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BRUNO RONDANI

MICROFOUNDATIONS OF OPEN INNOVATION:
The creation of open innovation management organizations

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2012

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Tese apresentada à Escola de Administração de Empresas de São Paulo da Fundação Getúlio Vargas, como requisito para obtenção do título de Doutor em Administração de Empresas

Campo do conhecimento:
Estratégia Empresarial

Orientador**:** Prof. Dr. Tales Andreassi

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I dedicate this work to my father Giacomo Rondani who inspired me to do things always at the limit of my capacities.

A pessimist sees difficulty in every opportunity; an optimist sees opportunities in every difficulty.
Winston Churchill

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ABSTRACT

Since Chesbrough (2003) first coined the concept of *open innovation* it has attracted a growing attention both in academia and in practice. Despite the increasing efforts to explore open innovation, many questions remain unanswered. Academic research has spread its focus into different topics such as innovation management, business strategy, organizational behavior and public policies. Practitioners, on the other hand, have been exploring the concept of open innovation in diversified ways. Taking into account the variability of open innovation practices, this study seeks to provide microfoundations for open innovation by adopting the effectuation theory. Effectuation theory was originally developed in the field of entrepreneurship research and can be defined as a set of *teachable* and *learnable* decision-making principles that together form an overall logic that expert entrepreneurs are observed to employ in situations of uncertainty in order to create new ventures and new markets. (SARASVATHY, 2001; 2008). We have shown that the effectuation theory has the strength to provide strong contribution to build a consistent micro level conceptual basis for open innovation practices. By performing an extensive case study of an open innovation management organization dedicated to foster collaborations between Brazil and Sweden, we examine the decision-making processes of 13 expert R&D and innovation managers representing eight different entities involved in the startup of this new organization. As a result of our research we identified and described a decision-making methodology used by expert innovation managers involved in the creation of an open innovation management organization. The research insights that emerged from this case study enabled us to develop a decision-making framework based on effectuation and open innovation theories that could support managers to start-up new organizations dedicated to open innovation.

Keywords: Entrepreneurship, effectuation, open innovation, case study, international cooperation.

RESUMO

Desde que Chesbrough (2003) cunhou o termo *inovação aberta*, o conceito tem atraído uma atenção crescente tanto no meio acadêmico quanto no mundo empresarial. Apesar dos esforços crescentes em explorar práticas de inovação aberta, muitas perguntas permanecem sem resposta. A pesquisa acadêmica expandiu o foco abordando o tema de forma bastante ampla como gestão da inovação, estratégia empresarial, comportamento organizacional e políticas públicas. Ao mesmo tempo, gestores também têm explorado na prática o conceito de inovação aberta de formas muito diversificadas. Levando em conta a variabilidade das práticas de inovação aberta, este estudo visa fornecer microfundamentos para a inovação aberta, adotando a teoria de *effectuation*. A teoria de *effectuation* foi originalmente desenvolvida no campo da pesquisa sobre empreendedorismo. Pode ser definida como um conjunto de princípios de tomada de decisão que pode ser ensinado e aprendido, formando uma lógica global empregada por empreendedores com *expertise* frente a situações de incerteza durante a criação de novos empreendimentos e novos mercados (SARASVATHY, 2001; 2008). Nós demostramos que a teoria *effectuation* tem a consistência para fornecer uma contribuição sólida no nível micro das práticas de inovação aberta. Neste trabalho, realizamos um estudo de caso extensivo sobre uma organização de gestão da inovação aberta destinada a promover a colaboração entre Brasil e Suécia. Examinamos os processos de tomada de decisão de 13 especialistas em R&D e gerentes de inovação que juntos representam oito diferentes entidades envolvidas em sua criação. Como resultado de nossa pesquisa, identificamos e descrevemos a metodologia de tomada de decisão utilizada pelos gestores de inovação envolvidos na criação de uma organização dedicada à gestão da inovação aberta. As percepções frutos da pesquisa realizada nos permitiu desenvolver um quadro de tomada de decisão com base nas teorias de *effectuation* e inovação aberta, capaz de apoiar gestores na criação de novas organizações dedicadas à gestão da inovação aberta.

Palavras-chave: Empreendedorismo, *effectuation*, inovação aberta, estudo de caso cooperação internacional.

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1 INTRODUCTION

In the past, large firms relied mainly on internal R&D to create new technologies and products. International R&D laboratories were often considered a forceful strategic asset, which could be seen as a considerable barrier to the entry of potential competitors. Manager's common sense would expect that large firms with extended R&D capabilities and complementary assets could outperform smaller rivals (TEECE, 1986). This process in which large firms originate, develop and commercialize technologies internally has been named the *closed innovation model* (CHESBROUGH, 2003). Although this model might have worked well during the past decades, the current innovation scenario has changed substantially.

Chesbrough (2003) has identified erosion factors that disable enterprises to afford innovation relying only on their own internal capabilities, namely: (1) the increase of highly skilled labor mobility, (2) abundant venture capital availability, (3) widely dispersed knowledge across multiple public and private organizations, and (4) the increasingly capability of external suppliers. Enterprises found necessary to engage in alternative innovation practices that would systematically look for external sources of innovation as well as new paths to introduce internally developed ideas into the market. In order to tackle these new challenges, a growing number of large firms have moved from the closed innovation model to a more open behavior in which they use equally both internal and external pathways to develop and exploit new technologies (CHESBROUGH, 2003).

Since Chesbrough first coined the concept of *open innovation* it has attracted a growing attention both in academia and in practice. Despite the increasing efforts to explore this concept, many questions remain unanswered. While practitioners have been exploring the idea of open innovation in diversified ways, academic research has spread its focus into different topics such as innovation management, business strategy, organizational behavior and public policies. Due to the variability found on open innovation practices and the extensive body of knowledge on innovation management, open innovation research agenda is still vast. Structural dimensions such as firm size, sector and geographic region, summed up with institutional frameworks (national systems of innovation, local governmental support, international intellectual property rights regulations), the emergence of intermediate markets of ideas, new organizational set ups (science park, consortiums, online communities, etc.) and the different modes of partnerships (R&D contract, joint-venture, M&A, IP licensing, etc.) makes understanding of open innovation management a very complex equation.

As a way of simplifying this equation and improve our understanding of open innovation, this work put light on the decision-making process of managers. As observed in an OECD (2008) survey, when researchers and practitioners explain why companies are embracing open innovation, it is possible to distinguish two different focuses. Either the focus is put on the strategic need companies have to systematically scan the available technologies and ideas inside the company as well as on the environment; or the focus is on the recognition that the companies need to be part of a community or network that is exchanging knowledge to develop new technologies and ideas (OECD, 2008).

The first decision-making focus (category I) induces managers to embrace practices such as technology and market scouting, technology intelligence and prize-driven innovation. It presumes the preexistence of knowledge, technologies or ideas outside the firm that must be located and retrieved. The second (category II), in opposition, will induce managers to team up with external partners who have complementary competencies and interests, and therefore, create synergy to build the future in common directions. It indicates that new knowledge, technologies or ideas could be co-created among partners. Discerning readers can promptly relate this distinction between the causal model and the effectual model as proposed by Sarasvathy (2008):

> Causal logic provides useful decision criteria to achieve given goals subject to environmental selection in the face of an uncertain future. Effectual logic provides useful design principles for transforming extant environments into new future in the face of ambiguous goals (SARASVATHY, 2008, p. 17).

> Effectuation is the inverse of causation. Causal models begin with an effect to be created. They seek either to select between means to achieve those effects or to create new means to achieve pre-selected ends. Effectual models, in contrast, begin with given means and seek to create new ends using non-predictive strategies. In addition to altering conventional relationships between means and ends and between prediction and control, effectuation rearranges many other traditional relationships such as those between organism and environment, parts and whole, subjective and objective, individual and social, and so on. In particular, it makes these relationships a matter of *design* rather than one of *decision*. (SARASVATHY, 2008, p. 16)

Effectuation theory was originally developed in the field of entrepreneurship research and can be defined as a set of *teachable* and *learnable* decision-making principles that together form an overall logic that expert entrepreneurs are observed to employ in situations of uncertainty for creating new ventures and new markets. (SARASVATHY, 2001; SARASVATHY, 2008). Nevertheless, as explained by Sarasvathy (2008), entrepreneurship is a particular application of effectuation. More generally, effectuation is about the creative

process that focuses on the human action as the "predominant factor shaping the future" (SARASVATHY, 2008, p. 94) and can be extensively defined as a "general theory of decision making in uncertain situations" (SARASVATHY, 2008, p. 254).

Contributing with previous research on both open innovation and effectuation, this study seeks to identify microfoundations for open innovation by adopting the effectuation theory as a conceptual basis for managerial practices and decision making processes performed by expert R&D and innovation managers facing the challenge of accessing external knowledge (category I) and building innovation networks (category II).

We have shown that the effectuation theory has the strength to provide strong contribution to build a consistent micro-level conceptual basis for open innovation practices. By performing a case study on international collaboration, we examine the decision-making processes of expert R&D and innovation managers, a group hereinafter called *entrepreneurs*, involved in the startup of an organization dedicated to open innovation management and innovation network between Brazil and Sweden.

Our research has as an outcome the identification and description of a decision-making methodology, based on expert innovation managers practices while involved in the creation of an open innovation management organization. The main result that emerged from this case study is the development of a decision-making framework based on the theories of effectuation and open innovation, which could provide managers with support and knowledge while starting-up new organizations dedicated to open innovation.

1.1 Justification

Sarasvathy (2000) initial work on effectuation has focused on the study of entrepreneurship. However, as emphasized by Kuepper (2009) it was rapidly applied in other specific decision-making problems such as R&D management (KUEPPER, 2009), corporate management (BLEKMAN, 2011), economics (DEW; SARASVATHY; VENKATARAMAN, 2004), psychology (SARASVATHY, 2003) and finance (WILTBANK; READ; DEW; SARASVATHY, 2009).

As stressed by Sarasvathy (2001a), in general, managers of each functional area of business are trained on causal or predictive reasoning. Causal rationality begins with a pre-

determined goal and a given set of means, and seeks to identify the optimal alternative to achieve the established goal (SARASVATHY, 2001a, p. 2).

In the effectual reasoning proposed by Sarasvathy (2001a), one does not begin with a specific goal. “Instead, one begins with a given set of means and allows goals to emerge contingently over time from the varied imagination and diverse aspirations of the founders and the people they interact with”. (SARASVATHY, 2001a, p. 2)

Nevertheless, this two opposed logics of reasoning can be used by the same person at different times depending on what the circumstances call for. In fact, Sarasvathy (2001a) acknowledges that “the best entrepreneurs are capable of both and do use both modes well, but they prefer effectual reasoning over causal reasoning in the early stages of a new venture, and arguably, most entrepreneurs do not transition well into latter stages requiring more causal reasoning” (SARASVATHY, 2001a, p.2).

What about open innovation management? Presumably, if a company embraces open innovation it is recognizing one of the pillars of the innovation managing theory which states that firms do not innovate in isolation (FAGERBERG, 2005) and that the growing complexity of knowledge bases necessary for innovation forces firms of all sizes to depend on external sources (GRANSTRAND; PATEL; PAVITT, 1997). If innovation management generally implies dealing with technology and/or market uncertainties, then when a company seeks for external source of technologies or access to the market – as presumed by open innovation – a third dimension of uncertainty is inserted, which is the external relations the company must deal with.

Chesbrough (2006) argues that one of the reasons for project leaders to reject external sources of technology is that at the same time it may increase the perceived risk of a project, if an external sourced technology is successfully absorbed top managers might infer that they do not need so many people as parte of the internal R&D staff anymore. This indicates that the use of open innovation is moderated by risk assessment and mechanisms of compensation. Chesbrough (2003) refers to the *not invented here* syndrome as a common behavior of a closed innovation R&D staff opposed to a culture of *acquired with proud elsewhere* of an open innovation firm. Moreover, Chesbrough contrasts open innovation with closed innovation where the companies’ target its innovation internally developed to its current business “like in a chess game” (JAMES MCGRODY *apud* CHESBROUGH, 2003):

> You know the pieces, what they can and cannot do. You know what your competitor is going to do, and you know what your customer needs from you in order to win the

> game. You can think out many moves in advance, and in fact, you have to, if you're going to win. (CHESBROUGH, 2003, p.13)

Open innovation approach would be preferable for an innovation project that has to deal with both technical and market uncertainty:

> In a new market, you have to plan your technology entirely different. You're not playing chess anymore; now you're playing poker. You don't know all the information in advance. Instead, you have to decide whether to spend additional money to stay in the game to see the next card. (CHESBROUGH, 2003, p.14)

While developing the effectuation theory, Sarasvathy (2008) points out three fundamental elements of effectual problem space: (1) Knightian uncertainty: it is impossible to calculate probabilities for future consequences; (2) goal ambiguity: preferences are neither given nor well ordered, and (3) isotropy: it is not clear what elements of the environment to pay attention to and to ignore. Whether to invest or not in an open innovation practice is often an effectual problem, especially if it refers to a category II type of open innovation practices.

Effectuation reasoning is, then, an alternative *process* to cope with the question at the micro-level of what do to when faced with a problem space as defined above, which could be a new venture creation or an innovation project investment. Sarasvathy (2008) argues that mainstream theories on innovation management would indicate that the best one could do is to advise the manager facing an effectual problem "is to take his best guess about future events, have faith in his vision or trust his intuition to persist with the opportunity they perceive, and build charismatic leadership skills that would enable him to persuade others to join them and follow through to eventual success" (SARASVATHY, 2008, p.72).

Rephrasing Sarasvathy (2008, p.13) we could say: what makes the study of *open innovation management* expertise interesting "is that the elements of expertise may be organized into a set of heuristic principles, which can thereafter be either embodied in expert systems or used as testable and teachable decision-making and problem-solving techniques" (2008, p.13).

For this research, we choose as the empirical context the case of a recently created organization which has as its mission the creation of a bilateral innovation network between Brazil, a large emerging country, and a developed and smaller European country, Sweden. This case is particularly interesting and contemporaneous. Brazilian government is fostering the consolidation of its National System of Innovation and international collaboration is one of its key policies. The smaller European country counterpart is facing huge challenges with the stagnation of traditional and mature markets. On one hand, very dependent on

commodities, Brazilian economy needs to develop a more competitive and innovative industry. On the other, the smaller European country needs to find new paths of growth.

Brazilian government is fostering the education of a mass of high-qualified professionals, the creation of technological parks and startup incubators, the increase of private investment in R&D activities, the decrease of the gaps between industry and academia, the attraction of R&D centers from foreign MNEs and the consolidation of international collaborations. Those policies are inducing (and in some cases even forcing) foreign MNEs to invest in collaborative frameworks with local industry, academia and government to produce innovation as part of their strategy to access and compete in the Brazilian market. Those relatively new and full of uncertainty open innovation frameworks are inducing the creation of new organizations, such as the one chosen to be our case study, dedicated to coordinate and manage multi-institutional and international innovation projects and programs.

1.2 Objective

Instead of testing higher-level theories of innovation management, this work seeks to understand how individual stakeholders act. As Sarasvathy (2008) explains, effectual theory seeks to identify "the micro-mechanisms that help transform who the entrepreneur is" and "the micro-processes that help founding entrepreneurs create new networks of self-selected stakeholders" (SARASVATHY, 2008, p.8). Our research theme is the decision-making process of expert R&D and innovation managers involved in the start-up of an organization dedicated to open innovation management and innovation networks. Therefore, it is possible to call those "R&D and innovation managers" entrepreneurs. Our research problem is to identify and describe their decision-making methodology.

Research Theme: Decision-making process of expert R&D and innovation managers involved in the start-up of an organization dedicated to open innovation management and innovation networks.

Research Problem: To identify and describe the existence of a decision-making methodology used by expert R&D and innovation managers involved in the start-up of an organization dedicated to open innovation management and innovation networks.

The main objective of our research is to identify and analyze if effectuation is a valid method and if it is used by expert R&D and innovation managers involved in the start-up of an organization dedicated to open innovation management and innovation networks.

Question 1: Is it valid, and to what extent, to refer to effectuation as a method for decision-making performed by expert R&D and innovation managers facing challenge of accessing external knowledge and building innovation networks?

Our complementary research objectives are: (1) evaluate how and why entrepreneurs involved in the startup of an organization dedicated to open innovation management and innovation network decide to define their objectives, organizational structure and resources needed; (2) identify how these entrepreneurs attract, select and define their projects; raise funds for their execution; systematize their management processes; identify and select partners to participate in their projects, as well as how they build and manage innovation networks, and (3) understand the factors that moderate or determine the degree of openness to external collaboration in multi-institutional arrangements of open innovation projects. This bring to the following complementary research questions:

Question 2: How entrepreneurs involved in the startup of an organization dedicated to open innovation management and innovation networks decide on the definition of their objectives, organizational structure and resources needed?

Question 3: How entrepreneurs attract, select and define their projects; raise funds for their execution; systematize their management processes; identify and select partners to participate in their projects, as well as how do they build and manage innovation networks?

Question 4: What factors moderate or determine the degree of openness to external collaboration in multi-institutional arrangements of open innovation projects?

1.3 Outline of the Dissertation

In order to present how this topic was investigated, this dissertation project is structured in five chapters. In this introductory Chapter, we present the topic, the research question, objectives and justification. Chapter 2 is where we delineated the theoretical background on open innovation and effectuation and proposed a theoretical framework. In Chapter 3, we present the research method used, which consists on the type of research; the research design; the units of analysis; procedures for data analysis; presentation of results, and considerations of validity and reliability of the research. Chapter 4 contains the description of our case study. It is where we present our data analysis, discuss the results and propose a reference model. In Chapter 5, we present our conclusions, main contributions, limitations and suggestion for future research. Finally, we present the bibliographic references used along this study.

2 THEORETICAL REFERENCE

This Chapter is organized in three main sections. In the first section, we present fundamental theories on innovation management related to the research objectives focusing on open innovation. Second section describes the Effectuation Theory. In the third section we present a theoretical framework that will support the research methodology.

2.1 Innovation Management

Innovation requires the combination of several different types of knowledge, capabilities, skills, and resources so that firms can bring it to the market (FAGERBERG, 2005). A single innovation is often the result of an extended process involving many interrelated innovations. Innovations may vary in their form: new products, new methods of production, new sources of supply, the exploitation of new markets, and new ways to organize business (SCHUMPETER, 1943). Also, innovation may be classified according to its nature, degree of innovativeness and impact: explorative or exploitative (BENNER; TUSHMAN, 2002; JANSEN, 2005), incremental or radical (LEIFER et al. 2000), sustaining or disruptive (CHRISTENSEN, 1997, 2002). Yet, innovation may be applied in different contexts (e.g., regions, countries, industries, sectors) and may vary through product or process diffusion (ROGERS, 1962; BARBARA, 2002). Introducing innovation for the first time in a different context might also be considered as an innovative activity whenever it implies important adaptation, for this reason we call such cases *incremental innovation* (OECD, 2005). Van de Ven (1986) argues that as long as the idea is new to the people involved, it must be treated as innovation even though others may look at it as an ordinary imitation. Indeed, this type of innovation includes a larger dose of imitative behavior and is sometimes called *technology transfer* (FAGERBERG, 2005).

In Schumpeter's early work (1934) innovation is viewed as the outcome of continuous struggle in historical time between individual entrepreneurs and social inertia. In his later work, Schumpeter (1943) recognized that innovations progressively involve cooperation and take place within larger organizations. In the world of large companies the entrepreneur is not necessarily an independent economic agent, but he could also be an employee or a team of a large company with an entrepreneurial function. According to

Schumpeter (1949), the entrepreneurial function does not need to be embodied in a physical person. The role of entrepreneurship skills is stressed as part of a cooperative entrepreneurship in large companies instead of the heroic creative labor of a single entrepreneur (HAGEDOORN, 1996). Schumpeter (1943) emphasized the need for systematic study of *cooperative entrepreneurship* in large firms (FAGERBERG, 2005).

For the theoretical point of view, it is not clear if radical or disruptive innovation are more likely to occur in large or in startup firms (CHRISTENSEN; RAYNOR, 2003; SOOD; TELLIS, 2010). Innovation requires the combination of existing ideas, capabilities, skills resources, etc. (FAGERBERG, 2005). Freeman and Engel (2007) add that innovation also depends on the mobility of resources and on the executants' alignment of interests. Large firms supposedly have greater variety of these factors within their control, and thus a greater scope to combine them in different ways, producing innovation that will be both more complex and sophisticated. On the other hand, small firms can compensate smaller internal resources by being more flexible when interacting with the external word (FAGERBERG, 2005). While large firms are expected to have more planning and coordination capabilities, small firms generally have more creativity enhancing environments (Freeman and Engel, 2007).

Innovation has shown to have a great variability over time and space. It was observed that, in the last few years, centers of innovation have shifted from one sector, region, or country to another in a faster pace (OECD, 2008). Through a number of studies (UTTERBACK, 1994; ANDERSON; TUSHMAN, 1990; CHRISTENSEN ET AL., 1998; MALERBA 2005) scholars have shown that industries differ considering their innovation dynamics and researchers have focused on explaining why and how they differ. Pavitt's (1984) taxonomy, developed to help researchers identify innovation activities across industries, evolved into one of the main areas of research within innovation studies along the 1990s. Inspired by the seminal work of Nelson and Winter (1982), research in this area has explored the manner in which industries and sectors differ in terms of their dynamics, particularly focusing on the differences across sectors in knowledge bases, actors, networks, and institutions (FAGERBERG, 2005).

Another important topic of research is the relation between innovation and economic growth. Analysis of cross-national differences in economic growth performance has shown that innovation is also an important variable at different levels of development (GROSSMAN; HELPMAN 1991, FAGERBERG 1994). Three factors were observed to affect differential growth rates across countries: innovation, imitation, and other efforts

related to the commercial exploitation of technology. Interesting noticing that while imitation has become more challenging over time, innovation has progressively become a more powerful aspect to explain differences in economic growth across countries. Fagerberg (2005) concludes that effective catch-up in technology also involves innovation to a significant degree rather than relying only upon imitation.

Empirical research has shown that firms do not innovate in isolation and that the upward complexity of knowledge bases required for innovation compels firms of all sizes to rely also on external sources (GRANSTRAND; PATEL; PAVITT, 1997; HIPPEL, 1988). Therefore, the so-called "absorptive capacity", as defined by Cohen and Levithal (1990), is cited as one of the main learning capabilities firms must possess to be innovative. In order to interact with external world companies, it is needed to establish managerial processes, which might be very sensitive and tricky (TIDD; BESSANT; PAVITT, 1997). Partners may be linked with "strong ties" and form relatively stable networks (HANSEN, 1999), which may be useful for managing and maintaining openness. However, just as firms can display symptoms of "path-dependency" (ARTHUR, 1994) the same can happen to established networks, as the participants converge to a common perception of reality (so-called "group-think"). Consequently, innovative firms often find it useful to also develop "weak-ties" in order to maintain a capacity for changing its orientation (HANSEN, 1999).

Central part of the management challenge around innovation in the twenty-first century is learning to deal with the process at an inter-organizational level. According to Tidd et al. (2005):

> Innovation involves an increasingly large and diverse set of players arranged in various kinds of network, and managing across these boundaries represents a new set of issues and requires new and complementary routines to help deal with them. (TIDD; BESSANT; PAVITT, 2005, p.100)

In Tidd et al. (2005), the authors indicate a number of writers that have looked at innovation from a process perspective, case studies that provide a good lens through which this process can be seen and numerous books that cover company histories in detail and give an insight into the particular ways in which firms develop their own bundles of routines. Innovation management literature has focused on particular aspects of the process, for example, on technology strategy, on product or services development, on process innovation, on technology transfer, on implementation and on learning.

Focusing on the firm level, Chesbrough (2003) proposes a new paradigm for industrial innovation management called *open innovation*. Written for managers,

Chesbrough's book (2003) quickly became a best seller and produced a great impact among practitioners. After the publication of a second book (CHESBROUGH; VANHAVERBEKE; WEST, 2006) directed to the academic community, open innovation also gained increasing attention from scholars. As it is defined in Chesbrough, et al. (2006):

> Open Innovation reflects the ability of firms to profitably access external sources of innovation, and for the firms creating those external innovations to create a business model to capture the value from such innovations. Contrasted to the vertical integrated model, Open Innovation includes the use by firms of external sources of innovation and the ability of firms to monetize their innovations without having to build the complete solution themselves. (CHESBROUGH et al., 2006, p.109)

In the next section we will focus on describing open innovation as the main innovation theory we will use to build our theory

2.2 Open Innovation

Frequently, large firms would primarily rely on internal R&D to generate new technologies and products. At the same time, managers would expect that eventual competitors consider their corporate R&D laboratories as significant barrier to entry. Nowadays, high mobility of skilled workers, high availability of venture capital and widely dispersed knowledge across multiple public and private organizations are allowing smaller and companies with smaller investments on R&D to also come up with innovative technologies and product to the market and defy incumbents regardless of their huge investments in R&D.

Summed up with the increasing capability of external suppliers and the lack of efficiency of corporate R&D, large firms understood the limitations of adopting internally oriented processes of innovation. Rather, firms are being induced to open up their innovation process to external opportunities. In opposition to the process in which firms originate, develop and commercialize technologies internally, Chesbrough (2003) has coined as *open innovation* the process where firms employ equally both internal and external pathways to develop and exploit new technologies. In an open innovation approach, firms rather engage in alternative innovation practices that will systematically look for external sources of innovation, as well as new paths for introducing internally developed ideas into the market.

Figure 1 shows a representation of a closed innovation process on the left and an open innovation process on the right. On the closed model, research projects and ideas are originated from the science and technology base of the firm. The ideas advance through a filtering process, where some of the projects are interrupted and others are selected to be continued and to receive more investments. The winners are chosen to be completed and eventually reach the market. Chesbrough (2006a) explains that this process is termed as "closed" since projects "can only enter in one way, at the beginning, and can only exit in one way, by going into the market" (CHESBROUGH, 2006a, p.2).

On the right side of Figure 1, it is shown a representation of an open innovation model. In this case, ideas can be originated from either internal or external technology sources, and new projects can enter into the process at different stages. Differently from the closed model, besides going to the market through the company's own marketing and sales channels, here projects can go to the market also through out-licensing or spin-off venture company. Chesbrough labeled this model "open" because there are "many ways for ideas to flow into the process, and many ways for it to flow out into the market" (CHESBROUGH, 2006a, p.3).

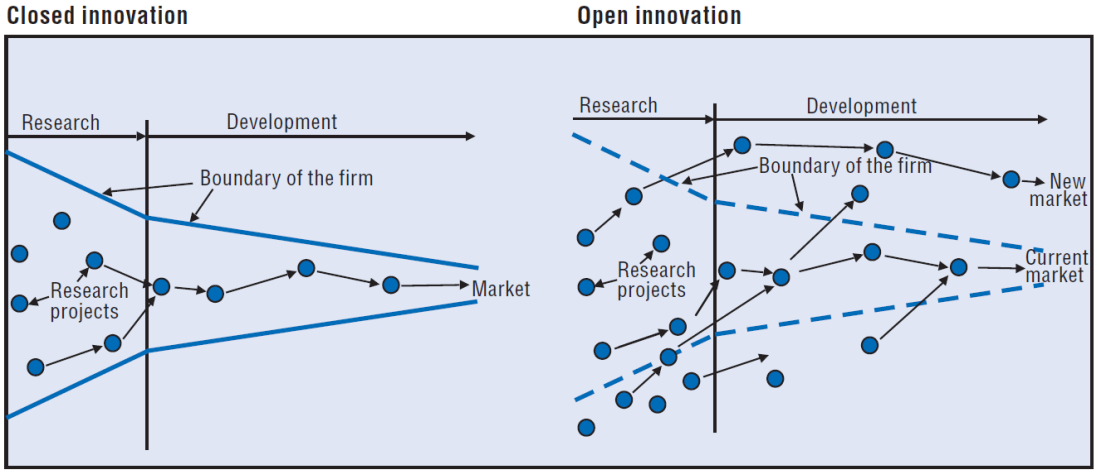

Figure 1 – Closed vs. open innovation
Source: Adapted from Chesbrough (2003) *apud* OECD (2008)

Undoubtedly, the open innovation model is a more dynamic and less linear approach in which companies look both "inside-out" and "outside-in" (OECD, 2008). It supports a tendency to continue moving from the structured linear stage-gate model of innovation to a more holistic approach that now supports classical interactions with suppliers, customers and other sources of ideas for innovation. As explained in the OECD (2008) study:

> Innovation is based on knowledge assets outside the company and cooperation is a way to source knowledge in order to generate new ideas and bring them quickly to market. At the same time companies exploit their own ideas as well as innovations of other entities, with academic research occupying a major place. (OECD, 2008, p.18)

Companies monetize internally developed technologies and intellectual property that are not part of their core business and thus better developed and commercialized by others. Multinational enterprises increasingly hook up with public R&D system, start-ups and spin-offs. The boundaries from companies become more permeable enabling knowledge to flow more easily between the external environment and the companies' internal innovation process (OECD, 2008).

