterprise, this would be easier.*". The size factor of the organization is identified as very important for potential strategy changes.

Company C CEO would be willing to apply for VBE, basing his opinion in the successful past collaboration experiences and in the possible opportunities that could be targeted, whether in business or in knowledge sharing areas.

Collaborative Product Development

For collaborative product development, the Company C CEO identifies Agile methodologies as the ones most appropriate for problem solving and experiential development, applicable to most scenarios, especially in the software domain due to faster time to market. However it isn't excluded that, depending on the size and complexity of the development project, other methodologies such as stage-gate could be more adequate: "*from my experience, I've been suffering the pains of waterfall related methodologies and I consider the problem solving approach from Agile methodologies more adequate but if I were to develop an airplane project, waterfall would be more suitable. In the current markets dynamism, we have less time to develop and we need to provide solutions fast*". CEO highlights two important factors for Agile methodologies utilization: "*we can have feedback sooner and we can continuously adapt to market changes since we can change our direction faster*".

For successful collaborative product development, CEO compares the involvement of different organizations with the involvement of different departments within a large organization: "*a large organization's product development team must be as big as three or four smaller organizations*" and that each participating should focus on their core competences so that each can work in different dimensions of the project: "*it makes sense to me that one organization focus on design, other focuses on the engineering and possibly another focuses on marketing*". Belonging to a VBE would trigger this fit of competences.

Company C's CEO considers that having these collaborative methodologies already in place would enhance the developments, by reducing resistance: "*if all involved organizations have similar methodologies, the alignment will be easier and will reduce the effort to adapt to a new methodology*".

Professional Virtual Communities and Lead Users

New innovation or product development opportunities don't have currently a specific process implemented in Company C. Through the interactions and learnings resulting from project development, if a new opportunity is identified, it is considered: "*in one project we had access to, there was the need to replace a legacy system due to its limitations. A lead user from that customer had a clear notion of what was needed and defined the solution in detail. That was then assigned to another organization who developed the product for the initial customer but also initiated the market placement for other potential customers in the same area.*"

When it comes to new technology trend assessment, information available online is usually the method used. CEO is aware of companies providing market research and technology assessment studies, however out of their reach due to cost: "*we use what the community gives us, which in these days is a lot*".

Company C CEO would be willing to join a community of professionals and that practice is already implemented in the organization: "*one of our managing partners already belongs to such a community, where periodically a study committee, formed by customers and technical people, is gathered to discuss topics around the technology*". CEO also recognizes that belonging to such communities projects an image of expertise both to the market and within the technical domains, which is an attribute Company C wants to be recognized for.

As factors that could prevent the CEO to join such communities, the main one would be the time availability. CEO expressed no specific concerns with IPR properties since, if the organization would be involved in such communities, a critical analysis of what could be published and what couldn't would have to be assessed. CEO is aware of the risk by somebody else using the knowledge created to unintended purposes, but relies on the common ethics and values shared by these communities to prevent those situations.