Nonetheless, open innovation does not negate the existence of well-structured internal R&D process commonly found in large firms. In Chesbrough early works (2003a, 2003b, 2006a, 2006b, 2006c) he focused on describing how open innovation emerged within large corporations. Recently, other researches on smaller and medium-sized firms have shown that they are also opening up their innovation process (VAN DE VRANDE *et al.*, 2009; GASSMANN; ENKEL; CHESBROUGH, 2010; VANHAVERBEKE, 2012).

Despite being quickly adopted by practitioners, open innovation did not firm ground in academia without great dispute. Trott and Hartman (2009) argues that open innovation as presented by Chesbrough (2003a, 2006a) is a mixture of previous theories; the "closed" versus "open" dichotomy is too narrow and that in reality "closed innovation" does not exist; that the open innovation model is basically a variation on the well-known stage-gate model (COOPER; KLEINSCHMIDT, 1986) without any feedback or feed-forward mechanisms, and that open innovation does not bring new phenomena nor new data. Trott and Hartman (2009), nevertheless, recognized that Chesbrough has been very effective in disseminating "the notion of technology transfer and the need to share and exchange knowledge" (p. 17) and that "the Open Innovation concept may have reached new audiences (e.g., CEOs of technology-intensive companies) that for so many years the innovation and R&D literatures failed to reach" (p. 17).

Today, open innovation has become one of the most popular topics in innovation management. Huizingh (2010) make an effort to explain why open innovation became so popular and he gives four reasons.

> First of all, Chesbrough assigned a single term to a collection of developments. By giving it a label, it got a face, and the following stream of studies gave it a body too. Open innovation became the umbrella that encompasses, connects, and integrates a range of already existing activities. […] Second, the timing was great, coinciding with the current interest for outsourcing, networks, core competences, collaboration, and the Internet. […] Third, Chesbrough's work offers ample opportunities for extension by developing, e.g., integrated theory (e.g., with other innovation management concepts or related management concepts), measurement instruments (how open is an innovation process?) and management toolboxes (how to do it?), which in turn will further stimulate proliferation. […] Finally, Chesbrough connected the processes of acquiring external knowledge and exploiting internal knowledge externally by placing them both under the open innovation umbrella with the labels inbound and outbound open innovation. (HUIZINGH, 2010, p.2)

According to OECD (2008) study, the fact that companies also rely on external sourcing to innovate is not new in innovation theory, neither is the fact that innovation is not a linear process and that companies are highly affected by the environment they are embedded. "The novelty of the concept of open innovation lies especially in the fact that the open innovation process has become an integral part of companies' innovation strategy and business model" (OECD, 2008, p.24).

Although Chesbrough (2006c) acknowledges the antecedents for open innovation and that it did not came from nothing, he believes he made some important contributions besides just branding former theories and presenting it on a new package. In prior theories of innovation, external knowledge played a useful, but supplemental role. In open innovation, external knowledge plays equal role to that afforded to internal knowledge (CHESBROUGH, 2006c). Another difference is that in open innovation the inventive output from within the firm is not restricted to the current business model, but instead, it has the opportunity to go to market through a variety of channels.

Additionally, the concept of open innovation draws attention to the evaluation of false negatives and not only false positives regarding the selection of R&D projects, which can constitute new opportunities if exploited by an external channel and managed as real options, rather than traditional net present value approach for allocating budgets to projects (CHESBROUGH, 2004). Moreover, open innovation differs from previous theories by considering that useful knowledge is generally believed to be widely distributed and thus a purposive outbound flows of knowledge and technology exists and must be exploited by companies; IP management must have a proactive and nuanced role; innovation intermediaries are raising which helps firms to commercialized ideas; and that firms need to

define new set of metrics for assessing their innovation capability and performance (CHESBROUGH, 2006c).

In this sense, open innovation theory, together with other streams of innovation theories such as *innovation networks* and *systems of innovation*, restates the need of external sourcing to innovate, the non-linearity of the innovation process and the need of external framework conditions. In addition to that, open innovation implies the systematization of these practices and in the junction of two fundamental processes: development and commercialization of innovation.

Figure 2 illustrates how the combination of rising development costs of technology development and shorter product life cycles and market windows squeeze the financial result of investing in innovation. The *open innovation business model* addresses the cost side of the problem by leveraging external R&D resources to save time and money in the innovation process while the revenue side is addressed by widening the market opportunities for the innovations created (CHESBROUGH, 2006a). By doing so, the firm no longer confines itself to the market: it operates directly, but, it might generate new revenues in other segments though licensing, joint-ventures, spin-off, or other means as part of its innovation strategy and value capturing processes (CHESBROUGH, 2006c).

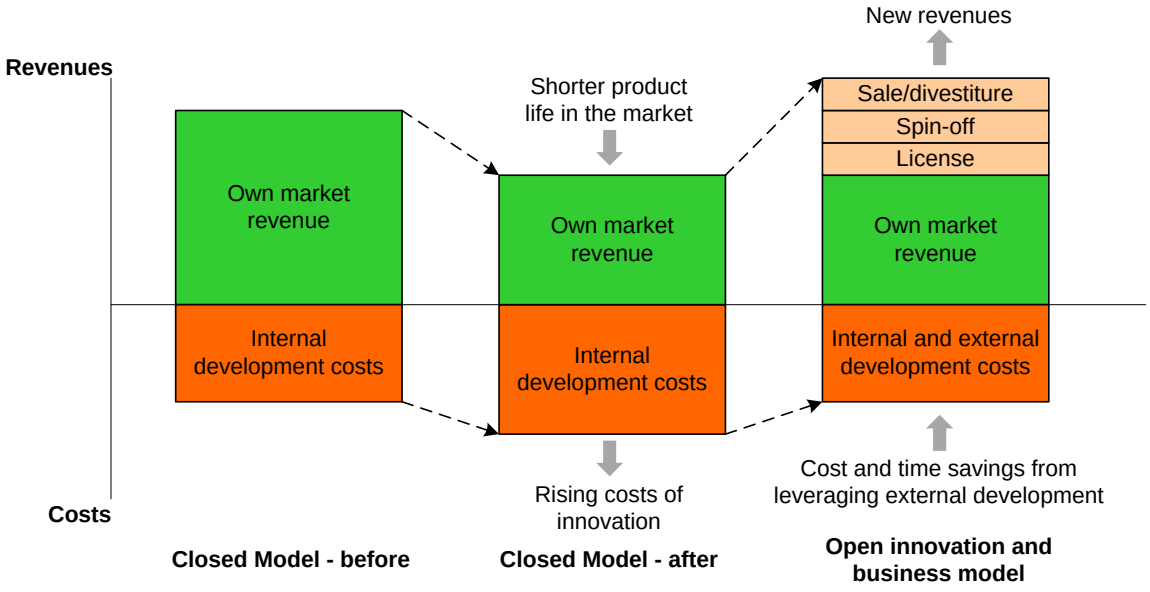

Figure 2 – The new business model of open innovation
Source: Adapted from Chesbrough (2006)

The prime benefit of open innovation is to develop a much larger base of ideas and technologies (OECD, 2008). As identified by Docherty (2006), the main benefits for companies to adopt open innovation practices are: (1) the ability to leverage knowledge

generated outside the company; (2) the extended reach and capability for new ideas and technologies in different markets; (3) the opportunity to refocus some internal resources on finding, screening and managing implementation; (4) the monetization on internal R&D through sales or licensing of unused in-house technology; (5) a greater sense of urgency for internal groups to act on ideas or technology; (6) the ability to conduct strategic experiments with less risk and fewer resources in order to extend core business and create new sources of growth, and (7) over time, the opportunity to create a more innovative culture from the outside world through continued exposure and relationships.

Cross-sector technologies such as information technology, biotechnology, nanotechnology, etc., are inciting some industry borders to shift (or in certain cases even to disappear). New business models and organizational structures are emerging as a result from these chances imposed by the convergence of various technologies. That helps to induce companies to join forces to capture new business opportunities, to share risks, knowledge and resources in order to fulfill synergies. To achieve these objectives, barriers and resistance have to be overcome before it is possible to implement open innovation strategies effectively and efficiently (OECD, 2008).

Nevertheless, open innovation also has important disadvantages, particularly since technology and innovation have often become the basis for companies' competitive advantage. In OECD (2008), some of these disadvantages are identified to be: (1) the extra costs of managing cooperation with external partners; (2) the lack of control, the adverse impact on flexibility, and (3) the overdependence on external parties and the potentially opportunistic behavior of partners. The more a company relies on open innovation, the more complex the management of innovation becomes, and mismanagement might result in the loss of technological competencies and greater dependency on external actors. In addition, it is worth mentioning that the increased risk of leakage of proprietary knowledge and involuntary spillovers means that sensitive knowledge may be revealed to external partners that may later become competitors (OECD, 2008).

2.2.1 Framework for open innovation

Considering empirical observations, Gassmann and Enkel (2004) identified three core open innovation processes. The first process is called *outside-in process*, in which integration of suppliers, customers, universities, research organizations, competitors and other external knowledge sourcing enriches company's knowledge base and innovative capabilities. The outside-in mode is characterized by in-licensing, external R&D contract and acquisitions agreement. Then, Gassmann and Enkel describe the *inside-out process*, in which internal ideas are brought to other markets by channeling them through different ways. Inside-out mode is done by out-licensing, divesting and creating spinouts. Finally, there is the *coupled process*, in which outside-in and inside-out are linked by working in alliances with complementary entities during which *give and take* are critical for success. Consequent thinking along the whole value chain and new business models enable this core process. The coupled modes are related to the formation of innovation networks where consortia, cross-licensing, co-development, joint-ventures and - as we will see later - open innovation arenas are the common arrangement. Table 1, Figure 3, and Figure 4 summarize the framework proposed by Gassmann and Enkel (2004).

Table 1 – Three Open Innovation Process Archetypes

Categories	Description	Management Focus	Locus of Innovation
Outside-in process	Enrichment of the company's own knowledge base through the integration of suppliers, customers and external knowledge sourcing. E.g., customer and supplier integration, listening posts at innovation clusters, applying innovation across industries, buying intellectual property and investing in global knowledge creation.	Deciding on the outside-in process as a company's core open innovation approach means that this company chooses to invest in co-operation with suppliers and customers and to integrate the external knowledge gained.	The outside-in process reflects companies' experience that the locus of knowledge creation does not necessarily equal the locus of innovation.
The inside-out process	Earning profits by bringing ideas to market, selling IP and multiplying technology by transferring ideas to the outside environment.	Companies that choose the inside-out process as a key process focus on the externalization of the company's knowledge and innovation in order to bring ideas to market faster than they can through internal development.	The inside-out process changes the companies' locus of exploitation to the outside of its boundaries.
The	Coupling the outside-in and	Companies that decide on the	The coupled

coupled process	inside-out processes by working in alliances with complementary partners in which give and take is crucial for success.	coupled process as a key process, combine the outside-in process (to gain external knowledge) with the inside-out process (to bring ideas to market). In order to do both, these companies co-operate with other companies in strategic networks.	process implies in joint innovation and exploitation.

Source: Adapted from Gassmann and Enkel (2004)

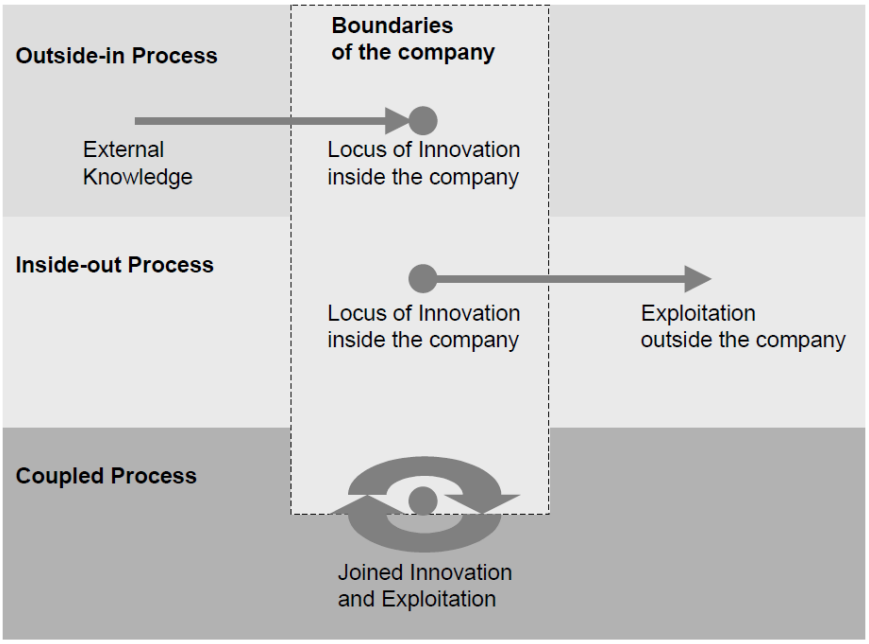

Figure 3 – De-coupling the locus of innovation processes
Source: Gassmann and Enkel (2004)

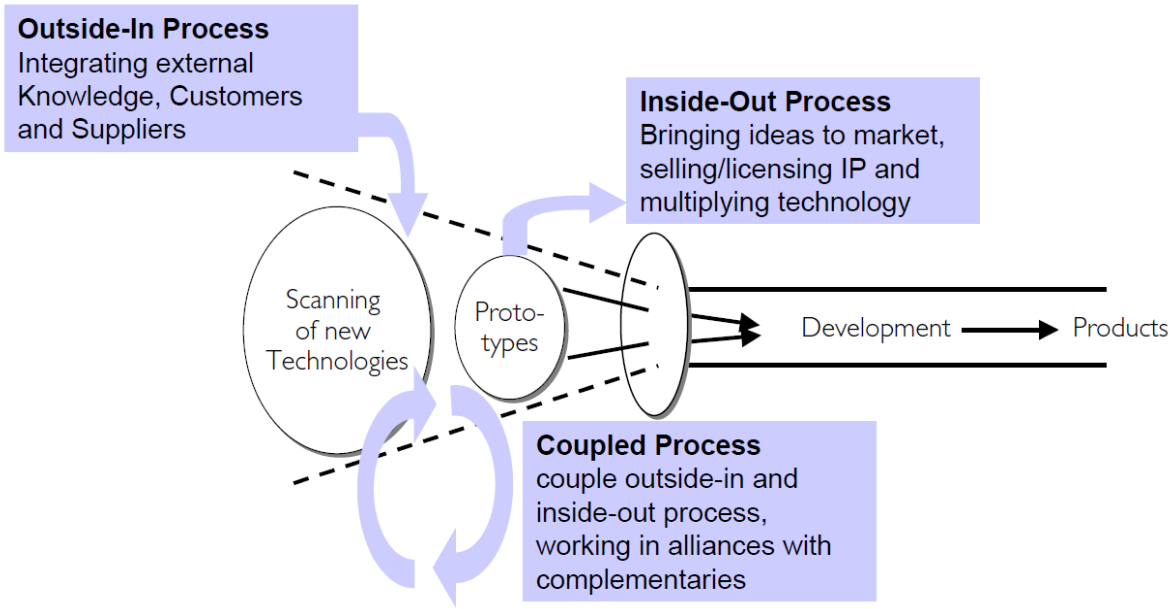

Figure 4 – Three archetypes of open innovation processes
Source: Gassmann and Enkel (2004)

As mentioned above, open innovation is a very comprehensive concept. According to Vrande *et al.* (2009), studies have distinguished between purposive outflows and inflows of knowledge to accelerate or reduce costs of internal innovation processes and to generate new revenues from innovative efforts, respectively. Vrande et al. (2009) proposes another framework or an open innovation based on the *technology exploration process*, in which purposive outflows of knowledge implies innovation activities to leverage existing technological capabilities outside the boundaries of the organization; and *technology exploration*, in which purposive inflows relates to innovation activities to capture and benefit from external sources of knowledge to enhance current technological developments. In a completely open situation, firms merge both *technology exploitation* and *technology exploration* so as to produce optimized value from their capabilities (Vrande et al. 2009).

Van de Vrande *et al.* (2009) distinguished eight open innovation practices, which are presented in Table 2.

Table 2 – Surveyed Open Innovation Practices

Practice	Definition
Technology exploitation	
Venturing	Starting up new organizations drawing on internal knowledge, and possibly also with finance, human capital and other support services from your enterprise.
Outward IP licensing	Selling or offering licenses or royalty agreements to other organizations to better profit from your intellectual property, such as patents, copyrights or trademarks.
Employee involvement	Leveraging the knowledge and initiatives of employees who are not involved in R&D, for example by taking up suggestions, exempting them to implement ideas, or creating autonomous teams to realize innovations.
Technology exploration	
Customer involvement	Directly involving customers in your innovation processes, for example by active market research to check their needs, or by developing products based on customers' specifications or modifications of products similar to yours.
External networking	Drawing on or collaborating with external network partners to support innovation processes, for example for external knowledge or human capital.
External participation	Equity investments in new or established enterprises in order to gain access to their knowledge or to obtain others synergies.
Outsourcing R&D	Buying R&D services from other organizations, such as universities, public research organizations, commercial engineers or suppliers.

Inward IP licensing	Buying or using intellectual property, such as patents, copyrights or trademarks, of other organizations to benefit from external knowledge.

Source: Van de Vrande *et al.* (2009)

Accessing and sourcing external knowledge and technologies as well as exploiting new ways to the market of internal developed technologies can take different formats. EIRMA (2004) identified the following modes of *outside-in* open innovation: purchase of technology; joint venturing and alliances; joint development; contract R&D; licensing; collaborations with universities; equity in university spin-offs; equity in venture capital investment funds. EIRMA (2004) proposes a framework of how to choose one or more of these options depending on the companies' strategy. Figure 5 presents the options for accessing external technology or knowledge distribution in terms of strategic autonomy of the company and the corresponding time horizon. At one extreme, e.g., the use of licensing implies that the company can access technology relatively fast but with quite significant dependency on the external partner. At the other extreme, internal development will typically take a much longer time but assures appropriability and much more strategic autonomy for the company. Other alternatives such as acquisition, contracted R&D, joint venture, joint development and equity stakes have intermediate positions in the matrix (OECD, 2008).

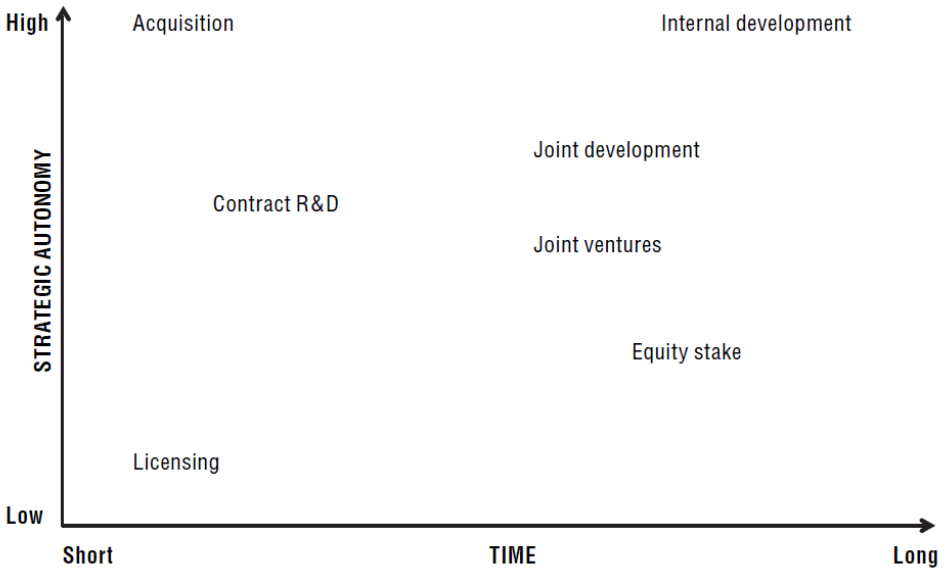

Figure 5 – Open innovation modes: strategic autonomy versus time
Source: Adapted from EIRMA (2004) *aped* OECD (2008)

Another way to evaluate how to choose among these different modes is according to their suitability for core, non-core and unfamiliar markets and technologies (EIRMA,

2004). In that case, it is possible to include not only outside-in modes of open innovation but, as represented in Figure 6, also modes to market internally developed technology and knowledge by different channels. According to this framework, internal development and acquisitions are usually implemented in core technologies for core markets. That presumes that collaborating with external partners may be excessively risky for the company's long-term success. Modes such as joint ventures and venture capital are typically used for sourcing knowledge from outside as well as for commercializing internally developed innovations. Spin-offs and selling are considered to be more appropriate for unfamiliar technologies marketed in unfamiliar markets and so on. Figure 6 highlights the importance of picking the appropriate mode of open innovation in relation to the company's strategy, technology and market portfolio. It directly connects open innovation to diversification, assuming that core competencies both in technology and in markets should be developed internally as much as possible. In contrast, open innovation may be a quicker alternative to internal development for diversification motives in non-core technology and/or markets (OECD, 2008).

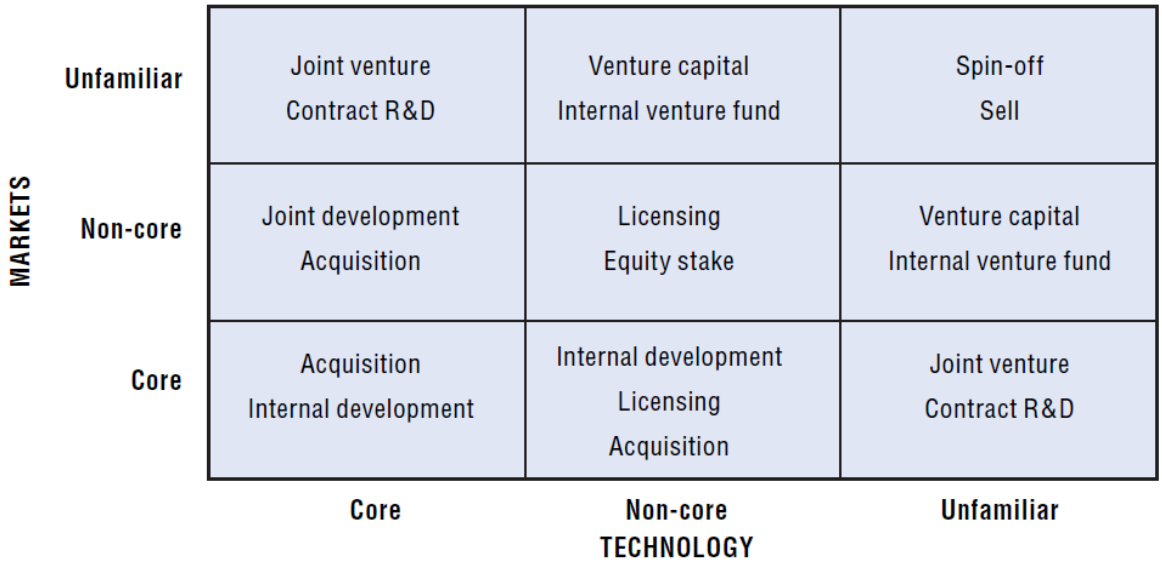

Figure 6 – Open innovation modes: technology and markets
Source: Adapted from EIRMA (2004) *apud* OECD (2008)

2.2.2 Open innovation and intermediaries

Irrespective to the challenges and opportunities, open innovation has gained popularity among R&D and innovation managers over the years and the more firms practice open innovation the more technology markets will emerge and become more efficient. According to Chesbrough et al. (2006c), intermediary markets of technology "facilitate the entry and interaction of firms into unknown industries or sectors and help those firms lacking of an appropriate architecture to create and capture value from external networking opportunities" (p.7). Intermediate markets for innovation are constituted by what has been called *innovation intermediaries*. They accelerate the search for possible solutions to selected problems by providing access to different sources of ideas and by helping inventors find firms interested in their inventions (CHESBROUGH, 2006a).

Dalziel (2010) defines innovation intermediaries as organizations or groups within organizations that work to enable innovation, either directly by enabling the innovativeness of one or more firms, or indirectly by enhancing national, regional, or sectorial innovative capacity. According to Dalziel, very broadly, such organizations could include industry associations, economic development agencies, chambers of commerce, science, technology or business parks, business incubators, research consortia and networks, research institutes, and university technology transfer offices.

Chesbrough (2006a) describes six cases of innovation intermediaries, each proposing a different business model: "online exchange portal; e-mail request for proposal; concept developer; membership-based innovation community; repository for legally obtained IP, and IP merchant banker. The primary functions of these intermediaries are defined to be: marketplace for technology transfer, agent, co-developer, broker and market maker" (CHESBROUGH, 2006a, p.141).

Howells (2006) compiled another list of ten common functions of innovation intermediaries: (1) scanning and information processing, (2) knowledge processing and combination, (3) gatekeeping and brokering, (4) testing and validation, (5) commercialization, (6) foresight and diagnosis, (7) accreditation and standards, (8) regulation and arbitration, (9) intellectual property and (10) testing, evaluation and training.

After evaluating 32 cases of innovation intermediaries, Lopez and Vanhaverbeke (2009) proposed a typology of four different categories. They suggested that managers should select one of the four kinds of innovation intermediaries identified in their typology, based

upon the following conditions: (1) innovation consultants: managers seeking specific solutions or information, interested in services and with a technology request close to the market; (2) innovation traders: managers searching for specific solutions to managerial or scientific problems in firms lacking either time or in-house resources to develop the technology and that are interested in short-term collaboration; (3) innovation incubator: managers seeking interaction with other companies in order to come up with new innovations and to procure innovation services, and (4) innovation mediator: managers seeking to establish relationships in an open platform, develop early stage technologies and innovations (LOPEZ; VANHAVERBEKE, 2009).

Open innovation presumes the existence of external ideas and technologies that could be useful for a specific company as well as market opportunities for unused technologies developed in-house. Companies shall then develop processes to access these external ideas (outside-in processes) and technologies, and business models to find these markets to developed ideas (inside-out processes). In the case of coupled processes, companies can also decide to join forces to create (instead of finding) new business opportunities by sharing complementary knowledge and resources to develop innovative solutions to challenges that could not be handled by a single organization.

As mentioned before, several different ways of practicing open innovation have emerged in the last few years. Etzkowitz and Leydesdorff (1995) have observed the triple helix arrangement in which industry, academia and governments collaborate to create innovation. Hagel and Brown (2006) have studied the phenomenon of creating networks of hundreds of participants that collaborate in a coordinated way to create useful knowledge to the sponsors of the initiative. Von Hippel (2005) has stressed on the role of users in developing innovations together with suppliers. Elmquist and Ollila (2011) have presented the concept of open innovation arena, arguing that it differs from other type of innovation intermediary in the sense that it both enables open innovation within a specific field of expertise and envisages itself as a key player in that field.

The notion of *arena meeting* has emerged as a neutral environment for different entities to discuss and specify complex problems between practitioners. Those same practitioners will better develop it to what can be called *open innovation arenas*. On arenas meetings, Equistar (2009) explains:

> A difficult issue is to *translate and transform human needs and societal problems into functional requirements* that can satisfy needs and solve problems. In order to achieve this, it is important to *organize meeting arenas, research projects and focus*

> *groups*. Such forums should involve potential users, consumers, producers, etc. If the forum is a research project, the composition should be interdisciplinary and include marketing researchers, economists, psychologists, etc. These forums should *contribute to the articulation of needs and problems and communicate preferences and demands to the potential supplying organizations*. (EDQUIST, 2009, p.16)

Open innovation arenas can be described as organizations created to tackle innovation challenges in a specific field of knowledge gathering different partners that can complement each other while finding solutions in alternative ways. In general, targets of an open innovation arena are loosely defined and the number of partners to not exceed dozens.

Hällbrant and Ingvarsson (2012) have focused on the process of creating such arenas and suggested four dimensions, named formal, informal, structural and physical. The formal dimension is about bringing people from different organizations together under formal agreements which moderate opportunistic behaviors, increase trust between the actors and bring structure to the activity. The informal dimension creates an open environment built on trust and motivation to interact. Without mutual trust, knowledge sharing is reduced and the actors are not encouraged to contribute. The physical dimension creates possibilities to meet and work together, either physically or virtually, and can facilitate knowledge sharing and creative work. Lastly, the structural dimension concerns what processes and activities are undertaken in the arena and thus what the different actors actually do in practice (Hällbrant; Ingvarsson, 2012).

2.2.3 Open innovation in global networks

Based on case studies as well as on large-scale data sets, OECD (2008) presented evidences of open innovation practices on global innovation networks. These studies conclude that the main reason for placing research and/or development facilities abroad is the proximity of large and growing markets. Other important factors are the availability of engineers and researchers, and the company's proximity to other activities such as production and sales. Moreover, the study reveals that suppliers and customers are the most desirable innovation partners. While universities and public research institutes are generally considered an important source of knowledge for companies' innovation activities, especially in more upstream research and exploration activities, they represent only a small amount of innovation collaborations (OECD, 2008).

Regarding the size of the firm, the study (OECD, 2008) affirms that larger firms innovate more openly than small firms. Innovation survey data indicate that large companies are more likely than small and medium-sized enterprises (SMEs) to collaborate on innovation. In the geographical aspect, it was also observed that a physical proximity matters in global innovation networks. Companies seem to prefer innovation partners that are geographically closer. As the only information available concerns the number of collaborations, nonetheless, the fact that companies may enter collaborations with more distant partners only if they are strongly determined by market demand or excellence seeking may be veiled.

As the last conclusion of OECD observed evidences, differences among industries are noteworthy. Collaboration on innovation is important to manufacture as well as to other services, notwithstanding some differences among countries. Industries such as chemicals, pharmaceuticals and information and communication technology (ICT) typically show high levels of open innovation (OECD, 2008).

2.2.4 Open innovation and systems of innovation

The expression *national system of innovation* (NSI) was first used in published form by Freeman (1987). Freeman brought deep understanding of innovation processes, historical insight and wisdom to the collaboration. He defined it as “the network of institutions in the public and private sector whose activities and interactions initiate, import, and diffuse new technologies” (FREEMAN, 1987). Two major books on national systems of innovation are Lundvall (1992) and Nelson (1993), which place different approaches to the study of NSIs (EDQUIST, 2004). Other contributions referring to systems and operating at the national level refer to *social systems of innovation* (AMABLE et al., 1997) and to *national business systems* (WHITLEY, 1994; WHITLEY, 1996).

Lundvall (2007) recognizes that the wide use of the *system innovation* (SI) concept has helped to move the attention toward national policy strategies that constitute positive sum games both internationally and domestically. Another positive impact of the systems of innovation approach is that the *system* dimension of the term has moved the attention in policy circles in charge of research, innovation and industrial development from linear to interactive thinking of innovation. This can be referred to as a movement from

"Science Policy" and "Technology Policy" toward "Innovation Policy" (LUNDVALL; BORRAS, 2005).

On the other hand, the *system* terminology may also lead to a mechanistic interpretation that the system can be easily constructed, governed and manipulated. Lundvall (2007) emphasizes that in the SI concept the innovation process may be seen as an intricate interplay between micro and macro phenomena where macro-structures condition micro-dynamics and vice versa, e.g., new macro-structures are shaped by micro-processes. In a dynamic context, this means that we need to understand systems as being complex and characterized by *co-evolution* and self-organizing and do not suppose mechanistic relations and interactions between components (LUNDVALL, 2007).

In a SI approach firms do not normally innovate in isolation, instead they innovate in collaboration and interdependence with other organizations. These organizations may be other firms or non-firms organizations. The behavior of organizations is also shaped by institutions that constitute incentives and obstacles for innovation. Organizations and institutions are components of systems for the creation and commercialization of knowledge and innovations emerge in such SI. The definition of SI is according to Edquist (1997) all the important economic, social, political, organizational, and other factors that influence the development, diffusion, and use of innovations. This means that the SI approach is about the determinants of innovations, not about their consequences in terms of growth, quantity of employment, working conditions, etc. (EDQUIST, 2001). An example of a national innovation system proposed by Arnold and Kuhlman (2001) is shown in Figure 7.

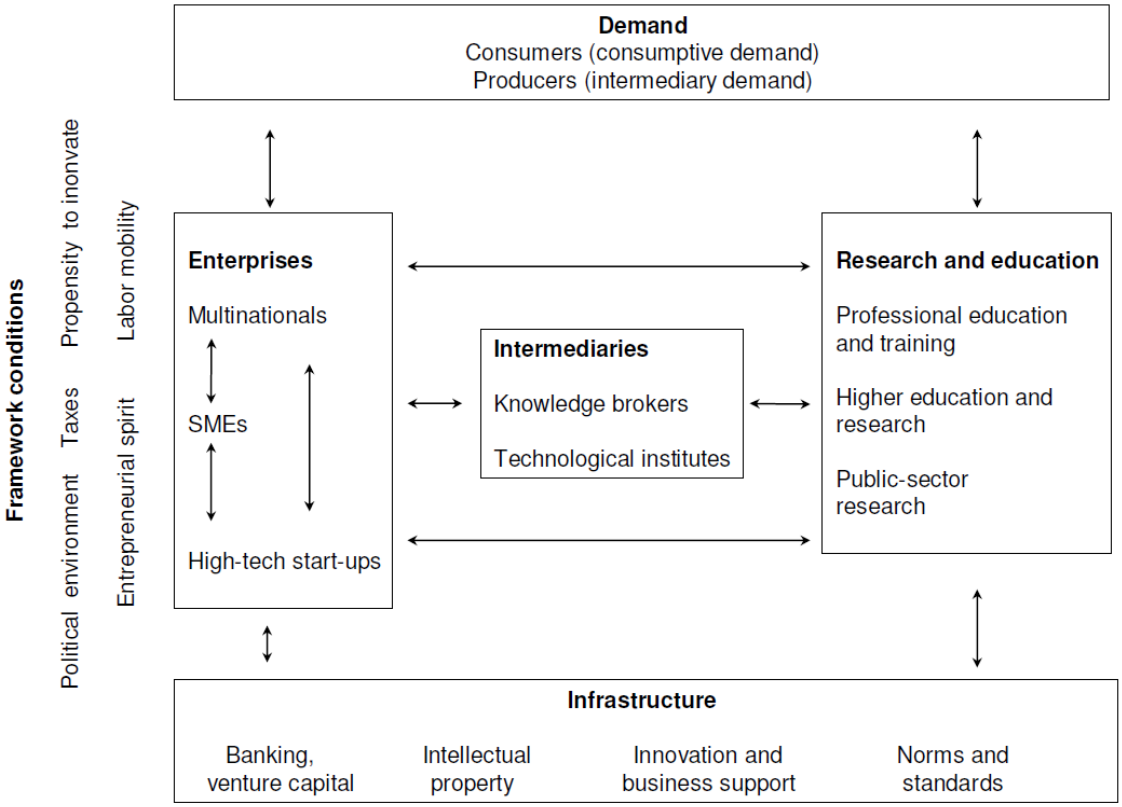

Figure 7 – A model of a National Innovation System
Source: Arnold and Kunh (2001)

Edquist (2001) helps us defining what a *system* is in everyday language as well in scientific contexts. For him, a system consists of two kinds of entities: there are firstly, some kinds of components and second, there are *relations* between these. Another characteristic is that there should be reasons why a certain array of components and relations has been chosen to constitute the system; they form a *whole*. Finally, it is possible to clearly define the *boundaries* of the system; i.e. discriminating what belongs to the system and what does not. However, only in exceptional cases the system is closed in the sense that it has nothing to do with the rest of the world. That part of the rest of the world that in some sense is important for the system is called its *environment*.

According to Edquist (2001), the main components of a SI can be placed in the two categories: *organizations* and *institutions*. Organizations are formal structures that are intentionally created and have an explicit purpose. They are players or actors. Some central organizations in SIs are firms, universities, investment institutions and public innovation policy agencies. Institutions, on the other hand, are sets of common habits, routines, established practices, rules, or laws that moderate relationships and interactions between individuals, groups and organizations; they act as the rules of the game.

The relations and interactions between the main components of SIs are essential in the learning processes that are often the basis for the development of innovation. Edquist (2001) argues that these relations may be of a market and or a non-market kind. Markets only coordinate transactions; they do not deal with other kinds of relations. Learning processes concern exchange of knowledge elements and collaborations that are not easily handled through market transactions. Other mechanisms that mediate the relations between components in the systems are also important.

This systematic approach supposes that a SI performs activities that influence the development, the use and the diffusion of innovations. Edquist (2001) proposes ten important activities categorized in Table 3 that define the main functions of a SI as hypothetical determinants of innovation processes. The increased emphasis on *activities* given by Edquist (2004) does not mean that the components can be disregarded or neglected in any sense. The focus on both activities and components is needed to understand innovation processes and to design innovation policies. In addition, there are some kinds of activities that are likely to be more important in most SIs, and other that are important only to specific SIs.

Table 3 – Activities of Systems of Innovation

Categories	**SIs Activities**
Knowledge inputs	Provision of R&D, creating new knowledge, primarily in engineering, medicine and the natural sciences. Competence building (provision of education and training, creation of human capital, production and reproduction of skills) in the labor force to be used in innovation and R&D activities
Demand-side factors	Formation of new product markets. Articulation of quality requirements emanating from the demand side with regard to new products.
Provision of constituents of SIs	Creating and changing organizations needed for the development of the new fields of innovation, e.g. enhancing entrepreneurship to create new firms and *intrapreneurship* to diversify existing firms, creating new research organizations, policy agencies, etc. Networking through markets and other mechanisms, including interactive learning between different organizations Creating and changing institutions - e.g. IPR laws, tax laws, environment and safety regulations, R&D investment routines, etc.
Support services for innovating firms	Incubating activities, e.g. providing access to facilities, administrative support, etc. Financing of innovation processes and other activities that can facilitate commercialization of knowledge and its adoption. Provision of consultancy services of relevance for innovation processes, e.g. technology transfer, commercial information, and legal advice.

Source: Adapted from Edquist (2004), p. 189-191

As Edquist (2001) explains, innovation policy is a public action that influences technical change and other kinds of innovations. It includes elements of R&D policy, technology policy, infrastructure policy, regional policy and education policy. Innovation policy goes beyond science and technology (S&T) policy, which mainly focuses on stimulating basic science as a public good from the supply side. Innovation policy also includes public action influencing innovations from the demand side (Edquist, 2001).

According to Edquist (2001), two conditions must be satisfied for public intervention to be justified in a market-based economy. First, the market mechanism and firms must fail to achieve the objectives formulated; this means, a 'problem' must exist. A 'problem' exists when firms and markets do not spontaneously fulfill the objectives that have been politically selected. Public intervention is not justified if the firms and markets are accomplishing the objectives. This is coherent with the principle that innovation policy should complement firms and markets, not replace or duplicate them. Second, the state and its public agencies must also be able to solve or mitigate the problem. If the public sector does not have this ability, there should, of course, be no intervention, since the result would be a failure. In other words, this condition is an attempt to make sure that political failures are avoided to the largest possible extent (Edquist, 2001).

In the neoclassical economic theory, the mainstream thinking is the one of no intervention. Markets should be permitted to do their work of achieving optimal efficiency, with incentives from competition, and the focus of policy is on the reduction of barriers to entry, growth and exit in competition policy. In such a viewpoint, the main motivation for government intervention is *market failures*. Market failures are said to be present when markets result in suboptimal outcomes. If the decision to innovate is left to private firms only, their innovation expenditures will be too low from a social perspective. Table 4 summarizes the causes of market failures (DE JONG et al., 2008).

Table 4 – Causes of Market Failures

Categories	Description
Lack of appropriability	Enterprises are usually unable to fully appropriate the benefits that can be derived from innovations. This means there is a decreased incentive for innovative activities. (Teece, 1986)
Uncertainty	Innovation is surrounded with risks. Uncertainty refers to the impossibility of knowing *a priori* the outcomes of innovation processes and associated risks. Enterprises are in general reluctant to invest in innovation even if the expected value of their investments is slightly positive but uncertain. This especially applies to small enterprises. Unlike large organizations they are unable to compensate risks by maintaining large innovation portfolios

	(Vossen 1998, Nooteboom 1994).
Indivisibility	Innovation can be pretty demanding in terms of monetary investments, e.g. some innovations demand significant investments in machines, equipment or marketing efforts. Again, such expenditures are usually better fundable for large enterprises. Besides, enterprises sometimes need an initial investment to build and maintain a stock of knowledge required for innovation. There is a minimum scale of knowledge needed before any new knowledge can be created: that is, new knowledge is created on the basis of an existing pool of knowledge (inside or outside the organization).
Asymmetric information	Due to asymmetric information private enterprises sometimes find it hard to find and/or persuade investors of the potential of their innovative ideas. For the same reason, innovating enterprises may not be able to find and recruit technical staff. Asymmetric information implies that the distribution of innovation resources in society is inadequate. As a consequence, valuable innovation projects are not implemented.

Source: Adapted from De Jong et al. (2008)

Market failures have been most commonly suggested as justification for policies such as supporting R&D, sponsoring basic research at universities and changing intellectual property rights (IPR). Due to the large adoption of the SI approach among policy makers, other than market failures, systems failures have also been suggested to justify public intervention. In the study presented by De Jong et al. (2008), researchers have identified four broad types of system failures that are commonly used to legitimize policy interventions. They are summarized in Table 5.

Table 5 – Causes of Systems Failures

Categories	**Description**
Capability failures	There may be crucial parts of the innovation system that are underdeveloped. This refers to the fact that key organizations in innovation systems, such as private enterprises, public research organizations, educational institutes or venture capitalists may be weakly developed in terms of innovative abilities. This type of failure also includes inadequacies in potential innovators' ability to act in their own best interests
Network failures	These relate to problems in the interactions among actors in the innovation system. Relationships between organizations in innovation systems are not self-evident and may need to be triggered and supported. Inter-organizational collaboration, for instance, is often risky and frequently fails. When missing or badly managed, knowledge will not be exchanged, inter-organizational learning will come to a halt, and investment opportunities will not be perceived.
Institutional failures	Institutional failure relates to a disability to (re)configure institutions so that they work effectively within the innovation system.
Framework failures	Effective innovation depends partly upon regulatory frameworks, health and safety rules, etc. as well as other background conditions, such as the sophistication of consumer demand, culture and social values.

Source: Adapted from De Jong et al. (2008)

Supposedly, the concept of open innovation is related to the literature of *systems of innovation* (SI). Open innovation refers to firms' external collaborations for innovation, while the concept of systems of innovation refers to interactions between organizations and institutions to produce innovation. Both components of literature have been developed in different disciplines (managerial *versus* economic). While open innovation looks at systems of innovation from within the company, the literature on systems of innovation looks at companies as black boxes. However, their correspondences cannot be negated. Table 6 presents an overview of the resemblances of both literatures.

Table 6 – Similarities between Open Innovation and Systems of Innovation

Open Innovation literature		*Systems of innovation literature*
Enterprises obtain better results if they open up their innovation processes, i.e. involve the world outside.	↔	Innovation is the result of complex and intensive interactions between various actors.
Innovation is no longer the domain of the internal R&D department; traditional stage-gate models provide an incomplete picture of how innovation should be organized.	↔	The linear model in which knowledge-related activities are divided in supply and demand does not hold any longer.
Enterprises can benefit from purposive inflows and outflows of knowledge. Knowledge spillovers offer opportunities and are not just a threat.	↔	Knowledge spillovers are essential for the functioning of the innovation system, and are very much desirable.
Enterprises need both internal innovation competences (other than R&D) and competences to connect with external parties in order to be successful.	↔	The functioning of innovation systems can be hampered by capability and network failures.
As enterprises increasingly depend on external sources, infrastructural arrangements (e.g. IPR) and other framework conditions become more important.	↔	The functioning of innovation systems can be hampered by institutional and framework failures.
Increased mobility of labor and presence of a trained labor force are important trends that eroded the closed innovation model.	↔	Human and social capital provide the oil necessary for lubricating the innovation system.
If the innovating enterprise cannot internally benefit from its innovations, maybe others can.	↔	The social benefits of innovation exceed those of the individual innovating actors.

Source: DE Jong et al. (2008), p. 5

De Jong et al. (2008) argues that open innovation literature is *complementary* to the SI literature. A main distinction is that open innovation has been identified from a managerial standpoint and has so far been studied mainly at the organizational level (CHESBROUGH; VANHAVERBEKE; WEST, 2006), while the systems literature was developed in an economic and industrial context (OECD, 2008). While the literature on innovation systems considers enterprises as black boxes, the open innovation model focuses the managerial process within companies. This connects open innovation to a recent examination on the modes of innovation that firms adopt. As previously exposed, businesses may use various modes to innovate, not just by the production and use of codified scientific

and technical knowledge (the Science, Technology and Innovation mode), but also by an experience-based mode based on *Doing, Using and Interacting* as described by Jensen et al. (2007) (DE JONG et al., 2008).

The concept of *social benefit* in the SI approach is translated to the notion of *value capture* at the firm level. That means, while society might generically and indirectly benefit from a "systematic" innovation process (result from interaction), the firm seeks to benefit directly from its "open" innovation process even if others might as well participate and benefit from an innovation (DE JONG et al., 2008). In a general sense, the complementarities between both literatures imply that the public policies for innovation are similar either to improve systems of innovation or to facilitate the practice of open innovation.

In De Jong et al. (2008) study, authors suggest that in a world of open innovation, public policies for innovation must be aligned with the behavior of innovating enterprises and/or the external conditions which motivate enterprises to practice open innovation. As key behavioral aspects of open innovation they identified:

(1) *Networking*: networks allow enterprises to rapidly fill in specific knowledge needs. They may also be a source of new business partners to commercialize internal knowledge;

(2) *Collaboration*: collaboration is more formal and systematic than networking. Its advantages are similar, i.e. collaboration partners may be sources of ideas and knowledge, or partners to commercialize internal ideas;

(3) *Corporate entrepreneurship*: enterprises can benefit from purposive inflows and outflows of knowledge by means of venturing activities, including *intrapreneurship*;

(4) *IP management*: the open model intellectual property (IP) is managed proactively. Enterprises can acquire external IP to fuel their research engines, and they can profit from their own, unused IP by licensing it to others, and

(5) *R&D*: the open paradigm does not imply that internal R&D is obsolete. Internal R&D can still be a source of better performance like it was in the old days. It also increases absorptive capacity to better benefit from external sources.

2.2.5 Open innovation and entrepreneurship

We identified two emerging streams relating the open innovation paradigm to entrepreneurship. The first stream relates open innovation to corporate venturing, which sees open innovation as a corporate management tool useful for creating new ventures through entrepreneurial action (CHESBROUGH, 2000; 2002; KAZANJIAN *et al*., 2002). The second stream understands open innovation as a management tool valid not only for big corporation (with large investment in R&D labs), but also useful to startups and entrepreneurs (DUSHNITSKY; LENOX, 2005; FREEMAN; ENGEL, 2007). As stated by Chesbrough (2003), corporate entrepreneurial activities include corporate venturing, *intrapreneurship*, and spinning off new ventures (CHESBROUGH, 2003).

Corporate venturing implies investments in new or existing businesses. It is usually done by large enterprises, investing in start-ups or small, rapidly growing businesses. Corporate venturing enables the retrieval of innovations that were initially unused or that did not seem promising. Enterprises may create corporate venturing initiatives to invest in start-ups and other businesses to be able to monitor potential opportunities (CHESBROUGH, 2006c). Another option for enterprises to become more innovative is to encourage their employees to innovate. Many practitioners and scientists, also outside the field of open innovation, endorse the view that innovation by individual employees is a means to foster organizational success (e.g. VAN DE VEN, 1986).

Work has become more knowledge-based and less inflexibly defined and specified. In this context, employees are considered increasingly important to create and implement innovations and companies have invested more in entrepreneurship initiatives. *Intrapreneurship* can be promoted in various ways, for example by investing in employees' ideas and initiatives, creating autonomous teams with dedicated innovation budgets, or stimulating employees' external work contacts in order to enhance opportunity exploration. Suggestion schemes such as idea boxes and internal competitions are also options to stimulate *intrapreneurship* (VAN DIJK; VAN DEN ENDE, 2002).

Enterprises also increasingly commercialize their internal knowledge outside the borders of their own organizations by spinning off or spinning out ventures (OECD, 2008). Spinning off differs from spinning out, as spinning off is characterized by no further stakes of the parental organization. The motives for spinning off are, in general, financially motivated rather than strategically motivated, i.e., when the in-house developed technology does not fit

well with the current business or the technology portfolio, but it can alternatively earn revenue by being sold to a third party (OECD, 2008). Several large high-tech enterprises spin off or spin out new ventures because the business idea does not fit into their existing business model. This is another reason why larger enterprises tend to increasingly link up with start-ups.

Another group of scholars have focused their research on the field of open innovation being applied by SMEs. Van der Vrande (2009) explains that innovation in SMEs is vulnerable by lack of financial resources, limited chances to recruit specialized workers, and small innovation portfolios (VOSSEN, 1998; ACS; AUDRETSCH, 1990) so that risks associated with innovation cannot be spread. SMEs need to deeply work on their networks to find absent innovation resources, and due to their smallness; they will be confronted with the boundaries of their organizations rather sooner than later. In today's increasingly complex and knowledge-intensive world with shortened product life cycles, such networking behavior has probably become even more important than before. Given these considerations, according to Van der Vrande (2009), open innovation practices are not applied exclusively by MNEs, but will also be present in SMEs, and will be increasingly adopted.

Lee *et al.* (2010) propose a different perspective regarding the same issue. They suggest that one possibility to boost open innovation in SMEs lies in collaboration with other firms at the commercialization stage. While large firms focus mainly on R&D for open innovation efforts, SMEs focus more on commercialization because, while many of them have superiorities in technology for invention, they often lack the capacity in terms of manufacturing facilities, marketing channels and global contacts to introduce them effectively to the innovation market (NARULA, 2004). Considering the fact that market is important in determining successful innovation (ROSENBERG, MOWERY 1978) and success in innovation implies the successful commercialization, SMEs' innovation can benefit greatly from support at the commercialization stage. Therefore, Lee *et al.* (2010) suggest that the open innovation model in SMEs should emphasize more on the latter part of the conventional open innovation model (CHESBROUGH, 2003) to describe open innovation for SMEs. They conclude that intermediaries are useful for helping SMEs organizing innovation networks and can contribute to build trust between network members. Lastly, De Jong (2006) argues that smaller organizations also significantly invest in setting up new businesses to make the most of their internal knowledge or ideas.

There is still another approach to relate open innovation to entrepreneurship, which is the entrepreneurial act of the corporate manager to innovation. As mentioned before,

innovation can also be viewed as the outcome of continuous struggle in historical time between individual entrepreneurs and social inertia (SCHUMPETER, 1934) at the same time that we also know that innovation often take place within larger organizations (SCHUMPETER, 1943). This means, entrepreneurs are not necessarily independent economic agents, they could also be an employee or a team of a large company with an entrepreneurial function that does not need to be embodied in a physical person (SCHUMPETER, 1949). According to Hagedoorn (1996) the role of entrepreneurship skills is stressed as part of a *cooperative entrepreneurship* in large companies instead of the heroic creative labor of a single entrepreneur. Chesbrough (2003) added that in an open innovation landscape *cooperative entrepreneurship* in large companies are not limited within the firm boundaries but purposively open to external collaboration.

2.3 Effectual Entrepreneurship

Consistent with recent evidence from evolutionary economics on the dynamics of markets and industries, the theoretical development presented by Sarasvathy on *effectuation* (2000, 2001 and 2008) pursues to offer "valid microfoundations" for an economics in which Schumpeterian perceptions on innovation, competition and growth are integral. Effectuation shares its foundations and is coherent with the recent developments in behavioral economics on human decision-making (SARASVATHY, 2008). Furthermore, developed around the empirical context of new businesses creation, effectuation theory is about the *creative process* in general, in which human action takes the preponderant role. Sarasvathy refers to *effectual entrepreneurship* as a *method* and as a *process* that can be identified, learned and taught. In Sarasvathy words:

> Just as scientific method enables the creation of technological artifacts from existing materials of the real world, the entrepreneurial method enables the creation of social and economic artifacts through the actions of individual entrepreneurs and their interactions with a variety of stakeholders in the real world. Understanding the entrepreneurial method and building effective institutions based on it will therefore be the key to the creation of economic opportunities. (SARASVATHY, 2008, p. 180)

2.3.1 Effectuation reasoning: the problem and the logic

Expert entrepreneurs are usually in the business of creating the future, in which they can mold through their own choices and actions working together with pre-committed stakeholders and customer-partners. On the other hand, corporate managers are in general trained to plan actions according to detailed sales forecast, market research and business planning. The question Sarasvathy aims to answer with her work in effectuation is if is there a rational method of decision-making that can help entrepreneurs facing unpredictable situations, such as new market creation.

Causal rationality begins with a pre-determined goal and a given set of means, and seeks to identify the optimal alternative to achieve the established target. In the effectual reasoning proposed by Sarasvathy (2001a), entrepreneurs do not begin with a specific goal. In its place, they start with a given set of means and let goals emerge contingently over time from the varied imagination and diverse aspirations of the same entrepreneurs and the people they cooperate with (SARASVATHY, 2001a). Nevertheless, this two opposed logics of reasoning can be used by the same person at different times depending on what the circumstances call for. In fact, Sarasvathy (2001a) acknowledges that the best entrepreneurs are the ones able to choose the right logic for each circumstance. But still, they prefer effectual reasoning to causal reasoning in the early stages of a new venture, and arguably, most entrepreneurs do not transition well into latter stages requiring more causal reasoning. Figure 8 graphically illustrates the causal reasoning discussed above.

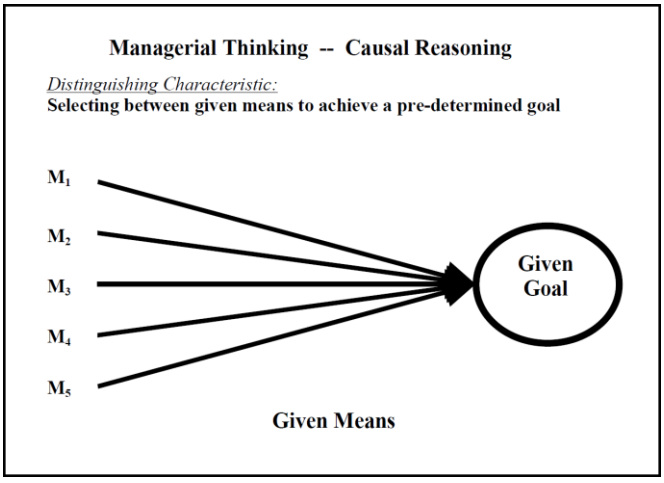

Figure 8 – Causal reasoning
Source: Sarasvathy (2001a, p.2)

While causal reasoning may engage creative thinking (e.g., creation of additional alternatives, strategic thinking, see Figure 9), effectual reasoning is intrinsically creative. While both causal and effectual reasoning call for domain-specific skills and training, effectual reasoning often demands more – imagination, spontaneity, risk-taking, and salesmanship (SARASVATHY, 2001a). According to Sarasvathy, causal and effectual problems may differ as well. In Sarasvathy words:

> Causal problems are problems of decision; effectual problems are problems of design. Causal logic helps us choose; effectual logic help us construct. Causal strategies are useful when future is predictable; goals are clear and environment is independent of our actions; effectual strategies are useful when the future is unpredictable, goals are unclear and the environment is driven by human action. (SARASVATHY 2008, p.73)

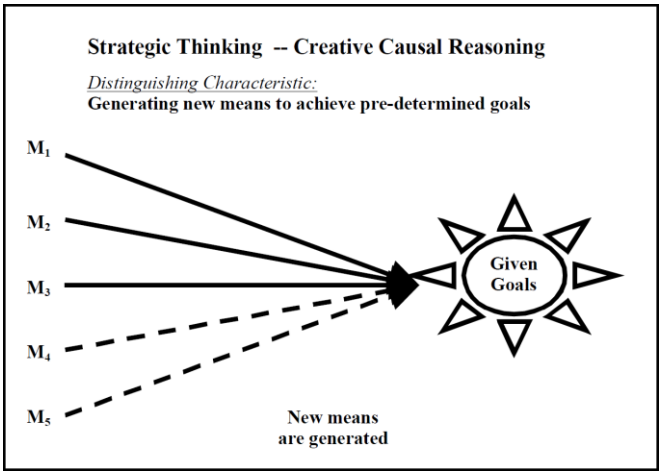

Figure 9 – Creative causal reasoning
Source: Sarasvathy (2001a)

Sarasvathy (2008) points out three fundamental elements of *effectual problem* space: (1) *Knightian* uncertainty: it is impossible to calculate probabilities for future consequences; (2) goal ambiguity: preferences are neither given nor well ordered; (3) isotropy: it is not clear what elements of the environment to pay attention to and to ignore.

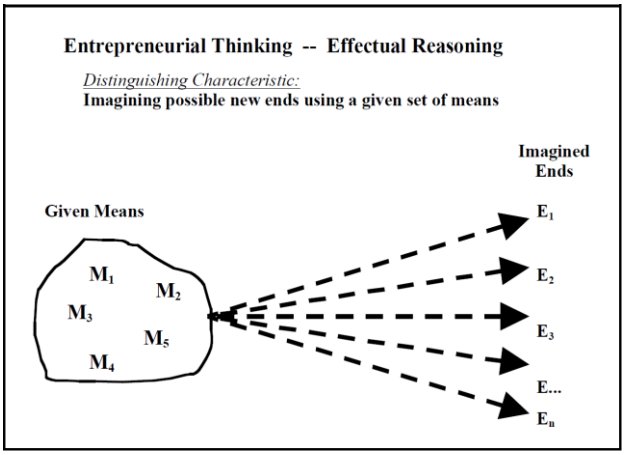

Figure 10 – Effectual reasoning
Source: Sarasvathy (2001a)

Whether to invest or not in an innovation project is often an effectual problem. As graphically illustrated in the Figure 10, effectuation reasoning is an alternative *process* to cope with the question at the micro-level of what do to when faced with a problem space as above, that could be a new venture creation or, as we argue, an innovation project investment. Sarasvathy states that mainstream theories on entrepreneurship and innovation management would indicate that

> the best we could do to advise entrepreneurs or managers facing an effectual problem – as defined above – is to take his best guess about future events, to have faith in his vision or trust his intuition, to persist with the opportunity they perceived, and to build charismatic leadership skills that would enable them to persuade others to join the idea and follow through to eventual success. (SARASVATHY, 2008, p.72)

Table 7 summarizes the differences between causation and effectuation logics as presented by Müller (2010).

Table 7 – Differences between Causation and Effectuation Logic

Dimension	Causation Logic	Effectual Logic
View of the Future	Predictive: Causation logic frames the future as a continuation of the past. Accurate prediction is both necessary and useful.	Flexible, Emergent: Effectual logic frames the future as shaped (at least partially) by willful agents. Prediction is neither easy nor useful.
Opportunity Discovery	Rational search and evaluation process	General aspiration, Gut-feeling/Intuition
Basis for taking action / Opportunity Exploitation	Goal-oriented: goals, even when constrained by limited means, determine sub-goals. Goals determine actions, including which individuals to bring on board.	Means-oriented/Experimentation: goals emerge by imagining courses of action based on given means. Who comes on board determines what can be

		and needs to be done (and not vice versa). Emphasis on strategic alliances and pre-commitments.*
	Business Planning (BP) is a step-by-step rational process; following stringent market analysis and competitive analysis	Business Planning (BP) is abstract and adaptive; focus on short-term experiments / trial-and-error
Dealing with Risk	Highest expected returns	Affordable loss principle

*According to Chandler et al. (2009) "pre-commitments and strategic alliances" is a shared dimension with the causation process, since this concept overlaps with the causation construct.
Source: Adapted from Müller (2010)

2.3.2 Effectuation reasoning: the process

Causal process starts by carefully defining the goal, planning resources and actions, and calculating the risks and returns of a new endeavor. After, it goes on to execution, where activities are led as close as possible to what was initially planned. At every stage the planning is updated and new projections are made to keep track of future events in order to adjust possible deviations or overcome obstacles. Causal process is based on a sequential progression from idea to: market research, financial projections, team, business plan, financing, prototype, market and exit. This progression should be made with caution knowing that surprises will happen along the way (SARASVATHY, 2001).

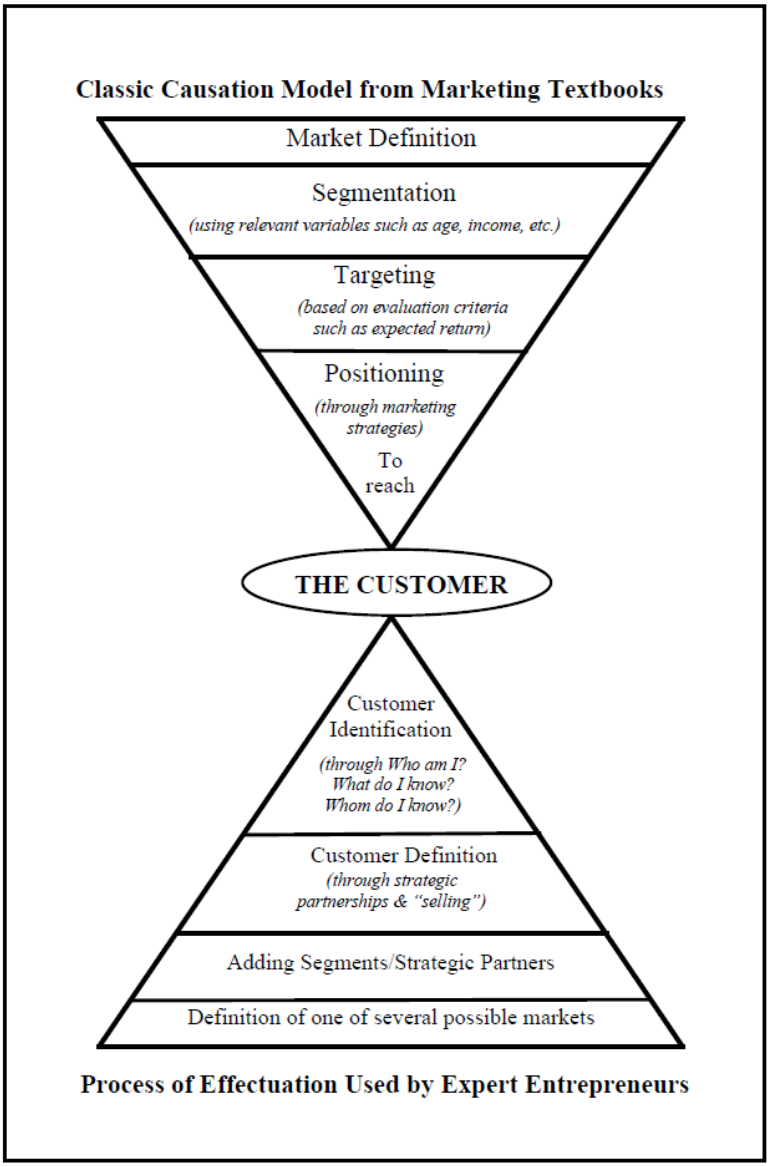

Figure 11 – Processes of effectuation used by expert entrepreneurs
Source: Sarasvathy (2001a)

On the other hand, effectual process starts with the available means. The *effectuator* starts by asking (1) who I am: his characters, perceptions and skills; (2) what I know: his education, training, expertise, and experience; and, (3) whom I know: his social and professional networks. With these means at his disposal, the effectuator begins to imagine and implement possible effects that can be created with them. Frequently, he starts very small with the means that are closest at hand, and move practically directly into action without any sophisticated plan. Unlike causal reasoning that starts by thoughtful planning and subsequent execution, effectual reasoning "lives and breathes" execution. On Sarasvathy words:

> Plans are made and unmade and revised and recast through action and interaction with others on a daily basis. Yet at any given moment, there is always a meaningful

> picture that keeps the team together, a compelling story that brings in more stakeholders and a continuing journey that maps out uncharted territories. (SARASVATHY, 2001, p.3)

As the result of an action, the effectuator's set of means and consequently the set of possible effects take shape and get combined into clearly feasible and desirable goals. At this point, entrepreneurs envisage discernible paths emerging from the vagueness (SARASVATHY, 2001). Effectuators discern that unexpected events during an endeavor are not defects or malformations; instead they are expected to appear as the norm and the response of the reality from which they learn to forge their way in shadowy setting. Figure 11 graphically depicts and contrasts the causal marketing process with the effectual one.

2.3.3 Effectuation reasoning: the principles

Effectual reasoning principles are tied together into a comprehensible logic that assures it is a credible alternative to causal rationality. Causal reasoning is based on the logic "to the extent that we can predict the future, we can control it" (SARASVATHY, 2001, p. 6). This explains why both scholar and managers place massive effort and resources on developing predictive models. Effectual reasoning, conversely, is based on the logic "to the extent that we can control the future, we do not need to predict it" (SARASVATHY, 2001, p. 6). Effectuation provides a methodological alternative for situations in which future is unpredictable and human action can actually change its course. Sarasvathy (2001b) explores three principles: *affordable loss*; *strategic partnership*, and *leveraging contingencies*:

> While causal reasoning focuses on expected return, effectual reasoning emphasizes *affordable loss*. While causal reasoning depends upon competitive analyses, effectual reasoning is built upon *strategic partnerships*; and while causal reasoning urges the exploitation of pre-existing knowledge and prediction, effectual reasoning stresses the *leveraging of contingencies* (SARASVATHY, 2001b, p.5).

The *affordable loss principle* states that while managers are trained to focus on maximizing returns by selecting optimum strategies and to analyze the market and select target segments with the highest potential return and lowest risks, effectuators begin with a determination of how much they are willing to lose. They tend to find ways to reach the market with minimum spending of resources. Effectuators do not bond themselves to any hypothesized or preexistent "market" for their idea. Instead, they are open to surprises as to

which markets they will ultimately end up building their business in or even which new markets they will end up creating. Effectuators use the very process of erecting the venture to bring other stakeholders on board and creatively leverage the resources available. At each stage of the process they choose options that create more options in the future. The estimate of affordable loss does not depend on the venture, but varies depending on the entrepreneur current financial condition and psychological appraisal of their commitment in terms of worst-case scenario. By this means, effectuators nullify the role of uncertainty in early-stages decisions.

As for the second principle, *strategic partnerships principle*, Sarasvathy (2001a) explains that effectuators focus on building partnerships rather than on doing a methodical competitive analysis. Since effectuators tend to start the process without assuming the existence of a predetermined market for their idea, detailed competitive analyses do not seem to make any sense to them at the early phase. Instead, effectuators emphasize alliances and previous committment from stakeholders based on preselected ventures or ventures goals, allowing them to actively participate in the shaping of the enterprise. In fact, the strategic partnerships principle combined with the affordable loss principle is crucial to effectual logic and has vital ramifications for the concomitant creation of markets and firms. Commitment from key stakeholders helps to reduce uncertainty by contracting along certain dimensions for the future, and as the stakeholders operate on those contracts and the network grows, the future starts to resemble the contracts agreed upon. Finally, since the effectuator is not committed to any particular market for their idea, the expanding network of strategic partnerships determines to a great extent which market or markets the company will eventually end up in (SARASVATHY, 2001b)

Finally, at *leveraging contingencies principle* it is explained that effectuators are able to turn the unexpected into the rewarding. Causal models usually aim to avoid the unexpected or to achieve predeterminate goals in spite of contingencies, it tends to focus on the avoidance of surprises as far as possible. Nevertheless, great entrepreneurial firms are often the result of contingencies. Effectuation, on the other hand, is about exploiting those contingencies. The realization that not all surprises are bad and that surprises, whether good or bad, can be used as inputs into the new venture creation process differentiates effectual reasoning from causal reasoning. Because effectuators often begin with only a very loose notion of their goals, they can make up their plans in an incremental way, utilizing uncertainty and contingent information as a resource for their goals rather than relying on goals as determining factors and resources acquisition and choice. Decision makers therefore

accumulate and take advantage of path dependencies in the effects they choose (SARASVATHY, 2001).

2.3.4 Dynamics of the effectual process

According to Sarasvathy (2008) either

> "new markets *exist* in some theoretical sense and firms enter them through a variety of exploratory strategies, or new markets *emerge* as a result of technological and institutional evolution of populations of firms engaged in adaptive processes of exploration and exploitation within a changing competitive landscape" (SARASVATHY, 2008, p.98).

When proposing the effectuation theory, Sarasvathy re-examines the big-picture philosophy of a preexistent universe of every possible market as the micro-foundation for action. Sarasvathy postulates a new micro-foundation based on the idea that "human action transforms current realities into new possibilities" (SARASVATHY, 2008, p.100).

Sarasvathy (2008) began developing a dynamic model of effectuation by thinking through an alternative philosophical basis on the exploration-exploitation paradigm for the creation of new markets. This dynamic model, graphically represented in Figure 12, illustrates how an entrepreneur actor begins questioning "who he is", "what he knows" and "whom he knows" and start by doing what he *can* do and believe is worth doing. One of the very things he does is to interact with other people and sets in motion a network of stakeholders. Some of whom will make commitments that on one hand will increase the resources available to the network, and on the other, will constrain future sub-goals and goals that get embodied into particular features of the artifact. Assuming the network keeps growing and is not dissolved due to exogenous shocks or fatal conflicts within its ranks, the pool of constraints converges into the new market or other effectual artifacts.

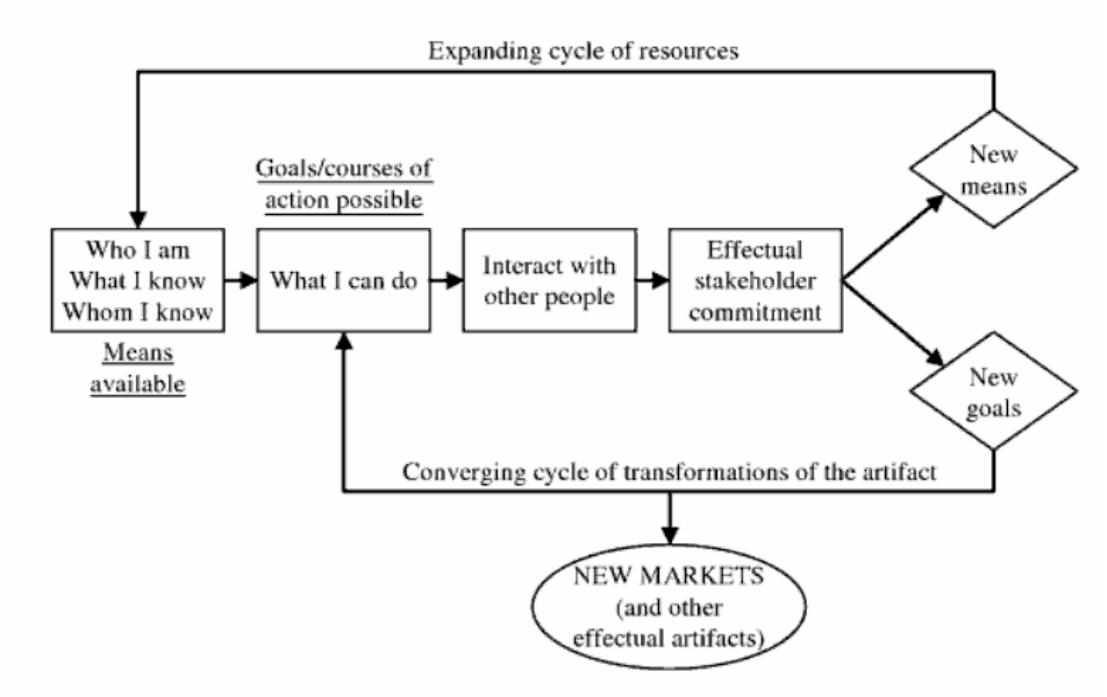

Figure 12 – Dynamic model of effectuation
Source: Sarasvasthy 2008 p. 101

At the heart of this dynamic model is the notion of an *effectual commitment*, which, according to Sarasvathy (2008), has some important characteristics. First, it emphasizes aspects that are controllable about the future and about the external environment, regardless how predictable they are, and it avoids analytical information that cannot be compressed into controllable aspects. Second, each effectuator commits only what he can afford to lose, and not what may be calculated as necessary to achieve target returns or outcomes. Third, the goal of the network is determined by those who make actual commitments and by what they negotiate; preexistent goals do not determine who comes on board. Fourth, as the means available to the network increase, goals become increasingly constrained. It means that what the artifact can look like becomes solidified over time even as the many ways of making it look like what the stakeholders want it to be become possible. Finally, the key to the process is not *selection* among alternatives (alternatives ends or means), but the *transformation* of existing realities into new alternatives. (SARASVATHY, 2008, p.109)

2.4 Relating Open Innovation and Effectuation

As mentioned before, Sarasvathy develop the effectuation theory in the field of entrepreneurship. However, it was promptly applied in other specific decision-making problems such as corporate management, economics, psychology, finance and, more lately, to R&D management (KUEPPER, 2009). As explained by Sarasvathy (2008), entrepreneurship is a particular application of effectuation. More generally, she states that effectuation is about the creative process that focuses on the human action as the "predominant factor shaping the future" (SARASVATHY, 2008, p.94) and can be extensively defined as a "general theory of decision making in uncertain situations" (SARASVATHY, 2008, p.254).

Effectuation prefers control over prediction and offers an alternative method of creating new artifacts under unpredictable circumstances. According to Kuepper (2009), these aspects make effectuation promising and particularly suitable to form a conceptual basis in the R&D management since according to him, R&D projects falls often in the criteria of effectual problems and can be considered a specific decision-making problem (DEWAR; DUTTON, 1986). Kuepper (2009) recapitulates effectuation in five key principles and apply them to the context of R&D projects. The first three principles are useful before as a preparation process for decision before starting project. The manager has to decide whether or not to implement the R&D project and which option to pursue. The last two principles are related to the implementation of an R&D project.

The five principles of effectuation are defined by Kuepper (2009) in the context of R&D projects as following: (1) *Means vs. goals principle*: effectual R&D approach starts on the basis of given resources and competences and emphasizes creating a new outcome on the basis of an existing mean; (2) *Affordable loss vs. expected returns principle*: decision maker has to define how much he is willing to lose in a worst case scenario by making in-advance commitments of how many resources he is willing to put at risk; (3) *Reduce vs. identify uncertainty*: effectual R&D approach will focus on forming partnerships and getting commitments from potential customers, suppliers or external groups of researchers in order to reduce project uncertainties, a causal approach will focus on identifying risk and avoiding the unexpected during the planning phases of the project; (4) *Acknowledge vs. overcome the unexpected*: effectuation considers surprises to be a vital source of opportunities. A causal approach follows a linear process that seeks to reach the given project target as efficient as possible and within the given timeframe, and (5) *Create vs. exploit opportunities*: human

agency is considered to be the prime driver of future developments. This has significant implications on the overall organization of the R&D process. A conventional causal approach is characterized by the assumption that future developments and existing trends are exogenously given. Thus, these trends cannot be influenced but can be exploited by through previsions and early assimilation.

Table 8 summarizes the differences between causation and effectuation principles applied to R&D projects.

Table 8 – Causation and Effectuation Principles on R&D Projects

Principles	Causation	Effectuation
Principle 1: Means vs. goals	R&D approach driven by given project targets	R&D approach driven by given means
Principle 2: Affordable loss vs. expected returns	R&D approach guided by expected project returns	R&D approach guided by in-advance commitments to what one is willing to lose
Principle 3: Reduce vs. identify uncertainty	Existing uncertainty identified and avoided through market and competitor analyses	Existing uncertainty reduced through partnerships and pre-commitments of stakeholders
Principle 4: Acknowledge vs. overcome the unexpected	Contingencies/surprises avoided or quickly overcome to reach given project targets	Contingencies/surprises seen as source of opportunities
Principle 5: Create vs. exploit opportunities	Development/trends seen as exogenously given that can be exploited by use of forecasts	Human agency seen as prime driver of future developments

Source: Adapted from Kuepper (2009)

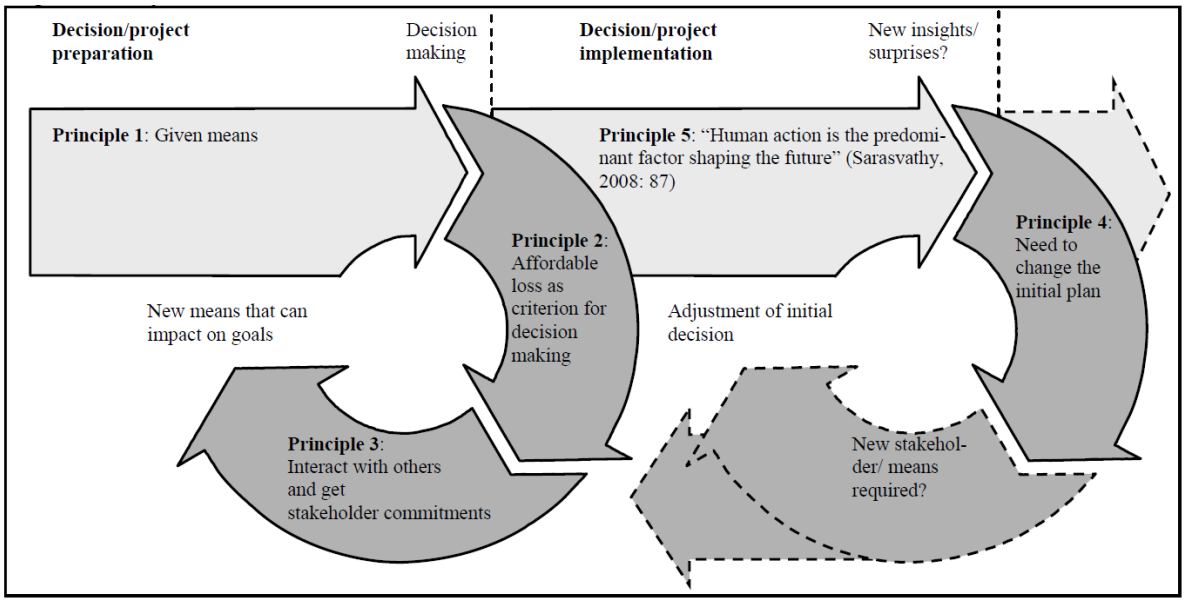

Figure 13 – Dynamic model of effectuation applied to R&D projects
Source: Kuepper (2009)

Coherent with Sarasvathy works, Kuepper acknowledges that effectuation is a dynamic nonlinear approach also when applied to R&D management. In his model, given means are the starting point of an effectual R&D approach. Commitments concerning the affordable loss as well as commitments from stakeholders enlarge the decision scope and form a framework that leads to a converging process. The sum of the existing means and committed resources are the basis for the decision-making and for refining project goals. After having decided about the project option (causal or effectual) that shall be pursued, the principles 4 and 5 guide to an iterative implementation process. New insights and surprises can lead to an integration of new stakeholders that again bring in new ideas together with new commitments. Figure 13 describes a dynamic model of effectuation also applied to R&D projects developed by Kuepper (2009).

The work developed by Kuepper (2009) provides us with insights that enable us to relate open innovation practices to effectuation reasoning. As mentioned before, Chesbrough (2006a) argues that a possible explanation for manager to reject external sources of technology is that external sources of technology contribute to the risk perceived by top managers and, even worse, if an externally acquired technology is successfully absorbed, it might be deduced that internal R&D staff is not performing well. This indicates that the use of open innovation is moderated by risk assessment and mechanisms of compensation.

Moreover, Chesbrough (2003) contrasts open innovation with closed innovation in which companies' target its internally developed innovations to its current business "like in a chess game". In this case, the assumption is that companies can plan their R&D project for an existent and preconceived market opportunity that they know the rules, what the costumers need, and what they have to do to succeed. In an open innovation approach, companies would be rather focusing on innovation projects that have to deal with both technical and market uncertainty "like in a poker game", where manager do not know all the information in advance and have to decide whether to spend additional money to stay in the game so as to see the next card (CHESBROUGH, 2003).

While we agree that closed innovation R&D projects (no external stakeholder during its implementation) can be classified as causal problems, we understand that not all open innovation practices implies in both technology and market uncertainties that would characterize them as effectual problems. This means, external collaboration might characterize an R&D project as an open innovation practice but is not sufficient to characterize it as an effectual problem. Also, it is important to distinguish open innovation from R&D project. Open innovation might include other business practices besides R&D,

such as business models, value chain integration, new business creation, mergers and acquisitions, technology transfer etc.

As described before, we proposed to divide open innovation practices depending on its focus. Category I of open innovation practices presume the preexistence of knowledge, technologies or ideas outside the firm that must be located and retrieved. Category II, in opposition, indicates that new knowledge, technologies or ideas could be co-created among external stakeholders as defined in effectual networks. We might infer that category II open innovation practices will often constitute effectual problems.

Taking a different approach, we can also relate open innovation to effectuation by the existing relation that we come across in the literature of entrepreneurship and innovation management. Sarasvathy (2008) argues that in the neoclassical economics the entrepreneur had no room, but according to the three Knigthian uncertainties categories[1], entrepreneurs are needed to take on the type in which the future is unknowable and its very instances cannot be even classified. Innovative entrepreneurs and corporate managers often find that introducing new technologies or business models into the market is not a question of generating detailed market analysis and forecasts (SARASVATHY, 2008). Instead, entrepreneurs and managers recognize that in many cases what markets will turn out to be and what kind of new markets will come into existence is very difficult and sometimes impossible to predict.

Christensen (1997), Minztberg (1994) and others have documented a wide variety of cases that illustrate this unpredictability in business. This volatility of the market is related itself to the human action. Entrepreneurs and, sometimes, corporate managers play an important role "creatively destructing" market structures. As mentioned before, according to Schumpeter (1949), it is not necessary to have one single person doing all the heroic creative labor to disrupt a market and therefore assuming the entrepreneurial role; entrepreneurship can also be seen, as part of a cooperative entrepreneurship in large firms, with many other actors involved.

With those arguments it is possible to relate firms' (of all sizes) innovation efforts and effectual entrepreneurship. In Sarasvathy (2008) own words:

> A number of scholars in evolutionary economics have articulated the necessity of developing rigorous and useful microfoundations for the discipline (Dosi, 1997; Loasby, 1999). They contend that there is no theory of entrepreneurship/firm

[1] The first Knigthian uncertainty consist of a future with a known distribution and an unknown draw; the second consists of both unknown distribution and unknown draw; and the third consist of a future that was not only unknown, but unknowable even in principle.

> behavior that is consistent with the basic supply-push story of how new markets are created that has been articulated in evolutionary/Schumpeterian economics (Geroski 2003, Klepper and Simons 2000, Rosenberg 1996). (SARASVATHY, 2008, p.119)

Sarasvathy (2008) explains that what emerges from comparing and cumulating the wide range of empirical studies on new market or industry creation is that the results are inconsistent with the micro-theories based on which the data were analyzed. This means, conventional accounts of entrepreneurship and firm behavior do not connect well with conventional accounts of industry creation.

In particular, Sarasvathy (2008) considers at least two stylized facts: (1) consumer preferences are ambiguous and market cannot be created or anticipated. Alternatively, even if we take preferences to be reasonably stable, as Lancaster (1971) and Stigler and Becker (1977) model them, consumption technology is changing, i.e. consumers are learning-by-using a technology, and (2) what consumers want is ill-defined, so there is no well-articulated demand, and therefore no market to be found or predicted (EARL, 1998; GEROSKI, 2003; LANGLOIS, COSGEL, 1993).

In conclusion, Sarasvathy (2008) believes these ideas challenge both the descriptive and prescriptive theories about firm doing market research to predict and innovate to preexistent demand and that abstract demand does not do much to influence the direction of innovation and the creation of new markets, since it cannot. As she expresses:

> At the moment, theories of market process have "black-boxed" this problem by assuming that different entrepreneurs/firms make different guesses about demand (e.g. Geroski 2003). In other words, we have the tautology that variation causes variation. But not only does this not "explain" much about how new markets come to be; it also is falsified by empirical evidence. Entrepreneurs do not "leave it" to differences in tastes or behavior to build markets. They work very hard to make tastes cohere and concurrently to embody them into particular transformations in real artifacts. While not all such artifacts may succeed down the road – i.e. while selection and retention over time may well be evolutionary – almost all variations are non-arbitrary. An effectual logic undergirds the creation of systematic variation. (SARASVATHY, 2008, p.120)

Furthermore, according to Sarasvathy (2008), the basic evolutionary view is that new markets are induced from the supply side based on commercialization of new technology into marketable products. Entrepreneurial firms create a huge amount of product variation around the initial components of a new technology; which implies that the product variation at the birth of markets is large. Different firms do business by delivering different products to the market. The argument that scholars have used so far is that this is a function of the fact that the technology is often new, so it is wide open to innovatory exploration of its various

facets, and that consumer tastes are ambiguous, so different firms make different guesses about what consumers really want. Instead, what we actually observe is an enormous variation. In Sarasvathy words:

> Effectuation illuminates these patterns of variation by showing how bounded rationality, partial knowledge and particular chains of self-selected stakeholder commitments work in concert to stitch together new markets piece by coherent piece. If individuals knew what they wanted (to the degree and precision that a neoclassical economist would like) and/or if the environment maximally constrained what agents could do, new market creation would actually be easier and happen faster than the facts warrant – computational bounds on human cognition notwithstanding. But stitching together patch-by-patch and building coherence commitment by commitment takes the time most markets take to coalesce. Furthermore, the effectual logic at the heart of this intersubjective process is empirically observable, theoretically feasible, and prescriptively useful in telling the troops what to do on the ground. (SARASVATHY, 2008, p.121)

By these reasons, we believe that effectuation can be proposed as solid microfoundations for the decision-making in the open innovation paradigm. Open innovation is the recognition of innovation managers and/or entrepreneurs that not only innovation is not made in isolation, but that inter-organizational cooperation agreements for developing innovation (and/or new markets) cannot be managed based only on causal reasoning (where prediction methods are effective). The more an organization relies on external collaborations to develop new knowledge, technologies or ideas to innovate (that means on resources that the firms does not fully control), the more effectual reasoning seems to be more suitable.

2.5 Theoretical Framework

In the previous sections we presented an overview about theories that we found relevant to our research objectives. In this section we organize these theoretical foundations into a framework that will help us collect and analyze empirical data from the case study. Our objective in building this framework is to extract from the theory what would be expected to be the main decision points for an entrepreneur to startup an organization dedicated to open innovation management or innovation network.

Figure 14 represents a comprehensive innovation process where an idea gains access to the market after being filtered, developed and offered throughout a business model. Commonly, this representation refers to a large organization, and this process is called

corporate innovation funnel. Nevertheless, as argued before, more rarely an innovation is fully developed and placed into the market solely by an individual firm: more and more often the development of an innovation depends on the collaboration of different stakeholders.

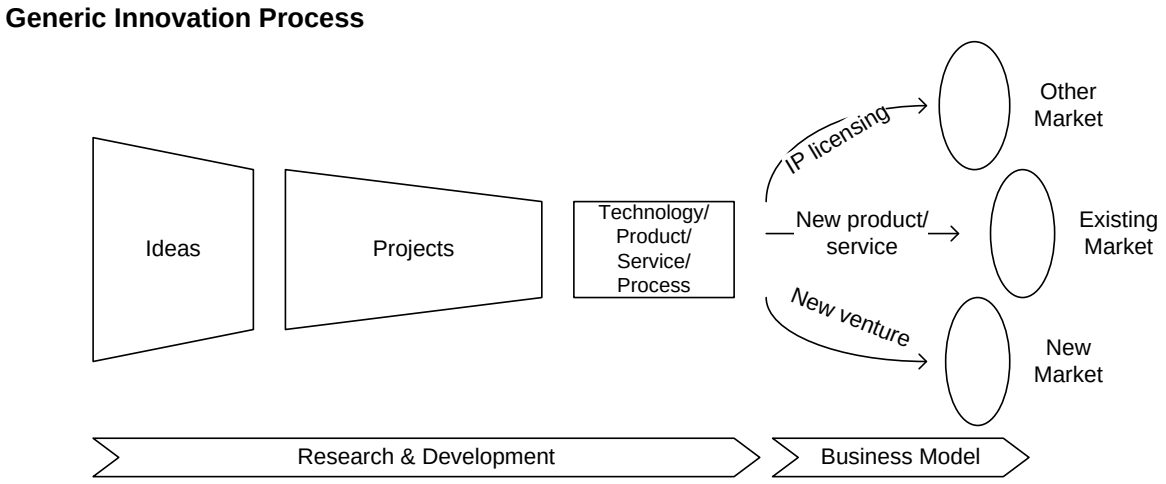

Figure 14 – Generic innovation process
Source: Developed by the author

The genesis of an innovation usually evolves more than one single organization. Although enterprises are the vehicle for innovation to reach the market, ideas are often developed by a group of stakeholders before they become marketable products or services.

Figure 15 illustrates typical stakeholders of an innovation process identifying examples of what are their most common contributions to the process.

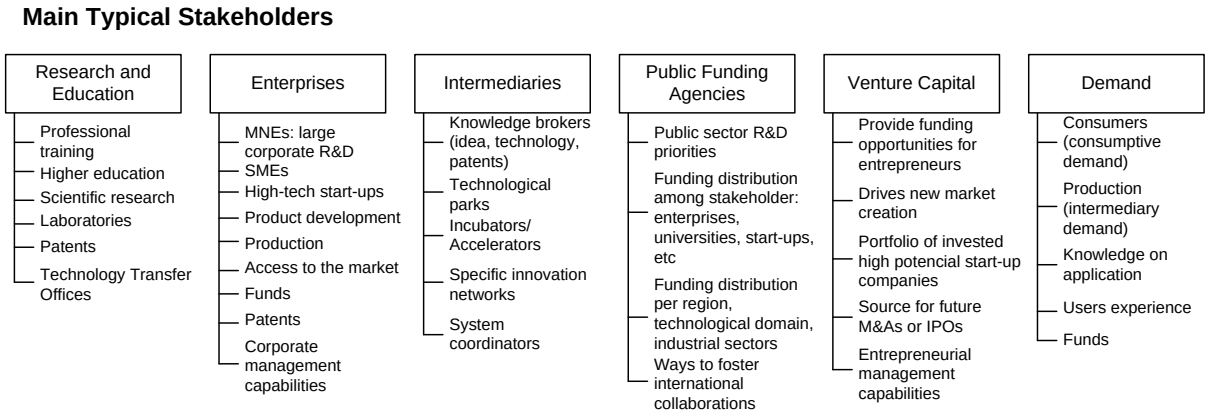

Figure 15 – Main typical stakeholders of an open innovation landscape
Source: Developed by the author

From the point of view of an enterprise, the innovation process can be separated in internal processes and external sourcing as represented in Figure 16. Internal processes commonly found are mentioned as being strategic planning, product development funnel, project management, staff training, IP management, metrics etc. We related external sourcing to open innovation management processes.

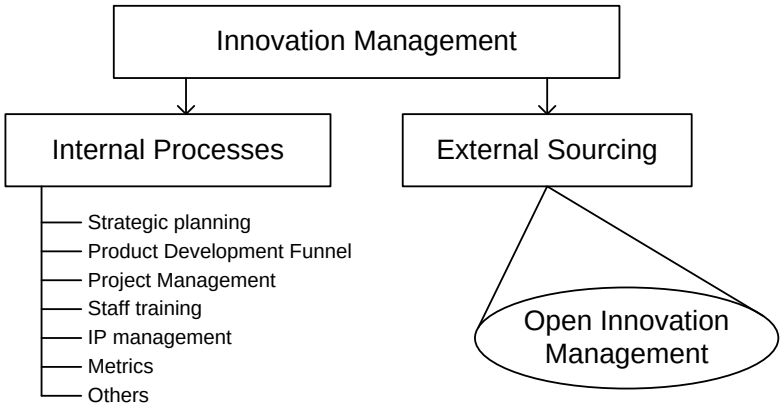

Figure 16 – Internal vs. External innovation management processes
Source: Developed by the author

Definitely, enterprises are the main actors of most modern innovation systems. Nevertheless, the other mentioned stakeholders of the open innovation landscape are likewise crucial actors and it is useful for the purpose of our research to also pay attention to the generic innovation process in their perspective. As depicted in Figure 17, each stakeholder has its own view and participation on the innovation process. A university or research institute, for instance, might be very helpful on the research phase of an innovation project, but is certainly not the best partner when the innovation is ready for commercialization. A venture capital fund might not be interested in funding product-enhancing project of a larger corporation or a well-established medium size company. But, it can be the main funding source for a start-up company to develop a highly innovative technology that can disrupt the market. A technological park might facilitate the collaboration among different partners by concentrating important stakeholders in a same physical address, but might also create closed clusters that can develop lock-in behavior and group thinking. A start-up company might be very flexible and quick in bringing innovative technologies to the market, but might be too small and lack corporate infrastructure to maximize the benefits of an innovation.

Large and multinational companies have been successful in conducting all the innovation process from idea creation to research, development, deployment and

commercialization. However, as we saw before, many reasons have forced even large firms to rely more intensively on external collaboration in order to maintain their innovative efficiency in a more complex competitive environment promoted by globalization and knowledge distribution.

Stakeholder view of the Generic Innovation Process

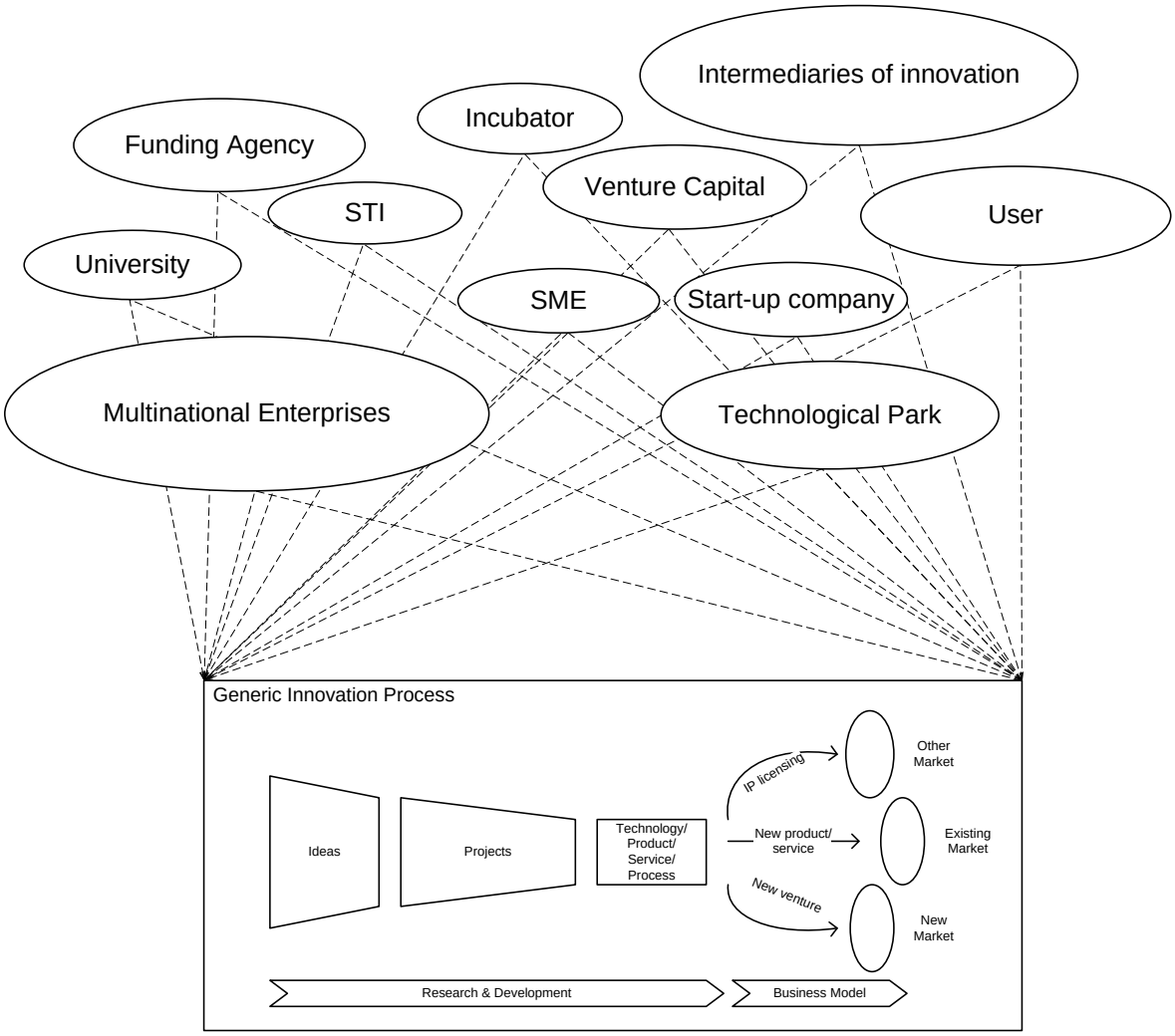

Figure 17 – Stakeholders view of a generic innovation process
Source: Developed by the author

As represented in Figure 18, stakeholders commonly interconnect to each other to collaborate in different manners across the innovation process. For that reason, we argue that it is not wrong to refer to their managerial practices for collaboration as innovation management practices.

Stakeholders interconnection for innovation

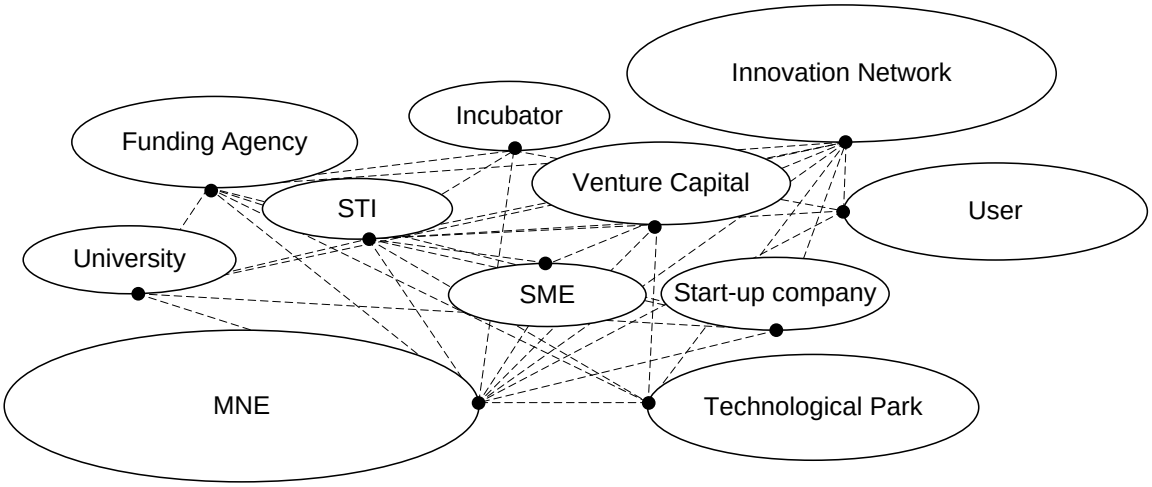

Figure 18 – Stakeholders interconnection for innovation
Source: Developed by the author

As mentioned before, originally, open innovation referred to the opening up of the innovation process performed by large organizations and quickly other studies have demonstrated how open innovation also applies in SMEs. In our framework, we will refer to open innovation management as the managerial practices each stakeholder maintains in order to interconnect and collaborate for the development of innovations, as shown in Figure 19.

Open innovation management

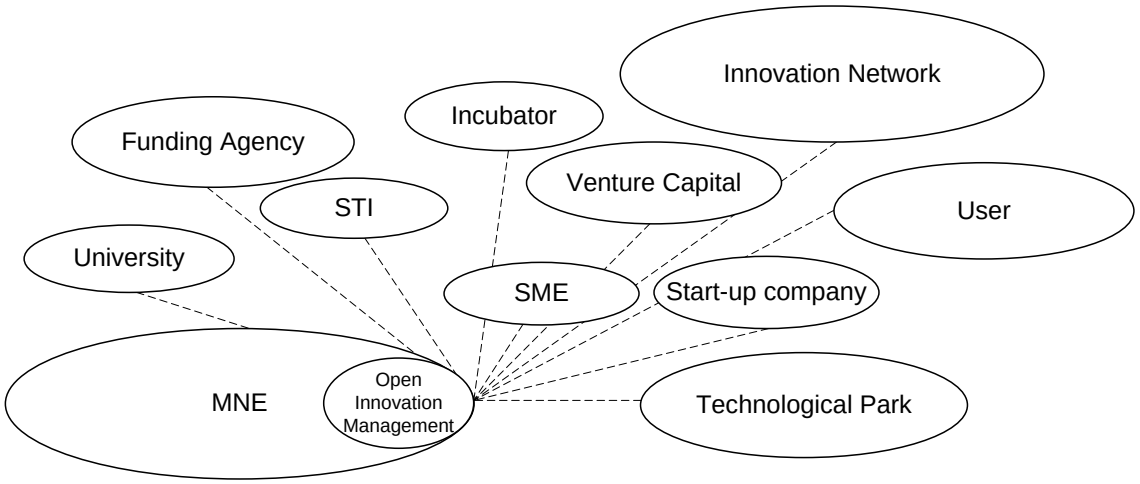

Figure 19 – Stakeholders open innovation viewpoint
Source: Developed by the author

Taking into account our theoretical reference, Table 9 summarizes the main open innovation practices in the point of view of an enterprise.

Table 9 – Open Innovation Management for an Enterprise

Modes of open innovation practice for an enterprise			
Outside-in process	**Inside-out process**	**Coupled process**	Gassmann and Enkel (2004)
Integrating external Knowledge, Customers and Suppliers	Bringing ideas to market, selling/licensing IP and multiplying technology	Couple outside-in and inside-out process, working in alliances with complementarities	
Acquisition/Spin-in with/out VC Contract R&D, in-licensing Inward technology transfer	Spin-out/off with/out Internal VC Fund Out-licensing Outward technology transfer	Joint development, joint-venture, strategic alliance, networking	OECD (2008)
Mode	**Exploration (R&D)**	**Exploitation (commercialization)**	Lee *et al.* (2010)
Customer-provider Strategic alliance Inter-firm alliance	Funding, licensing, outsourcing R&D partnership, joint-ventures Network	Outsourcing Partnership Network	
	Technology exploitation	**Technology exploration**	Van de Brande *et al.* (2009)
	Venturing Outward IP licensing Employee involvement	Customer involvement External networking External participation Outsourcing R&D Inward IP licensing	

Source: Developed by the author adapting the cited literature

As mentioned before, network failures are one of the causes of systems of innovation failures. Relationships between organizations in innovation systems are not self-evident and may need to be triggered and supported. Without proper managerial processes, inter-organizational collaboration will frequently fail. Intermediaries of innovation have become more common and more relevant in modern innovation systems. Figure 20 presents a number of examples of organizations that serve as stakeholder coordinators or as we call in this study, *open innovation management organizations* (OIMO).

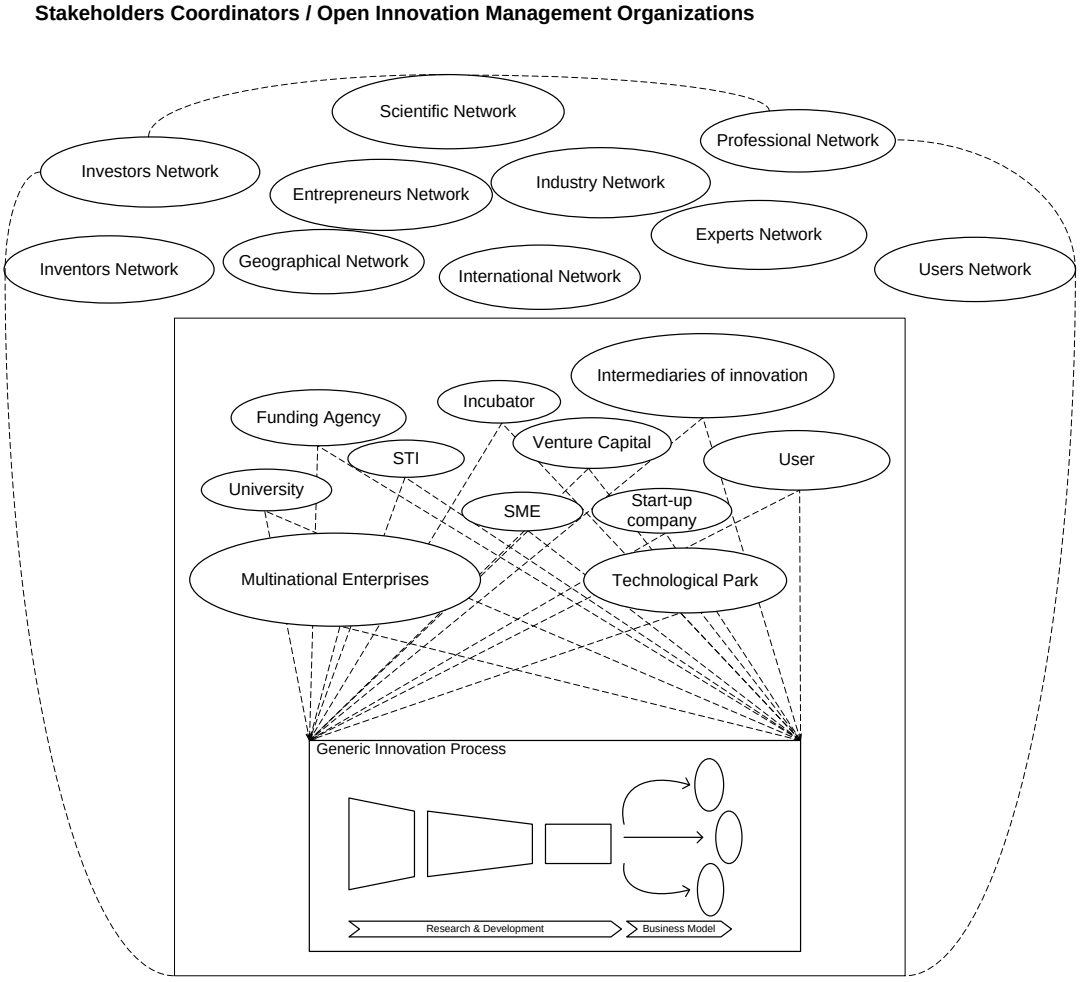

Figure 20 – Stakeholders coordinators of OIMOs
Source: Developed by the author

In an attempt to understand what are the most common open innovation practices adopted by all stakeholders involved in innovation processes, and taking into account the discussion above, we present in Table 10 for each of the stakeholders previously mentioned their respective main innovation management processes.

Table 10 – Innovation Management in Different Types of Organizations

Organization	Business Model	Key Innovation Management Processes
Enterprise	Revenues from a product or service	• Innovation development funnel • Internal innovation processes • External sourcing processes
University and Research Institutes	Endowments, tuition, grants and royalties from patents	• Contracted research with innovation focus • Co-development with industry • Technology transfer though training, licensing or spinouts companies

Organization	Business Model	Key Innovation Management Processes
Technological Park	Endowments, membership fees	• Attracting and fostering the interaction of different types of stakeholders in a same physical environment • Setting up of collaborative frameworks • Selection and monitoring of residents in the technology park
Start-up Incubator	Endowments, membership fees	• Attracting and fostering the interaction of start-ups companies in a same physical environment • Setting up of collaborative frameworks among them and external partners • Selection and monitoring of residents in the incubator
Public funding agencies	Public funds	• Selection of projects for funding in prioritized technological domains, regions, industry sector • Monitoring of outcomes
Venture Capital	Exit from investments	• Selection of entrepreneurs for investing in prioritized businesses opportunities • Monitoring and advising invested companies • Networking for developing invested companies • Definition of an exit strategy for investment
Open innovation management organization	Revenues from services, membership fees	• Fostering the interaction of its members among themselves or with external partners to trigger and coordinate inter-organizational collaboration

Source: Developed by the author

As a conclusion, there is an abstract *generic innovation process* that is mainly conducted by enterprises and often in cooperation with different stakeholders. Each stakeholder has its own perspective of the entire generic innovation process and relates to it performing a fraction of this process. Thus, it can be said that these stakeholders also perform *innovation management processes*. Open innovation is usually understood as a practice to be adopted by companies that have opened up their innovation management process to external sourcing. Nevertheless, the recent proliferation in the number of companies opening up to external sources is producing a response from the system and *intermediate markets for innovation* are emerging. The coordination of stakeholders is not self-evident and new

organizations have emerged to fill this gap. Is this work, as mentioned before, we are calling them *open innovation management organizations*.

The OIMO we characterized here, could be categorized as innovation intermediaries as described in 2.2.2, but since there is yet little understanding of all the different types of intermediates, we rather give them this name instead of trying to fit them in another definition. OIMOs are independent open innovation management organizations that coordinate cooperation among different stakeholders independently of their business model, they are neutral in regard to the institutions executing project or implementing innovation. This means, a OIMO does not focus in performing research, development or commercialization activities but on the innovation process itself at the management level.

Having defined what is an OIMO and what it does, now we need to define what are the main steps and dimensions for setting up a new OIMO. Presumably, the main questions before creating such an organization should be what would it be: its mission, main objective, public to be addressed, sources of revenues, region to operate, organizational model, main managerial processes, the staff and the initial investments needed.

Typically, this new organization will have as its mission the fosterage of interactions among its participants in order to produce new ideas. Eventually, these ideas shall become projects. Projects shall find funding to be executed and produce concrete results (or artifacts) that could be the setting up of new infrastructures (laboratories, demostrators), the training of qualified people, the knowledge created, new technologies, products, services and even new business. As an ultimate goal, the ideas should become business models and the partners involved should benefit from the process by participating in the results of the innovation.

From this perspective, it seems clear that in such a process it could be sometimes impossible to calculate the probabilities for future outcomes, preferences are neither given nor well ordered and it is not clear what elements of the environment to pay attention to and to ignore, as suggested by Sarasvathy when defining effectual problems. Therefore, we argue that the setting up of OIMOs might be an effectual problem once potentially it possesses the its three fundamental elements, namely: Knightian uncertainty, goal ambiguity and isotropy.

As Kuepper (2009) has proposed to the context R&D projects, we developed Table 11 which presents for each effectuation principle identified in the case of R&D project a number of questions that will help us formulate the instrument for data collection in our research adapted for OIMO, i.e. on open innovation management situations.

Table 11 – Decision-Making Process for Starting-Up an OIMO

Decision-making process for starting up an Open Innovation Management Organization		
Principle	**Effectuation**	**Causation**
1) Means vs. goals	1) Our OIMO was defined on the basis of given means/resources 2) The target of our OIMO was vaguely defined in the beginning 3) Given means and resources have been the starting point for OIMO 4) The process converged towards the OIMO targets on the basis of given means/resources 5) Rather given means than concisely given OIMO targets have been the starting point for the organization 6) The OIMO specification was predominantly based on given resources 7) Given means have significantly impacted on the framework of our OIMO	Our OIMO was specified on the basis of given targets The target of our OIMO was clearly defined in the beginning Given OIMO targets have been the starting point Required means and resources have been determined on the basis of given OIMO targets A concisely given OIMO targets has been the starting point for the organization The OIMO specification was predominantly based on given targets Given project targets have significantly impacted on the framework of our OIMO
2) Affordable loss vs. expected returns	1) Considerations about potential losses were decisive for the definition of an action 2) OIMO budget was approved on the basis of considerations about acceptable losses 3) The selection of an action was mostly based on a minimization of risks and costs 4) We mainly considered the potential risk of the action 5) Decisions on capital expenditures were primarily based on potential risks of losses	Considerations about potential returns were decisive for the definition of an action OIMO budget was approved based on calculations of expected returns (e.g., ROI) The selection of an action was mostly based on analyses of future returns We mainly considered the potential odds of the action Decisions on capital expenditures were primarily based on potential returns
3) Reduce vs. identify uncertainty	1) We tried to reduce risks of an action through internal or external partnerships and agreements 2) We jointly decided with our partners/stakeholders on the basis of our competences 3) Our focus was rather on the reduction of risks by approaching potential partners and customers 4) In order to reduce risks, we started partnerships and received pre-commitments	We tried to identify risks of an action through market and competitor analyses We have taken our decisions on the basis of systematic market analyses Our focus was rather on the early identification of risks through market analyses in order to be able to adopt our approach In order to identify risks, we focused on market analyses and forecasts
4) Acknowledge vs. overcome the unexpected	1) We always tried to integrate surprising results and findings during the OIMO startup process – even though this was not necessarily in line with the original OIMO target	We only integrated surprising results and findings when the original OIMO target was at risk
	2) Our OIMO startup process was flexible enough to be adjusted to new alternatives and opportunities	Our OIMO startup process focused on reaching the project target without any delay

Decision-making process for starting up an Open Innovation Management Organization		
Principle	**Effectuation**	**Causation**
	3) Findings of new opportunities influenced the OIMO target	Findings of new opportunities did not influence the OIMO's target
	4) The OIMO startup planning was carried out in small steps during the project implementation	The OIMO startup planning was basically carried out at the beginning of the project
	5) Despite potential delays in OIMO startup execution we were flexible and took advantage of opportunities as they arose	We first of all took care of reaching our initially defined targets without delays
	6) We allowed the startup process to evolve as opportunities emerged – even though the opportunities have not been in line with the original target	We have always paid attention to reach the initial target
	7) Potential setbacks or external threats were used as advantageous as possible	By the use of upfront market analyses we tried to avoid setbacks or external threats
5) Create vs. exploit opportunities	1) Before starting an action, we did not carry out detailed analyses concerning future trends	Before starting an action, we could identify trends through concise analyses and forecasts
	2) We have rather started a new trend than exploiting exogenous trends	The action was our answer on existing trends
	3) We did not carry out any analyses on future trends because we could control the development and trends in our concerned field of action due to the fact that we and our partners have been the active drivers	We carried out elaborate analyses on future trends because we felt that a better understanding of future trends would give us more control over such developments

Source: adapted from Kuepper (2009)

We adapted the five principles of *effectuation* proposed by Kuepper (2009) in the context of R&D projects to the context of OIMOs as following: (1) *Means vs. goals principle*: effectual OIMOs are started on the basis of given resources and competences, and the target of an effectual OIMO is vaguely defined in the beginning. Causal OIMOs would be specified on the basis of given targets very well defined since the beginning; (2) *Affordable loss vs. expected returns principle*: entrepreneurs of an effectual OIMO have to define how much they are willing to lose in a worst case scenario by making in-advance commitments of how many resources he is willing to put at risk. Entrepreneurs of a causal OIMO would primarily consider potential returns before defining any important action; (3) *Reduce vs. identify uncertainty*: effectual OIMO's entrepreneur approach will focus on establishing partnerships and getting commitments from potential partners in order to reduce project uncertainties. Causal OIMO's entrepreneurs would rather focus on the early identification of risks through different analyses; (4) *Acknowledge vs. overcome the unexpected*: effectual OIMOs consider surprises to be a vital source of opportunities. For causal OIMOs new findings and opportunities that appears along the way do not influence its targets, and (5) *Create vs. exploit*

opportunities: entrepreneurs of an effectual OIMO considers human agency to be the prime driver of future developments. In the case of a causal OIMO, entrepreneurs would rather consider that elaborated analyses on future trends provide them with a better guide of how to decide on their actions.

As a conclusion to this Chapter we presented open innovation and effectuation approaches and theories in order to identify, always focused on our research objectives, how effectuation could provide microfoundations to open innovation management. We developed the concept of *open innovation management organizations* (OIMO) as a particular type of innovation intermediate in which we can observe the decision making approach of R&D and innovation managers. We have developed a theoretical framework relating OIMOs and the principles of effectuation in order to support our research methodology and data collection.

3 METHODOLOGY

In this chapter we present the methodological procedures that will be performed in the research. Here we outline the research type, the research design, the units of analysis, the selected case and the procedures that will be used to collect and analyze the data and results.

3.1 Research Types

A scientific method consists in the systematization of principles and techniques sufficiently general, able to serve the scientific literature production in numerous fields of knowledge. For that reason, one must guarantee that the problem is approached in a valid, reliable and adequate way with the concepts involved in the research. The methodology is fundamental to any kind of research. It assumes that after the clear formulation of the problem by specifying the types of information required, the investigator should prepare a research project in order to define the appropriate conditions for the collection and data analysis (MIGUEL, 2007).

Research projects are divided roughly into two main methodological approaches, the quantitative and qualitative. In both cases, they are characterized by careful effort for the discovery of new information, knowledge, relationships, or verification and expansion of existing concept (GODOY, 1995a). According to Godoy (1995b), in a quantitative study, the researcher conducts its work from a pre-established plan, with clearly stated hypothesis and variables operationally defined. There should always be a great concern with objective measurement and quantification of the results. The focus of the work is on the accuracy. The distortions in the stage of data analysis and interpretation should be avoided to ensure a safety margin regarding the inferences obtained.

On the other hand, qualitative research does not imply the use of sophisticated statistical tools (as needed in quantitative research), does not seek to list and/or measure the events studied, but seeks to obtain descriptive and exploratory data about people, places, and interactive processes through direct contact between the researcher and the situation being studied.

Qualitative research has special value for investigating complex and sensitive issues and it is certainly appropriate to generate information that is very detailed. On a qualitative research, data are often seldom pre-categorized and findings are not straightforward to generalize. Consequently, researches must be very careful about the systematization process of data collection and take steps to ensure validity and reliability in the study. Validity refers to the degree to which a study accurately reflects or assesses the specific concept that the researcher is attempting to measure. Reliability is the extent to which an experiment, test, or any measuring procedure yields the same result on repeated trials (PATTON, 2002).

As pointed by Sarasvathy and Kotha (2001), the entrepreneurial process adopted by organizations in their setting and starting up phase can be unique and, therefore, difficult to be identified and measured. This situation leads to questions like "*How researchers can study a unique phenomenon and, than, generalize it from such situations and circumstances?*" The challenge therefore is to identify the underlying processes and principles of rationality in the creation of new organizations. As suggested by Edmonson and McManus (2007), this challenge is common in the questions raised from newborn theories, typically dealing with new constructs and few forms of measurement. For that reason, qualitative methods of data collection and analysis are more appropriate in efforts willing to construct a suggestive theory, opening the field for future work.

Consequently, we decide to perform a qualitative research mainly due to four main reasons: First of all, the open innovation theory as inaugurated by Chesbrough (2003) has gained a great attention from both practitioners and academic researchers in the last few years; nevertheless, it is still a newborn theory with a wide-open research agenda and little attention was paid until now to its microfoundations. Second, open innovation phenomenon is still varying and mutable. We observe the appearance of new organizations dedicated to open innovation management, which are not fully covered by the mainstream theory; besides, the population is still small. The third reason is that decision-making process in innovation management is still an unfamiliar and uncategorized phenomenon and they are difficult to quantify *per se*. Finally, the presence of the researcher to collect data is required since there is no general theory to precisely assess the proposed research problem. Once we decided to perform a qualitative research we have now to justify which method should be used that better suits our research objective.

3.2 Theory Building From Case Study

Eisenhardt (1989) defines building theory from case studies as a research strategy that involves using one or more cases to create theoretical constructs, propositions and/or midrange theory from case-based, empirical evidence. According to Yin (2009), case studies are empirical descriptions of particular instances of a phenomenon typically based on a variety of data sources. Cases can be used as the basis from which to develop theory inductively. A theory can emerge from case studies in the sense that it is situated in and developed by recognizing patterns of relationships among constructs within and across cases and their underlying logical arguments (EISENHARDT; GRAEBNER, 2007).

Replication logic is crucial to build theory from case studies (Eisenhardt, 1989). In other words, each case serves as a distinct experiment that stands on its own as an analytic unit. Like a series of related laboratory experiments, multiple cases are discrete experiments that serve as replications, contrasts, and extensions to the emerging theory (YIN, 2009). But instead of isolating the phenomena from their context as laboratory experiments do, case studies emphasize the real-world context in which the phenomena occur. The theory building process follows recursive cycling among the case data, emerging theory and existent literature. Although sometimes seen as biased, well-done theory building from cases is remarkably objective, as its close adherence to the data keeps researchers unbiased (EISENHARDT; GRAEBNER, 2007).

According to Eisenhardt and Graebner (2007) a reason that justifies the attractiveness and relevance of theory building from case studies is that it is one of the best of the connections from rich qualitative evidence to mainstream deductive research. Its emphasis on developing constructs, measures and testable theoretical propositions makes inductive case research consistent with the emphasis on testable theory within mainstream deductive research. Actually, inductive and deductive logics are a reflection of one another: while inductive theories are built from cases producing new theory from data, deductive theories complete the cycle by using data to test a previous theory. Furthermore, since it is a theory building approach that is deeply embedded in rich empirical data, building a theory from cases is likely to produce a theory that is accurate, interesting, and testable. Hence, it is a natural complement to mainstream deductive research (EISENHARDT; GRAEBNER, 2007).

In short, we choose to use theory building from case study as our research strategy, because we believe our research question is better addressed by theory building

rather than theory-testing research. Our research question was developed based on two relatively newborn theories in related literature, open innovation (CHESBROUGH, 2003) and effectuation (SARASVATHY, 2001). The research gap identified in open innovation theory is the lack of attention it received by scholars until the present time on its microfoundations. At the same time, effectuation academics are focused on individual entrepreneurial behavior for new business creation rather than on *cooperative entrepreneurship* as proposed by Schumpeter (1949) and performed by employees of large firms while they try to innovate.

We believe also that the nature of our research question justifies the need for inductive theory building. Our research question is tightly scoped within the context of existing theories, and we trust that the qualitative data extracted during our research can offer insights into the complex organizational process focus of this work, an achievement that quantitative data could not easily reveal. According to Edmondson and McManus (2007), theory building research using case study typically answers research questions addressing "how" and "why" in unexplored research areas particularly well, which is exactly the case of our research question.

Once we have decided to perform a theory building from case study, it is important to justify what type of case study we choose to perform.

3.3 Definition of the Case Study

As defined by Yin (2009), a case study is an empirical method that investigates a contemporary phenomenon within a real context, in situations where the boundaries between the phenomenon and the context in which they live are not clearly established. In those studies, multiple sources of evidence are used giving the researcher the opportunity to turn to the multiple dimensions of a problem, focusing on it as a whole. The case studies are an appropriate research strategy when the researcher has little control over behavioral events, when the focus of analysis is restricted to contemporary phenomena and when they are asked questions like "how" and "why" (YIN, 2009).

In general, case studies can be categorized in three main types: explanatory, descriptive and exploratory (BERG, 2001). *Explanatory* cases are used to conduct studies of causal relation. The idea is to identify partners (pattern-matching) in a way that different information from the same case study can be related by a theoretical proposition. *Descriptive*

cases demand from the researcher the presentation of a descriptive theory in order to pre-define with accuracy the unit of analysis to be investigated. *Exploratory* case studies are common to be used as a prelude for a broader future study; nevertheless, it must also be designed based on a theoretical reference. For our research, we choose to perform a descriptive case study, where we aim to identify and describe a decision-making process and a methodology used by entrepreneurs when starting up a new organization dedicated to manage open innovation.

Research based on case studies can be single-case or multiple-cases. The use of single-case is justified in specific circumstances such as in a critical test of an existing theory, under rare or extreme circumstances, if the case is typical or representative, and if the case is longitudinal (two or more points in time) (YIN, 2009). Nevertheless, although single-case research can richly describe the existence of a phenomenon (SIGGELKOW, 2007), multiple-case studies typically provide a stronger base for theory building (YIN, 2009).

According to Eisenhardt and Graebner (2007), the theory is better grounded, more accurate, and more generalizable (all else being equal) when it is based on multiple case experiments. Multiple cases enable comparisons that clarify whether an emergent finding is simply idiosyncratic to a single case or consistently replicated by several cases (EISENHARDT, 1991). Multiple cases also create a more robust theory because the propositions are more deeply grounded in varied empirical evidences. Constructs and relationships are more precisely delineated because it is easier to determine accurate definitions and appropriate levels of construct abstraction from multiple cases. Multiple cases also enable broader exploration of research questions and theoretical elaboration (EISENHARDT, GRAEBNER, 2007).

Yin (2009) declares that in general, there usually is a criticism against single-case studies, which reflects the fear about the peculiarity or the artisanal conditions surrounding the case (for instance, the access to a key-informant). As a consequence, the criticism can become skepticism about the ability of the researcher to perform empirical work beyond what was produced in the single-case study. Thus, he highly recommends the use of multiple-cases and if not, the researcher shall provide a very strong argument to justify the use of a single-case.

Regardless the recommendations above, we decided to perform a single-case study in our research. We justify our choice in the following sections.

3.3.1 Case selection

Cases are not selected as to be a representation of some population as are data in large-scale hypothesis testing research. It is worth clarifying that the purpose of this research is to develop theory, not to test it, and so theoretical (not random or stratified) sampling is appropriate. Eisenhardt and Graebner (2007) explain that theoretical sampling simply means that cases are selected because they are particularly suitable for revealing and extending relationships and logic among constructs.

Cases might be selected because they are highly effective, not effective, representative, typical, or of special interest. Stake (1995) argues that the selection offers the opportunity to maximize what can be learned, knowing that time is limited. Hence, the cases that are selected should be easy and willing subjects and it is preferable that it is selected intentionally to find the objects of study contained in the questions of the research. Before selecting our case we made sure that it would meet the some important requirements that would minimize the risk of not accomplishing our research objectives:

Requirement 1: The organization should have the management of open innovation explicit on its mission.

Requirement 2: The organization should be in the start up phase stage.

Requirement 3: The organization should not have its focus restricted to a single sector or country.

Requirement 4: The organization must not be owned or controlled by a only one larger organization.

Requirement 5: The organization should consider a broad spectrum of collaboration frames among stakeholders. It means, it should not be limited to one or two fixed open innovation processes.

The first requirement refers to the fact that it would be difficult to clearly define whether the organization is an OIMO or not if it does not refer explicitly to it. It must be in its

startup phase because our purpose is to identify an underlying decision making method adopted by the entrepreneurs. For the second requirement, we believe that the period between one to three years of existence is soon enough for a subject to not be forgotten regarding the elements of the startup phase and not too young to not have taken too many relevant decisions to be analyzed.

The third requirement aim to select a case with a higher degree of complexity and eventually a higher level of uncertainty. To lead with more than one sector implies having more generic internal process and less attachment to existent sectorial paradigm of how to manage innovation. International presence implies a number of other challenges such as differences of culture, distance, language and even calendar, which is something that makes it more difficult for the entrepreneurs to have a clear view of future events.

Requirement four is important to avoid organizations that are part of a single governmental entity, larger enterprise or university. OIMOs that depend on bigger organizations would eventually heritage from their mother organization mindsets and behavior that could influence their decision making process and might not allow us to achieve our research objectives.

Finally, requirement five is necessary to assure that we are not choosing as our case an organization that would focus on single relations among entities such as seeker-solver, inventor-investor, industry-university or user-provider. We expect that our selected case would deal with a multi-configuration, multi-institutional and international open innovation arrangements.

With these requirements in mind we selected to be our case a recently founded organization called Swedish-Brazilian Research and Innovation Centre (CISB). CISB has as its mission the creation of a bilateral innovation network between Brazil, a large emerging country, and a developed and smaller European country, Sweden. This context is particularly interesting and contemporaneous. Brazilian government is fostering the consolidation of a solid National System of Innovation and international collaboration for innovation is one of its key policies. Highly dependent on exports, Sweden is facing huge challenges with the stagnation of traditional and mature markets. On one hand, very dependent on commodities, Brazilian economy needs to develop a more competitive and innovative industry. On the other, Sweden needs to find new paths of growth.

Brazilian government is fostering the education of a mass of high-qualified professionals, the creation of technological parks and startup incubators, the increase of private investment in R&D activities, the decrease of the gaps between industry and

academia, the attraction of R&D centers from foreign MNEs and the consolidation of international collaboration. Those policies are inducting (and in some cases even forcing) foreign MNEs to invest in collaborative frameworks with local industry, academia and government. The aim is that innovation is part of the strategy to access and compete in the Brazilian market. Sweden has a very successful experience in building ecosystems for innovation and is often recognized as one of the most innovative countries in the world. It is known for having produced global companies in high technology sectors such as Eriksson (telecommunication), Saab (aeronautics), AstraZeneca (pharmaceutical), and very innovative companies in highly competitive markets such as Tetrapak, Electrolux, Scania, Volvo and Stora Enso.

Although Swedish industry has an important historical footprint in Brazil, collaboration for innovation between the two countries is not yet well explored. Open innovation frameworks, such as the one proposed by the organization chosen to be our case study is a very new type of initiative worldwide. Build, coordinate and manage multi-institutional and international innovation networks is a big challenge and full of uncertainty.

As mentioned before, the number of cases was also a very important concern. Given the complexity of the selected case we decided focus on single-case study rather than a multiple-case. The selected case is an open innovation management organization founded with the support of a group of more than 40 organizations and the financial commitment of six independent organizations. We believed that those aspects offer to the case a potential to obtain generalized conclusions, or even analytic, as explained by Yin (2009).

3.3.2 Justification for the use of a single case

The use of single case studies are very common in the literature, nevertheless, the validity of the knowledge acquired by means of single case study has been questioned. The main critics of this method are against the lack of scientific accuracy, its reliability, and most important, its representativeness. Aiming to present the main possible contributions that single case studies can provide for theory building and practice in business administration, Zanni *et al.* (2011) present different arguments in favor of this methodological approach.

As for representativeness, several authors have refuted the idea that single cases need to provide basis for generalization of the findings for a given population, the so-called empirical or statistical generalization (PLATT 2007; STAKE, 2000). Single cases can offer

different possibilities of generalization, other than the empirical one. Firstly, there is the generalization that can be made by the reader. Enabled by the extensive description of a case, the reader can draw their own generalizations, in its context and based on personal experience. In the literature, we find different nomenclatures for this argument: naturalistic generalization (STAKE, 1982), inferential generalization (LEWIS; RITCHIE, 2003), heuristics generalization (TSOUKAS, 2009) or transferability (HELLSTROM, 2008; LINCOLN; GUBA, 2000).

Another valuable contribution of single cases is linked to the possibility of generalization to the theory. This means that, through an inductive process, it is possible to generate or transform theory. This process occurs when the case allows the joints between the context and constructs, enabling new theoretical constructs (LEWIS; RITCHIE, 2003). There is also the possibility of the case to act in the generation of meaning for the organizations, the extent to which cognition allows an alignment of its members through the construction of shared interpretations (MARCH; SPROULL; TAMUZ, 1991).

Finally, the last two arguments in favor of single cases is the possibility of falsification of the theory, in which a single example may challenge a proposition consolidated (POPPER, 2000; SIGGELKOW, 2007; STAKE, 2000) and generate insights, often associated with the initial moment of a more broad in that seek for empirical generalization (SIGGELKOW, 2007; TSOUKAS, 2009).

Tsoukas (2009) points out that the more researchers are concentrated in understanding the specificities of a phenomenon, the more descriptive they will become and, as a result, they will be more flexible in terms of the existent theories. On the other hand, the more researchers look to situate their study within what is known about the phenomenon of interest, the more he will tend to describe this phenomenon in terms of what has already been defined in the literature.

In that sense, the major theoretical contribution to studies with small samples is to see particular cases as opportunities to subsequent adjustments already crystallized in our understandings of reality. Thus, without the specificity of particular cases, new distinctions are not possible to be made. In social sciences, the main goal is not to seek general laws that are present in the particular case, but allow a better view, a further elucidation (ZANNI *et al*., 2011).

In our research we are very interested in the single case methodological approach due to the possibility of generalizing the theory, meaning that it is possible to contribute to open innovation theory by identifying microfoundations that can be provided by effectuation.

Also, we see an OIMO as a particular case that gives us the opportunity to understand the variance of open innovation practices into a logical framework. Lastly, we aim that our case study will generate meaning to the members, partners, entrepreneurs and management team of the OIMO we chose to study through the construction of shared interpretations. Hopefully this work will help the OIMO to succeed. In this perspective, our case study also seeks to reveals exactly what would be impossible to if we were looking for empirical generalizations: what is unique and specific in our case (ZANNI *et al*., 2011).

Moreover, in another line of argument, an OIMO (as we defined in the Theoretical Framework in section 2.5) are supposedly funded by a group of organizations or individuals. Since the unit of analysis of our research is the decision-making process made by the R&D and/or innovation managers from different and independent organizations involved in the starting up of a new OIMO, a single-case can be generalizable and replicable. The OIMO we selected to be our case was created by a group of 13 entrepreneurs representing eight different organizations (three leading multinational companies, three research institutes, one science park and one governmental agency).

3.3.3 Research propositions

Case studies do not aim to formally test hypothesis. Instead it considers theoretical propositions that will guide the data collection, processing and analyses. As suggested by Yin (2004) propositions are not only useful to keep the research focused on its main objectives, avoiding overwhelming data collection, but also to provide a solid reference for data analysis. We defined six propositions to guide our research, the first five are derived from effectuation principles and adapted to the context of OIMOs and the sixth relates open innovation to effectuation:

> **P1 – Means vs. goals**: open innovation management organizations are rather defined on the basis of given means or resources than on the basis of fixed targets.

> **P2 – Affordable loss vs. expected returns**: open innovation management organizations actions are rather defined considering acceptable losses (costs) and risks rather than expected returns provided by forecasts.

P3 – Reduce vs. identify uncertainty: open innovation management organizations' entrepreneurs try to reduce risk of an action through internal or external partnerships and agreements rather than well-set contingency plans.

P4 – Acknowledge vs. overcome the unexpected: open innovation management organizations startup process is flexible enough to be adjusted to new alternatives and opportunities rather than being focused on reaching the project target without any delay. Open innovation management organizations entrepreneurs allow the startup process to evolve as opportunities emerge, even though the opportunities have not been in line with the original target and potential setbacks or external threats were used as advantageous as possible

P5 – Create vs. exploit opportunities: before starting an action, open innovation management organizations entrepreneurs do not carry out detailed analyses concerning future trends; they rather start a new trend than exploiting exogenous trends.

P6: Open innovation and Effectuation: the more an organization relies on external collaborations to innovate (that means on resources that the firms does not fully control) the more effectual reasoning is suitable.

3.3.4 Research outline

Before being able to outline the present research we went through a pre-research process that included four major steps: observation, identification of the phenomenon of interest, definition of the research problem and the literature review. We begin our research by observing traditionally innovative MNEs of developed countries trying to establish open innovation networks in Brazil, an emergent market with no well-established tradition in industrial R&D. In the last few years, American and European MNEs such as IBM, GE, Microsoft, Saab, Renault, Siemens, Qualcomm, British Gas, Schlumberger, P&G, Kraft, Whirlpool, Ericsson, Volvo, just to mention a few, announced the creation of open R&D centers in Brazil.

The phenomenon of interest was the attention given on these announcements to the search for cooperation with local industry, universities and to raise governmental R&D funds to develop innovation projects. This observed phenomenon seemed not compatible with the idea that if the MNE decides to develop R&D activities in an emerging country, it will be in well anticipated, planned and with unambiguous and clear objectives. Most of the announcements lacked a more structured plan and were many times political responses to local government strengthening and fostering actions, like tax incentives and credit for R&D or protectionist actions such as tax penalties and sectorial regulations to oblige foreign companies to invest in local R&D.

This observation and identification of the phenomenon led us to define if the research problem was valid or not to refer to effectuation as a method for decision-making performed by open innovation managers starting up initiatives in an emerging country.

With this in mind we started our literature review journey. The first literature review objective was to clarify our understanding of the field. We started by researching in three main disciplines of business administration: business strategy, innovation management and entrepreneurship. This process was recurrently conducted until we achieved familiarity with the body of research in our field and practiced sufficient critical thinking to be able to propose a conceptual framework from where we could derive our research methodology and analyses.

3.3.5 The level of analysis

In any area of academic inquiry, there are numerous ways in which the phenomena under study may be defined and settled for systemic analysis purposes. The selection of the micro- or macro-level analyses should not be a matter of methodological convenience. The responsible scholar must be prepared to evaluate the relative utility – conceptual and methodological - of the various alternatives open to him, and to apprise the manifold implications of the level of analysis finally selected (SINGER, 1961).

As summarized above, innovation is at the very least a two-level phenomenon that involves an actor (e.g., an individual, a team, an organization) and the broader environment in which the actor is embedded (e.g., an industry, a sector, a country). Additionally, innovation is practiced within the context of a given set of political and economic institutions (e.g.,

regulation, intellectual properties laws, capital markets). Yet, as Gupta *et al*. (2007) argues, to date, most innovation researchers have tended to focus on one level of analysis, and it is rare that their contributions operate at different levels or that they are considered in combination.

Not surprisingly, little is known about how variables at one level of analysis influence innovation at another level; how variables at different levels of analysis interact to determine the extent and type of resulting innovation; how innovation processes and/or mechanisms can be applied to different levels of analysis; and the degree to which constructs and processes that are part of innovation at multiple levels of analysis share similar antecedents and consequences (GUPTA et al., 2007).

While proposing open innovation as a new paradigm for understanding industrial innovation, Chesbrough (2006a) argues that although the contours of the new model of innovation remains obscure, clearly any adequate understanding will require an externally-focused perspective, involving actions of multiple actors in a far more distributed innovation environment. He recognizes that while such a new model will require close study of the innovation activities of the organization from a multiple level analysis (individual, group, organizational and institutional), open innovation theory building has largely focused on the firm level. Nevertheless, Chesbrough presents open innovation as both a set of practices for firms to profit from innovation and as a cognitive model for creating, interpreting and researching those practices (CHESBROUGH, 2006a). In his research agenda for open innovation, Chesbrough et al. (2006c) propose five relevant levels of analysis: the individual, the organizational, the value network, the industry or sector and the national institutions.

We decided to focus our research on the individual level; i.e., on the entrepreneurs involved in the creation of an open innovation management organization. In line with the research produced by Sarasvathy and Kotha (2001), related to the identification of an effectuation process in an organization, our work also considers the decisions events related to the startup phase of the chosen organization as our unit of analysis. In this sense, case study method is very convenient since it is impossible for the researcher to manipulate the phenomenon being analyzed and at the same time he cannot analyze it without considering its context. Thus, the decision events were analyzed in the context entrepreneurs and organization were embedded.

3.4 Collection, Processing and Data Analysis

According to Yin (2009) there are six possible sources of evidence for case studies: documents, archival records, interviews, direct observation, participant observation, and physical artifacts. Indeed, one of the main strengths of case study is the its ability to deal with a full variety of evidences (YIN, 2009). Case studies do not imply the use of a particular type of evidence and they can be done using either qualitative or quantitative evidence (or both) (EISENHARDT, 1989; YIN, 2009). While quantitative data often appears in case studies, qualitative data usually predominates (PATTON; APPELBAUM, 2003). Yin (2003) argues that the benefits from these six sources can be enlarged if three principles are followed: (1) use of multiple sources of evidence; (2) creation of a case study database, and (3) maintenance a chain of evidence.

In our work we considered the following sources of evidence collected systematically for one year from end of Feb/2011 to beginning of Feb/2012:

a) **Documentation**: as a very important and rich source of evidences, we had access to internal and external presentations, official by-laws (including draft versions), minutes of meetings, selected e-mails exchanges, action plans (including draft versions), annual budget, activities report, press releases, newsletters, appearances in the media in the format of interviews, media articles and news, academic articles, website and information posted in an online platform with access controlled;

b) **Interviews**: as Yin (2009) suggested, interviews were performed as guided discussions between the interviewer and the respondent. Interviews were formally collected along the 12 months in specific occasions, when important events of decision were about to happen. This strategy was used to produce a longitudinal view on time of the events we were focusing on. Questions that oriented our interviews are presented in Table 11 of section 2.5;

c) **Participant observation**: during the period of nine months I worked as a consultant for the entrepreneurs involved in the creation and setting up of the CISB. All of them were representatives of foreign organizations. My mission was to advise on how to establish CISB in Brazil by providing them with information about the Brazilian System of Innovation (identification of potential partners in industry, academia and government for specific projects, identification of funding opportunities, offer of second opinion before they took relevant decisions). This

position gave me special access to respondents and better understanding of the organization. I could conduct interviews and evaluate how they reacted to specific situations where a decision had to be taken, by providing them with information on real opportunities and circumstances.

The processing of data was preformed by the extensive use of notes. Each relevant data collected during the investigation of documents was used as an input to define new guides for new interviews. It was crucial for our data collection strategy to anticipate when an important decision event would take place so we could focus our attention on it and set up interviews with appropriate timing. Easy access to respondents gave us the opportunity to analyze data right after an interview and propose new interviews whenever needed.

Collection, processing and data analysis were made recursively along the period of 12 months. This process enabled us to produce a database, in which throughout previous analyses of documents we selected the relevant events of decision-making on terms of open innovation management practices. This means that the decision event we were interested at should affect the *degree of openness* of the organization or on the previously described open innovation practices. For each event we would define a guide for an interview with a selected group of respondents. This guide was produced having in mind the propositions we established to compare effectuation *vs*. causation approach in the decision making process of the respondent.

3.4.1 Selection of decision-making events

In order to focus on our research objectives we used our theoretical framework to define what type of decision events we should target for the data collection. Figure 21 depicts the logic process of starting up an open innovation management organization and Figure 22 represents the other decision aspects related to strategy and operation.

Figure 21 – Expected start-up phases of an OIMO
Source: Developed by the author

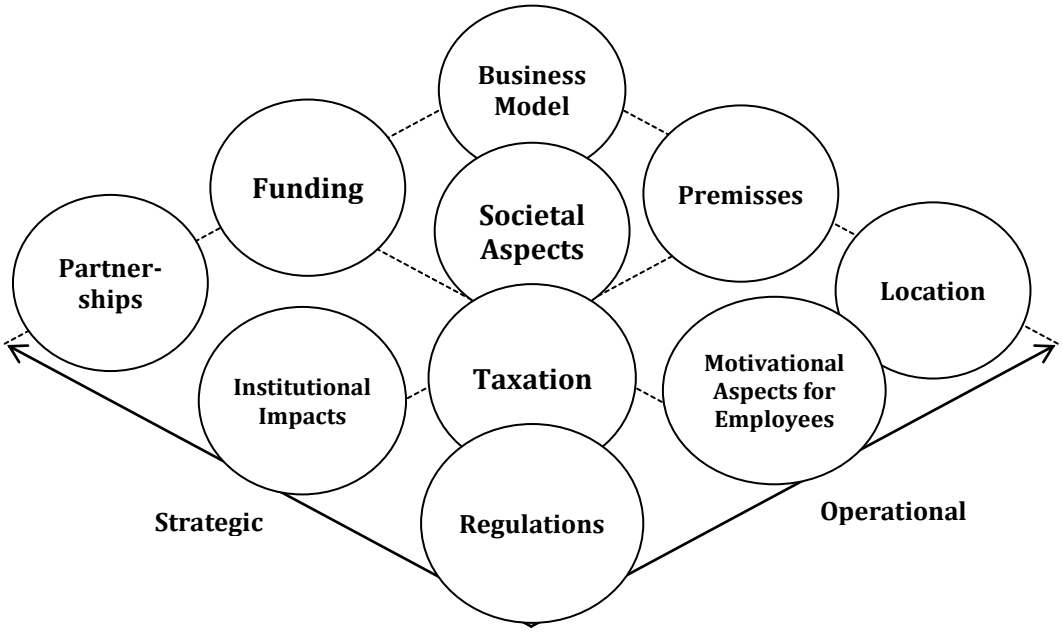

Figure 22 – Strategic and operational decision aspects in the start-up of an OIMO.
Source: Developed by the author

For a decision event to be selected for investigation it must refer to an action related to the startup phase presented in Figure 21 and to a strategic or operational aspect as exposed in Figure 22. These categories help us guide the data collection, processing of collected data and data analyses.

3.4.2 Selection of respondents

The choice of respondents is also very important in case studies. They should be able to answer the interviewer's questions so they will contribute to the clarification of questions guiding the research (VOSS et al, 2002).

During 18 months, organizations played different roles in the creation of CISB. Out of the more than 40 organizations that formally committed to support CISB, we will consider eight different organizations for our case study. These organizations are more important once they were the ones that also made financial commitments to the setting up of CISB.

We selected from one to three respondents from each of those organizations to form what we call the *entrepreneurs* of CISB. Table 12 presents the full list of respondents, their role in the starting up of CISB, the profile of their organizations, the dates when the interviews were performed, main topic of each interview and the approximate duration. In total, 51 interviews were performed.

Table 12 – Profile of Respondents and Interviews

COD	Profile/ Role at the startup of CISB	Organization's Profile	Date	Main Topic	Approx. Duration
SB1	Group CSO, is the high level sponsor from the founding member of CISB. He approved the seed money to the startup of CISB and took the first main decisions	Produces military aircrafts, defense products and security solutions	1) Mar 7, 2011 2) Sep 6, 2011	Creation of CISB Partnership	1 hour 2 hours
SB2	Group CTO, is the leading executive in the creation and development of CISB. He assumed the condition of Chairman of the Executive Board. His role in the beginning was to communicate with other CTOs from global companies to also join CISB	Idem	1) Mar 7, 2011 2) Apr 5, 2011 3) Apr 18, 2011 4) May 9, 2011 5) Sep 16, 2011 6) Dec 19, 2011 7) Feb 2, 2012	Creation of CISB Partners Preparation for inauguration Preparation for inauguration Members prospects Projects Action Plan 2012	2 hours 4 hours 1 hour 2 hours 2 hours 1 hour 1 hour
SB3	Innovation and Industrial Cooperation Director for Brazil, he is the project manager of CISB in the eyes of the founding member. He was the main responsible for the implementation of CISB. Seats in the executive board of CISB.	Idem	1) Mar 7, 2011 2) Mar 21, 2011 3) Apr 18, 2011 4) May 5, 2011 5) May 9, 2011 6) Jun 1, 2011 7) Nov 25, 2011 8) Dec 19, 2012 9) Jan 31, 2012 10) Feb 2, 2012	Creation of CISB Partners Preparation for inauguration Preparation for inauguration Preparation for inauguration Action Plan 2011 Projects Projects Projects Action Plan 2012	3 hours 4 hours 1 hour 2 hours 2 hours 1 hour 1 hour 2 hours 1 hour 1 hour

COD	Profile/ Role at the startup of CISB	Organization's Profile	Date	Main Topic	Approx. Duration
SC1	Head Group of Development, decided to join CISB as a member and is a top management representative on R&D definition	Global producer of trucks, buses and diesel motors	1) Jul 1, 2011 2) Jan 18, 2012 3) Feb 2, 2012	Joining CISB Action Plan 2012 Action Plan 2012	1 hour 2 hours 1 hour
SC2	R&D Director for Brazil. He is responsible for conducting R&D projects in Brazil and is the contact point for CISB	Idem	1) Sep 29, 2011 2) Nov 29, 2011 3) Dec 15, 2012	Partnerships Projects Projects	2 hours 2 hours 2 hours
SE1	CEO for Brazil. He has the challenge of setting up R&D activities in Brazil	Integrated group of forest products companies, specializing in newsprint and magazine papers and fine papers and packaging boards	1) Jun 27, 2011 2) Jan 11, 2012	Joining CISB Action Plan 2012	2 hours 2 hours
SE2	R&D Manager. He has to work together with Brazilian CEO in setting up R&D activities in Brazil	Idem	1) Jan 17, 2012	Projects	2 hours
SP1	Chief Business Development Officer. He is responsible for setting up R&D opportunities for his organization in Brazil	Technical research institute which business areas include applied research, technical studies and investigations, quality assurances, standardization and certification	1) Jun 31, 2011 2) Sep 13, 2011 3) Oct 13, 2011 4) Jan 16, 2011 5) Feb 2, 2012	Joining CISB Partnerships Projects Action Plan 2012 Action Plan 2012	1 hour 1 hour 2 hours 2 hours 1 hour
IN1	Business Area Director. He is responsible for setting up R&D opportunities for his organization in Brazil	Research institute engaged in R&D in the pulp and paper industry, packaging industry, the graphics industry and biorefineries	1) Jun 30, 2011	Joining CISB	2 hours
IN2	Project Manager. He works with IN1 in setting up R&D opportunities for his organization in Brazil	Idem	1) Nov 23, 2011 2) Jan 15, 2012 3) Feb 2, 2012	Projects Projects Action Plan 2012	2 hours 2 hours 2 hours
FC1	Director. He is responsible for setting up R&D opportunities for his organization in Brazil	Research center for industrial Mathematics, undertake and promote mathematical research to the benefits of industry, commerce, and public institutions	1) Nov 29, 2011 2) Jan 15, 2012 3) Feb 2, 2012	Partnerships Projects Action Plan 2012	2 hours 2 hours 1 hour
VIN	Senior Program Manager, International Relations. He is responsible in his organization for the bilateral relations on cooperative innovation with Brazil	Government agency that administers public funding for research and development. The agency's mission is to promote development of efficient and innovative systems within the areas of technology, transportation, communication and labor.	1) Mar 6, 2011 2) May 17, 2011 3) Jul 1, 2011 4) Jan 31, 2012 5) Feb 2, 2012	Supporting CISB Supporting CISB Sponsoring CISB Project Portfolio Action Plan 2012	1 hour 1 hour 2 hours 1 hour 1 hour

COD	Profile/ Role at the startup of CISB	Organization's Profile	Date	Main Topic	Approx. Duration
LSP	Chief Executive Officer. He serves as a role model for CISB, he acts like a coach for the entrepreneurs involved in the creation of CISB and also as the local support in Sweden	It is a science park dedicated to research and development in mobile communication, intelligent vehicles and transports systems, and modern media industry	1) Mar 8, 2011 2) May 17, 2011 3) Jun 14, 2011 4) Set 12, 2011 5) Nov 24, 2011 6) Feb 1, 2012	Supporting CISB Supporting CISB Partnering with CISB Arenas Arenas Action Plan 2012	1 hour 1 hour 3 hours 2 hours 1 hour 4 hours

Source: Developed by the author with collected data from interviews

The group we are calling *entrepreneurs* of CISB is formed by experienced R&D and innovation managers employees of renowned innovative organizations.

3.5 Case Validation

According to Yin (2009) cases studies shall maximize their quality by testing four critical conditions, namely: construct validity, internal validity, external validity and reliability.

In order to ensure construct validity we used multiple sources of evidence, with an established chain of evidences being collected and validated in longitudinal documentation reviews and interviews. Additionally, an employee of CISB well trained in case study methodology reviewed and validated the case study report. Internal validity was ensured by using the analytical technique of *logic models* as suggested by Yin (2009). As explained before, although we decided to perform a single-case study, external validity problems were reduced when we selected a case that involves eight different and independent organizations.

Finally, despite trusting on participant observation as a source of evidence, the reliability is not affected, once there is no conflict of interest; the observant had no influence in taking any decisions while working as a consultant for the subjects of the present work. On the contrary, the observant participant is also an interested part on the accuracy and validity of the conclusion of this research. Moreover, reliability is demonstrable by the extensive use of notes and the development of a database for the case study.

The minutes of the case study were reviewed and approved for publication by the subjects interviewed for the purpose of this research. It was decided sometimes not to mention their names while describing specific events as a way of assuring the focus on the research objectives only. There are no sensitive or confidential information being used in this work.

4 CASE STUDY

> *"We could have established a closed laboratory to exploit the knowledge created in Brazil, but we thought in doing something different. We already had good experience in Sweden in building more open arenas for innovation. Based on a particular experience with one of our science parks, we gather interest from other organizations in specific fields of research and decided to do it together." (Pontus de Laval, CTO of Saab AB on April 8th, 2011 during the 2nd Innovation Learning Laboratory organized by ABDI and VINNOVA)*

In 2008, a Swedish business delegation came to Brazil to discuss possibilities of a joint action in some industrial sectors. In that year, a Brazilian official mission to the European country was carried out to identify potential areas for cooperation. As a result, in 2009 both countries signed the *Additional Protocol on Innovative High Technological Industrial Cooperation*. This document established the areas of bilateral cooperation and set up a bilateral working committee responsible for setting up a working plan. In May 2010, the Brazilian Agency for Industrial Development (ABDI) and the Swedish Innovation Agency (VINNOVA) took the lead in the execution of this plan and promoted in Sao Paulo the 1st Innovation Learning Laboratory – Brazil-Sweden. The event brought together leaders from industry, government and academia from both countries to produce a set of recommendations to public and private sectors and to identify the possible development of new partnerships and bilateral trade.

In September 2010, the *chief executive officer* of Saab AB and the mayor of São Bernardo do Campo announced the plans for the creation of an aerospace research center in the city. In December 2010 Saab AB, supported by ABDI, VINNOVA, the Municipality of São Bernardo do Campo (SBdC), the Federal University of Paulista ABC (UFABC) and the Swedish Embassy in Brazil organized a workshop to discuss R&D project opportunities in the field of aerospace and defense with other Brazilian organizations. In February 2011 a second workshop was organized in the city, and the first project ideas and partnerships were presented. In this second occasion, participants presented ideas for projects that were not only limited to the field of defense. Eventually, entrepreneurs spread ideas into other areas such as urban security and urban planning. Both workshops attracted leaders from industry, government and academia from both Brazil and Sweden.

In April 2011 ABDI and VINNOVA organized the 2nd Innovation Learning Laboratory – Brazil-Sweden. Unlike the first edition, in which issues such as transport, energy, co-incubation of startups and internationalization of companies were presented, the

aim of the second laboratory was to report experiences that have been physically developed and what else could be done cooperatively between both countries. In that occasion Saab presented how their initial vision and plans to build an aerospace research center in Brazil have evolved into the creation of an independent organization called CISB, with a much wider scope.

On the 18th of May 2011, the official inaugural ceremony of CISB was held. This ceremony attracted significant attention from the media, academia, government and industry from both countries. Brazilian president, Dilma Rousseff, while hosting the Swedish Prime Minister, Fredrik Reinfeldt in Brasilia, stated on the day before:

> The field of innovation offers great perspectives of expansion [for the collaboration between Brazil and Sweden]. The Swedish-Brazilian Research and Innovation Centre to be inaugurated tomorrow in the city of São Bernardo do Campo will enable a valuable exchange of experiences. (ROUSSEFF, 2011)

4.1 About the organization

The Swedish-Brazilian Research and Innovation Centre (CISB) was founded on May 18, 2011 as a Brazilian not-for-profit research and technology association, based in São Bernardo do Campo, São Paulo. The founding members of CISB were Saab AB (a Swedish aeronautic, defense and security company) and Saab do Brasil Ltda. (Brazilian subsidiary of Saab AB) (CISB, 2011a). However, 42 other organizations representing academia, industry and government of both countries were introduced as "partners in the creation and development of CISB" (CISB, 2011b). These organizations made no financial commitment to CISB at that time but offered their political support for setting up CISB as an independent entity (from Saab).

On the occasion of its founding, CISB was presented as a "bridgehead between the countries and a hub in Brazil under the formal State-to-State agreements signed between Brazil and Sweden" (CISB, 2011b). In other words, CISB main goal is to integrate the Swedish innovation system, regarding its maturity and cases of success, with the dynamic innovation system Brazil has being developing in the past decade. As stated on its website, CISB was created to "search for solutions of complex global and societal problems that cannot be solved by individual organizations and that need to be addressed by open

innovation and multi-institutional innovation network arenas" (CISB, 2011b). By doing this CISB is "giving an important step to make it concrete the technical cooperation between Brazil and Sweden, this experience will serve as a role model for other countries", as stated by Mauro Borges, president of ABDI (ABDI, 2011).

By the end of data collection, in February 2012, CISB had officially admitted five new members and another three were on their way to join. The first members to join were two major global Swedish companies: Scania AB and Stora Enso AB; two state-owned Swedish research institutes: SP Technical Research Institute of Sweden and Innventia AB, and another research institute result of a joint venture between Fraunhofer-Gesellschaft and Chalmers University of Technology, the FCC Fraunhofer-Chalmers Centre. The three other entities that accepted to join after we ended the data collection for this research were three Swedish universities: Royal Institute of Technology, Linköping University and Chalmers University of Technology (CISB, 2012a).

Besides those who were admitted as members of the association, the other three organizations also committed financially with CISB were: the Swedish Innovation Agency, VINNOVA, Lindholmen Science Park, LSP and the Electrical Energy Company of Minas Gerais, Cemig. Their role will be mentioned afterwards in specific sections.

4.1.1 Challenge-driven innovation: vision and mission

One of the strategies adopted by CISB, stressed on its communication materials, came from the 2nd Innovation Learning Laboratory – Sweden-Brazil. In this event, VINNOVA's representatives distributed their recently publicized document called "Challenge-driven Innovation VINNOVA´s new strategy for strengthening Swedish innovation capacity". In the spring of 2010, VINNOVA initiated this new strategic process. Its aim was to improve VINNOVA's effectiveness and efficiency in supporting innovation-led growth in Sweden and to respond to the global challenges facing Swedish industry and society.

As proposed by VINNOVA, globalization of knowledge, technology and capital flows have enabled new sources and forms of competition and opened up new markets and opportunities for the creation and delivery of innovations. To remain competitive, industry is

being forced to move up the value chain and embrace innovation, entrepreneurship and collaboration in new ways (VINNOVA, 2011).

In CISB's readings, both Brazil and Sweden are facing a number of social challenges that will have a strong impact on economic performance. While there is also an increasing need to address global challenges like climate change, health, pollution, resource depletion, etc., new, innovative solutions and approaches are urgently needed to meet these challenges (CISB, 2011c).

In response to the conditions described above, challenge-driven innovation strategy is suited to tackle new challenges and opportunities. It derives from the important societal challenges driving the development of innovations and bringing global market opportunities. In contrast to science and technology-led initiatives, challenge-driven innovation strategy has three important characteristics. The first one is addressing essential or critical needs in society and industry. These needs require users and customers whose demands for solutions incentive them to engage in developing and testing new solutions. Co-creation is a critical success factor. Then, as the second characteristic is the promotion of new, cross-sector collaborations to find solutions to the needs; solutions to social and societal challenges are rarely found in one traditional sector or a single research field. New collaboration patterns are emerging among actors in different value chains. Finally, it is important to stress the fostering systemic approaches that deal with different social subsystems, framework conditions, political, commercial, technological subsystems, etc.

Aligned to the vision above, CISB has initially focused its efforts on four social challenges that drive the development of innovations with international potentialities. The choice has been based on the CISB's missions to promote innovation-led sustainable growth in both Sweden and Brazil and to connect and catalyze actors involved in the creation and delivery of innovations in areas which both countries have common interests. Those areas are:

a) Transport & Logistics;
b) Defense & Security;
c) Sustainable Energy & Biorefineries; and
d) Urban Future & Innovation.

CISB's official mission, as stated on its communication material, is to create a fertile innovation network between Swedish and Brazilian industry, academe and government through a challenge-driven innovation strategy by promoting:

a) Less fragmentation and improved operational focus and resource mobilization;

b) Innovative cross-sector solutions to unleash as-yet undiscovered innovation opportunities on the market; and
c) Increased demand-driven innovation initiatives, which balance traditional supply-based science and technology schemes.

Also, it is highlighted that CISB will work for its industrial members aiming to increase their competitiveness and improve their impact on sustainable growth by five main actions: (1) Giving proper access to key critical technologies and technical expertise; (2) Promoting development of innovative ideas, disruptive technologies, disruptive ways to design, develop, integrate solutions; (3) Increasing control of value chains through innovation; (4) Increasing attractiveness for young and brilliant people, to promote science and technology development through new generations, and, finally, (5) Providing external sources for research and technology (R&T) activities and integration with other innovation networks in both countries and embedded regions.

4.1.2 Open innovation and triple helix: operational framework model

CISB's official documents explicitly declare having been inspired by the triple helix framework (ETZKOWITZ, 2005) and open innovation paradigm (CHESBROUGH, 2003). Following the Lindholmen Science Park model, in Gothenburg, CISB was designed to foster active cooperation between industrial, governmental and academic organizations and to function as a neutral and open arena for the development of new relationships and innovations.

Figure 23 below represents the *modus operandi* of CISB. It is directed by an executive board, oriented by an advisory board and managed by an internal team of employees. The executive board is formed by representatives of the members while the advisory board is formed by external renown and experienced individuals. As defined in the organization by-laws, ideally, members of the association and members of the advisory board shall have a balanced number of Brazilian and Swedish representatives from industry, academia and government. Members are responsible for covering the operational costs of CISB throughout the payment of a periodic membership fee. Members shall also feed CISB management team regarding the challenges the team should address and propose collaborative

innovation projects. Funding for the specific projects shall come (but is not limited to) from members, other companies, governmental funding agencies from both Brazil and Sweden, contracted directly by users and/or corporate venture capital funds.

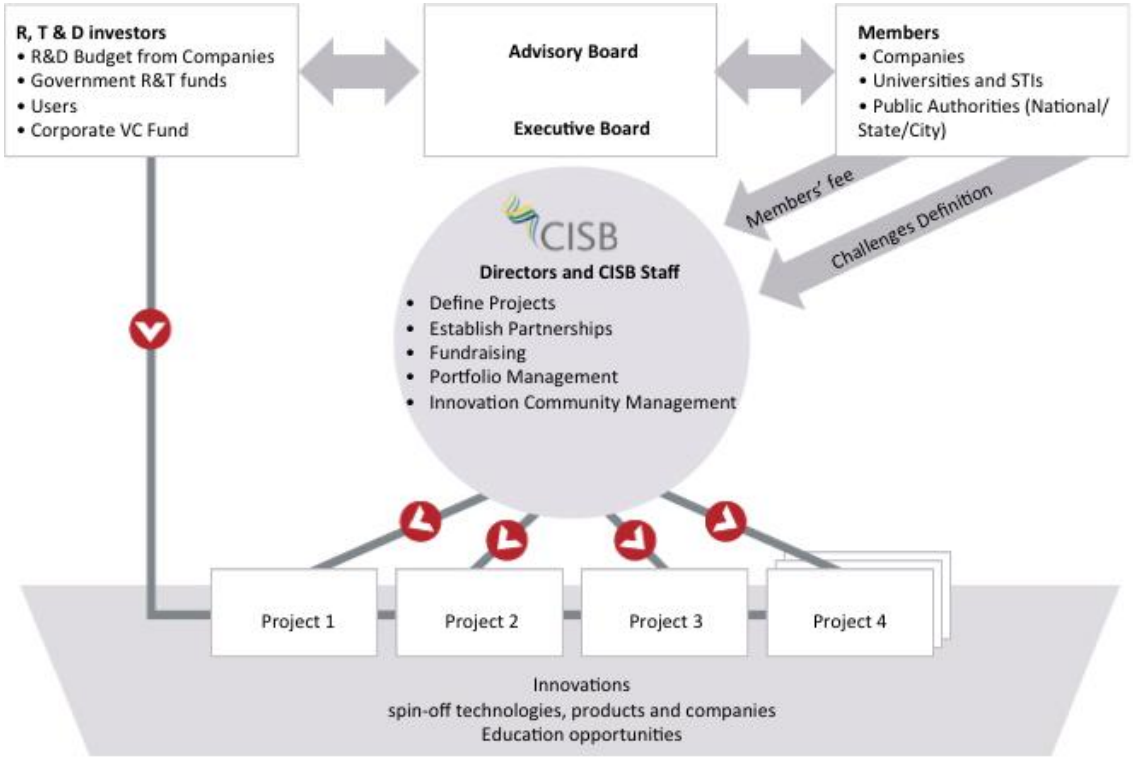

Figure 23 – Modus Operandi of CISB
Source: CISB About (2011)

CISB team shall perform the following core activities:

a) Innovation communities networking and management;
b) Define specific challenges and opportunities for investing in R&T and innovation;
c) Manage ideation process in CISB's innovation communities;
d) Establish partnerships, specially between Brazil-Sweden;
e) Define R&D projects and educational & training programs;
f) Fundraising for innovation projects (public grants, corporate funding, VC, etc); and
g) Portfolio management of projects and programs.

Focusing on benefits for its members, it is anticipated that CISB can also perform other non-core activities such as:

a) Enhance knowledge and skills in innovation management as well as in the Swedish and Brazilian national systems of innovation;

b) Perform peer reviews of innovation projects (panel of specialists);
c) Support continuous improvements on scientific and engineering capabilities (new approaches, international certifications and standards);
d) Support open innovation practices by watching for outside-in and inside-out opportunities and ensuring high visibility in scientific and innovation community;
e) Advise on opportunities for accessing public mechanics to foster innovation (tax incentives, funding and financing);
f) Facilitate technology transfer negotiations, definition and implementation of intellectual property policies; and, finally,
g) Contribute to build external brand image linked to innovation in both countries.

Additionally, it was also anticipated that CISB would not perform the following activities for any of its individual member:

a) Support internal and closed projects;
b) Produce technical content of projects;
c) Manage or conduct the scientific and/or engineering tasks of projects;
d) Provide support during production and operational support phases of projects; and
e) Innovation consultancy services for the members.

4.1.3 Target organization

Being a young organization, CISB *entrepreneurs* have defined some ideas to guide the management team while setting up the organization. A general view of the target organization was developed by the members and is described below.

CISB target organization is meant to be lean and flexible. Employees should work very integrated among themselves, with members' representatives and with members' and partners' internal innovation teams. The team is composed by a leading executive (CEO), three functional managers and one internal administrator.

To address specific demands and opportunities CISB was defined as a network organization. External teams from partners and members shall easily connect to CISB team based on São Bernardo do Campo on more specific roles. Some of these roles could be the establishment of local hubs across Brazil (to be present in other States such as Minas Gerais,

Rio de Janeiro, Santa Catarina, Pernambuco), international hubs (one in Sweden and in other countries such as South Africa, India, USA), cooperation with SMEs and Venture Capital groups (to work out spin-in and spin-out opportunities), cooperation among scientific and technological institutions (to connect organizations such as RISE in Sweden and Embrapii in Brazil), coordination of specific thematic areas, etc.

As mentioned before, the target organization is meant to be present all over Brazil and Sweden establishing local hubs, but it is not limited to these two countries. Any connections with other countries, as long as it is also related to Brazil and Sweden, are welcome. CISB team shall work closely to the innovation management teams of members and partners. To address specific demands and opportunities, program managers can join the team whether they are directly financed by members or by external partners and if they have particular roles. Figure 24 represents CISB target organizational structure.

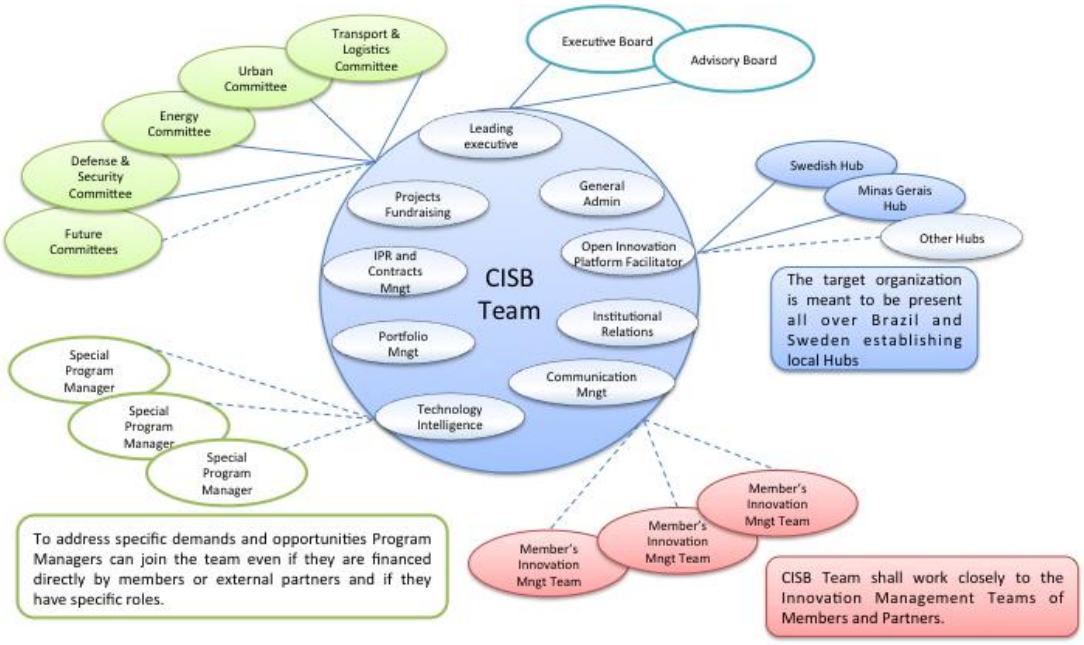

Figure 24 – Target organization for CISB
Source: CISB (2011c)

Unarguably, CISB concept fits satisfactory well in our definition of an open innovation management organization (OIMO) as presented in section 2.5 of our Theoretical Reference. CISB is meant to coordinate the cooperation innovation projects among actors of the triple helix of two countries; it is independently managed; it is supported by six different organizations; is open for partnerships and new memberships, and is neutral regarding its members.

After having contextualized, conceptualized and characterized CISB, we now move to what CISB has done during our observation period.

4.1.4 Main actions

The creation and development of CISB can be divided into three main periods during the first 18 months of its existence:

a) Public announcement for the inaugural ceremony, from September 2010 to April 2011. This period is marked by the public announcement made by Saab AB for the creation of an Aerospace R&D center and the inauguration of CISB in São Bernardo do Campo.

b) Inaugural ceremony for the official registration, from May 2011 to August 2011. This period is marked by the official inauguration, in which Saab presented 40 organizations as partners for the creation of CISB, 24 projects ideas in a portfolio distributed in 4 thematic areas. In that occasion, CISB was officially founded. This period ends when all the legal credentials to operate and were received, and CISB had its initial endowment from the founding members. Also, at that time, the organization had its key staff recruited, premises and internal management processes set up for the startup of local operation.

c) Full operation as a legal, formal and independent organization, from September 2011 to February 2012. This period is marked by the signature of the first agreements and contracts in the name of CISB, the submission of the first project proposal to governmental authorities and the admission of new members.

Table 13 – Main actions performed by CISB (from Sep/2010-Feb/2012)

#	Main actions	Period
1	Announcement of the creation of a Aerospace R&D Center in São Bernardo do Campo	Pre-inauguration
2	1st Workshop in December in São Bernardo do Campo	Pre-inauguration
3	2nd Workshop in February in São Bernardo do Campo	Pre-inauguration
4	Recruitment of key staff	Pre-inauguration
5	Definition of CISB principles, by-laws, budget, address, name and logo	Pre-inauguration
6	Attraction of key contributors and signature of about 40 letters of intent (LOIs) with partners on the creation of CISB	Pre-inauguration
7	Definition of 4 thematic areas	Pre-inauguration
8	Definition of 24 projects ideas and proposals	Pre-inauguration
9	Inaugural event with more than 400 participants in the official ceremony and 220 people in the workshop and thematic discussions. 95 entities were represented. Event was jointly organized with the visit of Swedish Prime Minister which produced a broad media coverage	Pre-inauguration
10	Setting up organization: business plan, internal managing processes and offices	Pre-registration
11	Recruit staff, hire key service providers (IT services, accountability, public relations, architect, legal office, innovation management consultants, etc), define internal management processes	Pre-registration
12	Key meetings for the attraction of members, partners, projects and funding opportunities with Brazilian companies, Brazilian subsidiaries of Swedish companies, local authorities related to Science, Technology and Innovation in Brazil	Pre-registration
13	Establishment of the Swedish Hub at Lindholmen Science Park with funding from Vinnova for three years for the salary and travel expenses of a full time senior employee	Full-operational
14	Project proposal application for the Fapemig-Cemig call on Microgrid in a partnership between CISB, UFMG, KTH, Concert, Lactec, Hitachi and Designresources	Full-operational
15	Project proposal for the establishment of a Capability Development Centre in Brazil in a partnership between CISB, Municipality of SBdC, UFABC, Saab, LSP and CSIR-DPSS/SA	Full-operational
16	Launching of a Defense & Security Arena in a partnership between CISB and LSP	Full-operational
17	Launching of Transport & Logistic Arena in a partnership between CISB and LSP	Full-operational
18	Signature of Agreement on the Science without Borders program involving CISB, CNPq, SP, Innventia, Saab, KTH, Chalmers and LiU	Full-operational
19	1st CISB Annual Event was held together with Open Innovation Seminar which guaranteed a great media coverage	Full-operational
20	Admission of 5 new members: Scania, Stora Enso, SP Technical Research Institute of Sweden, Innventia and Fraunhofer-Chalmers	Full-operational

Source: Developed by the author with collected data from interviews

Table 13 summarizes all the main actions executed by CISB entrepreneurs in the first 18 months of existence. In the next section we will extract from CISB's main actions what were the main decision events in a way we can identify patterns in process of decision-making used CISB entrepreneurs.

4.2 Main Decision-Making Events

During the period from September 2010, when the initial idea was presented, to February 2012, when CISB had its first Executive Board Meeting with eight entities being represented, entrepreneurs of CISB had to take a great number of strategic decisions. In this case study we are interested in understanding the decision-making process of this group of entrepreneurs. In Table 14 we present the decision-making events that were selected for the sake of this case study. These events were selected according to the criteria presented in section 3.4.1 and the list of actions presented in Table 13.

Table 14 – Main decision-making events (from Sep/2010-Feb/2012)

#	**List of Selected Decision-Making Events**	**Main Actors in the Decision Making Process**	**Period of the Decision Making Process**
1	Creation of CISB	Founders	Set/10 - May/11
2	Thematic Areas and Project Portfolio Definition	Partners	Set/10 - May/11
3	New Members Admission	Founders and other Members	Aug/11 - Oct/11
4	International Hub	Founder and Partner	Jun/11 - Set/11
5	International Exchange Program	Founder and Partner	Jun/11 - Feb/12
6	Energy & Urban Development Project	Member and Partner	Aug/11 - Feb/12
7	Defense & Security Laboratory	Members and Partners	Set/11 - Feb/12
8	Biorefinery Project and Laboratory	Members and Partners	May/11 - Feb/12
9	Security & Transport Arena	Members and Partners	Set/11 - Feb/12
10	Technology Transfer Projects	Founder	Set/11 - Feb/12
11	Action Plan and Budget 2012	All Members	Dec/11 - Feb/12

Source: Developed by the author with collected data from interviews

In the following sections, we will go through each of the selected decision events aiming to identify patterns in the behavior of our subjects.

4.2.1 The process of creating the organization

When Saab publicly announced in September 2010 the creation of an Aerospace R&D Center in São Bernardo do Campo it was one of the short listed contenders of the Brazilian international multibillion dollars bid for the purchase of high-end military aircrafts (FX-2). At the time, Saab's CEO announced that they would invest "US$ 50 million in the next five years" and "hire 40 doctors and master engineers in the following year" (ABCD Maior, 2011). He also expressed that in the following months their chief technology officer (CTO) would come to Brazil to set up the "details" such as "facilities and the technical body" for the creation of this center (ABCD Maior, 2011).

In fact, in December of this year, only three months after, a technology management team from Saab came to Brazil and organized a workshop in which they presented their first project ideas to potential local partners an also a view about their plans for the center. In February 2011, another workshop was organized. In May 2011 CISB was finally founded.

Clearly, the decision of setting up an R&D center while disputing the FX-2 bid was a political act of Saab. Executives from Saab never denied that in their public statements. Nevertheless, Saab assured the investments would be made even if Saab loses the bid. In the worlds of Saab's CEO:

> Saab is fully committed to establish CISB. We guarantee the start up and intent to invest in a number of projects together with Brazilian academia and industry. Our estimate so far is that our investment will exceed 50 million USD in the coming five years. This commitment is independent on the outcome of the FX-2 procurement. We do this because we believe our center will generate innovations with corresponding business both in Brazil, Sweden and internationally. (Author's notes from Håkan Buskhe, Saab CEO, speech during CISB inauguration ceremony on May, 18)

Saab was also interested in other business opportunities and by performing R&D activities in Brazil, the chances of winning bids would definitely increase. In the words of Saab's *chief strategy officer* (CSO) as a sample from the protocols:

> Our strategy is to benefit from the Brazilian System of Innovation to enhance our position in the Aerospace, Defense and Security market by implementing a new organizational model where R&T investments are shared between business partners and executed by local industry, universities and research institutes in cooperation with our business divisions. This local organization shall increase our chances to win bids and at the same time feedback our global innovation activities as to increase our group's global competitiveness. [SB1]

Despite the discussions above, it is a very challenging task for Saab to invest US$ 50 million in aerospace R&D in five years. Saab had no industrial footprint in the country and, even worse, Brazil has no tradition in scientific or technological development in the research areas Saab proposed. With this in mind, we come back to our research objectives – not to explain exactly *why* Saab decided to build CISB – and analyze *how* the Saab's experts R&D and innovation managers faced the problem imposed by their CEO: to create a R&D center in Brazil (moreover, in São Bernardo do Campo, SP) and invest US$ 50 million in the next five years.

Saab's team had to take some crucial decisions during the creation phase of CISB. First, the center had no clear objectives and targets besides investment figures and business strategies drivers. What exactly the center could do (what type of projects, laboratory resources, technical body) was not defined before the announcement of its creation. To answer to these questions, Saab's CTO proposes (quoted from the protocols):

> The idea is to create a small team of project experts that helps the stakeholders to create projects in which we address different R&D challenges. This team will use workshops and other forums to address key societal challenges and help to identify suitable project teams. They will then help the project partners with funding issues and other needs to make it run. [SB2]

CISB entrepreneurs decided to explicitly adopt the concept of open innovation and triple helix. Here is a sample of quotes from the protocols:

> We will gather the main stakeholders from the public, from academia and from industry to tackle key societal challenges with technology. Open innovation in collaboration is much faster than R&D in closed research labs – we can attract more bright people with different perspectives than a single company could. With this model we decrease the distance between the public needs and the industrial solutions by placing all the stakeholders at the same table. [SB3]

Additionally, they decided to take Lindholmen Science Park (LSP) from Gothenburg as a role model (see Figure 25) and proposed a similar model for CISB. The LSP gathers representatives from local government, universities and industry to form an executive board that will support and monitor the board of directors. The board of director will build arena steering groups on specific matter and will build a project around those arenas. For example, as stated by Saab's CTO:

> The triple helix model has proven successful in Sweden. Saab has a very successful experience in participating in the startup of Lindholmen Science Park. We believe this experience could serve as a role model for the development of CISB. [SB2]

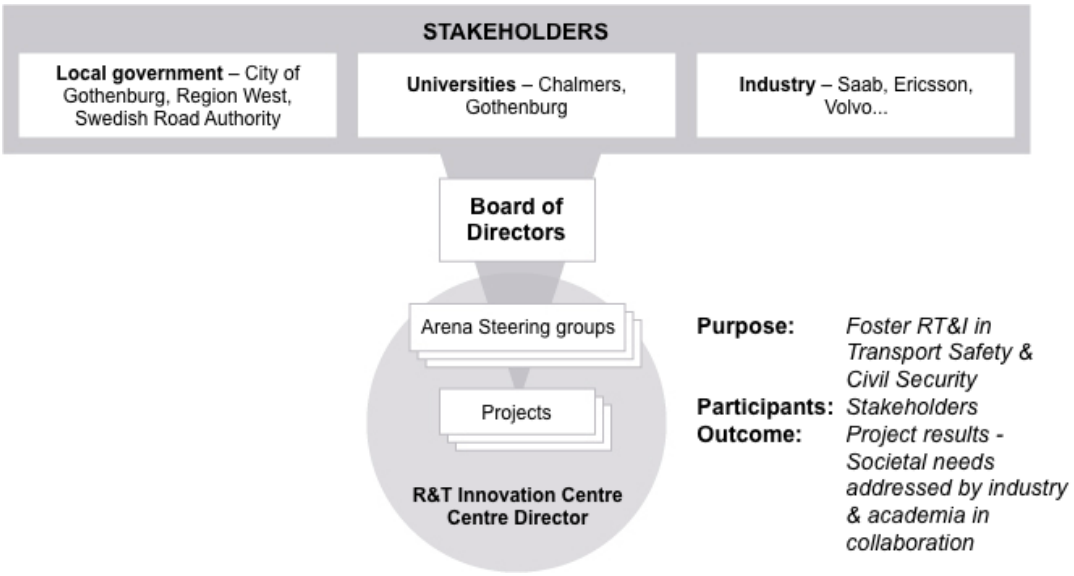

Figure 25 – Conceptual representation of the Lindholmen Science Park
Source: Material obtained during the interview, provided by LSP

Figure 26 depicts the first conceptual representation of CISB presented by its entrepreneurs. It highlights the nature of the stakeholders, a governance board, and the center itself aiming to produce collaborative R&T projects and spin-offs and educational opportunities as well.

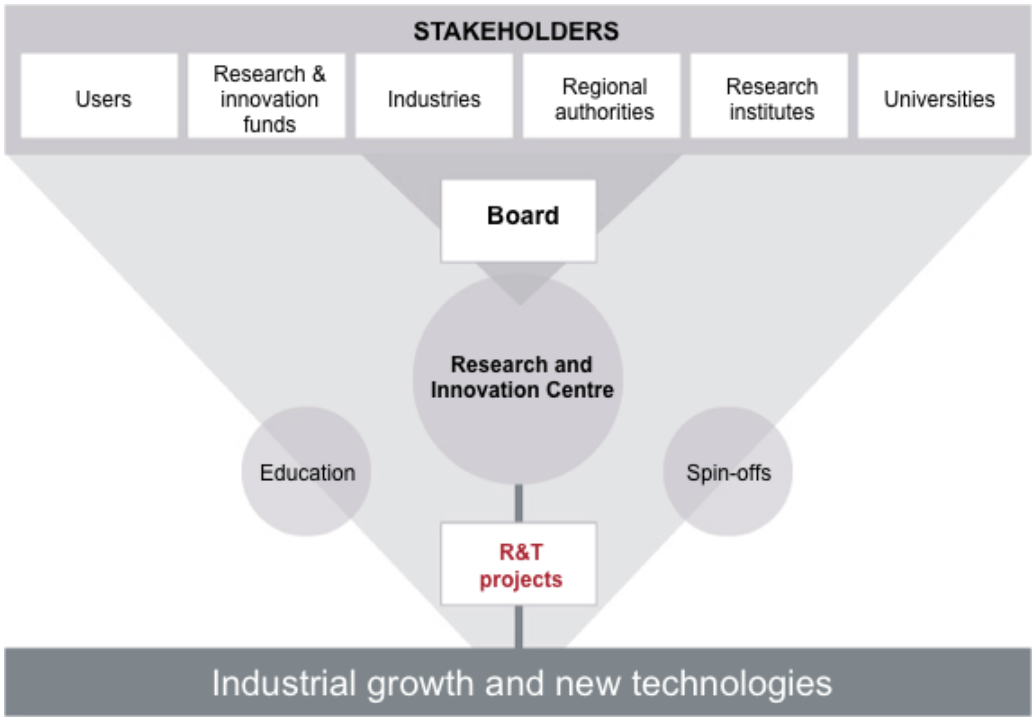

Figure 26 – Conceptual representation of CISB
Source: Material obtained during the interview, provided by SB3

With this reference model, the entrepreneurs now had to decided on how to attract an important stakeholder to join the initiative. The first approach was to present it as *A Swedish Cooperative Initiative* and invite organizations very close to Saab's network:

Swedish industry	Government (Federal, State, City)	Universities & Institutes	Technology Parks
•Saab •Scania •Investor	•Vinnova, The Swedish Governmental Agency for Innovation Systems •STC, Swedish Trade Council •Linköping City	•CTH, Chalmers University of Technology, •KTH, Royal Institute of Technology •LiU, Linköping University •Swerea, Materials research institute	•Mjärdevi Science Park at LiU •Lindholmen Science Park at Chalmers

Figure 27 – First stakeholders invited to join CISB initiative
Source: Material obtained during the interview, provided by SB3

Next step was to attract Brazilian partners. The so-called entrepreneurs managed to organize the first and second workshops with five other partners: ABDI, VINNOVA, the

Municipality of São Bernardo do Campo, UFABC and the Swedish Embassy in Brazil. Those workshops were the first three steps to be discussed:

a) Strategies and Opportunities for R&T in Brazil & Sweden;
b) Industry & Users Demand for Future Technology; and
c) R&T Cooperation Between Academia & Industry.

The first workshop gathered around 70 participants from government, academia and industry each. Figure 28, Figure 29 and Figure 30 presents the *way forward* proposed at the beginning of the first workshop in December 2010, at the second workshop in February 2011 and at the inaugural event in May 2011. It is interesting to notice how the organization was set up on the basis of the effect the former workshop had created.

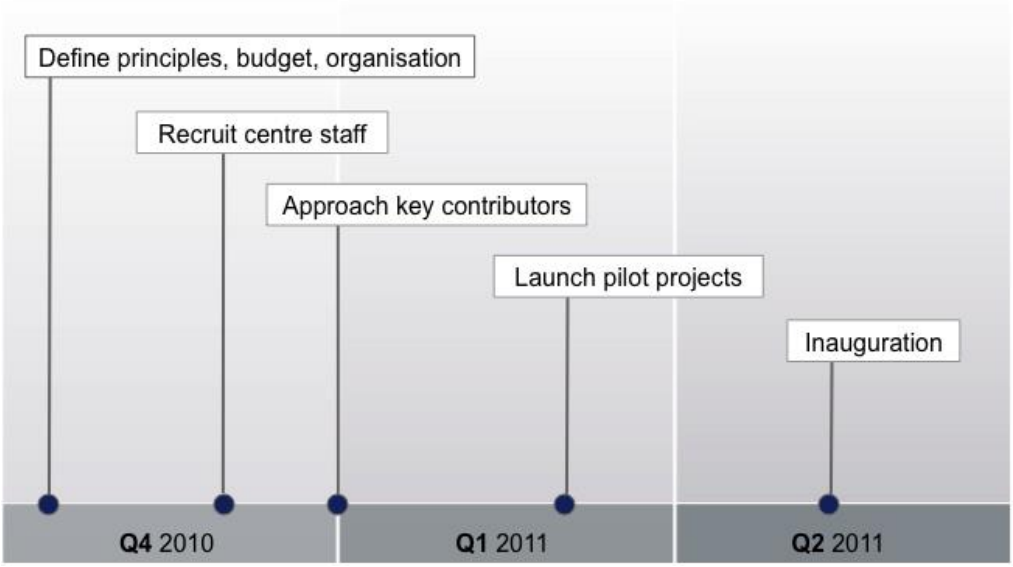

Figure 28 – Way forward presented in December 2010
Source: Material obtained during the interview, provided by SB3

In the first workshop in December 2010, Saab presented the basic concepts behind their idea of CISB; they announced their interest in recruiting a staff, approaching partners to define first project idea before the inauguration.

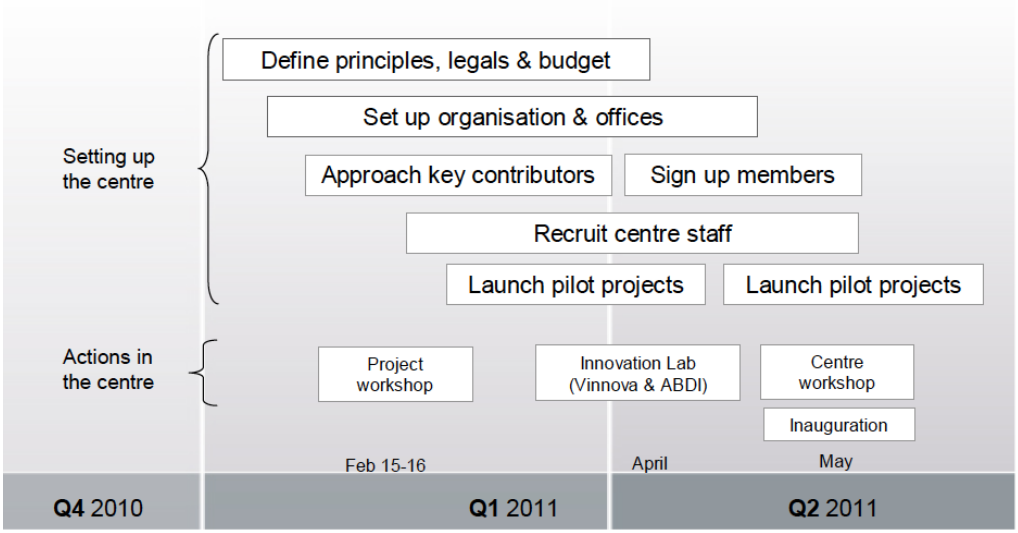

Figure 29 – Way forward presented in February 2011
Source: Material obtained during the interview, provided by SB3

In the second workshop, in February 2011, the same material was updated with few more details but it was still focused on creating enough momentum for an inauguration in May 2011.

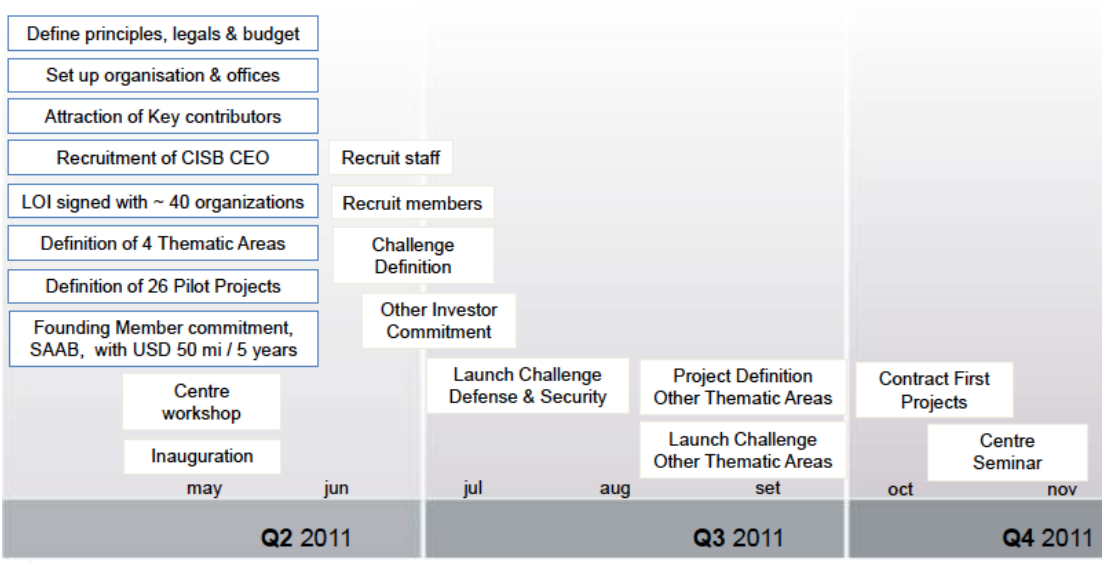

Figure 30 – Way forward presented in May 2011
Source: Material obtained during the interview, provided by SB3

During the ceremony of inauguration, although CISB was being officially founded only by Saab AB and Saab do Brasil, CISB was presented to the public as a result of the pre-commitment of more than 40 entities. Those organizations were identified and contacted among Saab's network and with the help of the five-first partners. They were invited to sign a Letter of Intent were they would activities, among other, commit to:

a) Respond with serious interest, support and continued dialogue to the initiative of CISB;
b) Agree to show their company name as “partners in the development of CISB” and as “Potential Members”;
c) Assign point of contact;
d) Suggest cases for the Centre project portfolio by being a heading partner or as a tentative partner;
e) Participate in “Interim Board” and “Advisory Group”; and, finally,
f) Participate at Inauguration of Center on May 18, in São Bernardo with a senior level representative.

As a result, the inaugural event of CISB attracted more than 400 participants to the ceremony. During the inaugural event, five thematic forums were organized and they counted with about 220 participants representing 95 different entities well distributed in terms of nationality (Brazil and Sweden), industry, academia and government. Top management executives from industry, rectors and governmental authorities were there to demonstrate their commitment to the initiative. The presence of the Prime Minister of Sweden in Brazil concomitant with CISB’s inauguration and the announcement made by president Dilma about the Center guaranteed a broad coverage from the media. Saab’s CEO could not be more enthusiastic.

> I’m proud that in such a short time we have been able to set up this Swedish Brazilian research and innovation center. We started the process in late September last year and now we are up and running! It is also very exciting to test a new model for open innovation across country borders. The concept that we now launch is completely new and innovative in its design. (Author’s notes Håkan Buskhe, Saab CEO, in his speech during CISB inauguration ceremony on May, 18)

Analyzing these first facts in the light of our research questions and propositions presented in 3.3.3, we can propose the following interpretation: when Saab announced the creation of an R&D center there was no “fixed targets” but rather “given means”, which is consistent with proposition 1. Saab’s experts R&D and innovation managers responded with an open innovation and effectuation approach to the challenge imposed by their top management, in order to set up an R&D center in such a short time.

The entrepreneurs of CISB started by asking (1) “who they were” and they concluded that they were coming from one of the most innovative countries in the world known to have as their key for success their collaborative spirit when it comes to innovation.

The second question was (2) “what they knew” and they come to the realization of the 10 years experience of Lindholmen Science Park as a role model for Brazil, and by the (3) “whom they knew” and they decided to ask for support from their closest network and gather as first key contributors VINNOVA, ABDI, Swedish Embassy, Municipality of São Bernardo do Campo, UFABC and Centro Univertário da FEI to set up the workshops. Using those “means”, the entrepreneurs began to imagine and implement possible effects that could be created with them and moved directly into an action without the elaboration of a clear plan of action.

Entrepreneurs focused on building partnerships rather than on doing a methodical analysis. Since the beginning, entrepreneurs tended to start the process without assuming the existence of a predetermined marketplace for their ideas (of setting up R&D activities in the field of aerospace); detailed competitive analyses did not seem to make any sense to them at the early phase. Instead, entrepreneurs focused their actions on building partnerships right from the start. Furthermore, obtaining pre-commitments from key stakeholders helped them to reduce uncertainty in the early stages of creating their R&D center. Finally, since such entrepreneurs were not committed to any particular marketplace for their ideas, the expanding network (of those strategic partnerships built along the way) was determinant to the great extent of areas their center would eventually end up focusing on. This led us to evaluate how they decided the thematic areas (or research fields) and the first project portfolio of ideas.

4.2.2 Thematic areas and projects portfolio definition

When Saab announced their plans to set up an R&D center in Brazil it was announced that this center would focus on the fields of aerospace, defense and security. Eight months later, after the inaugural event, CISB presented 29 project ideas distributed in the four thematic areas mentioned before: transport & logistics, defense & security, sustainable energy & biorefineries and urban future & innovation.

The thematic areas were identified and proposed by the partners involved in the series of workshops and through different interactions, such as smaller meetings, other events, e-mails, etc. During the event of inauguration each thematic area already had its Swedish “sponsor” and its “key contributor” that were highly motivated to achieve the success of the initiative. Discussions on the area of transport & logistic were led by Volvo, Scania and

Lindholmen Science Park; defense & security by Saab; sustainable energy by the Royal Institute of Technology; Biorefineries by Innventia, and urban future and innovation by representatives from the cities of Linköping, Borås and Gothenburg.

Following the path opened by Saab, a network of stakeholders was set to motion. Starting with a very small commitment to participate in the discussions promoted by CISB, key contributors had finally started their own networks and attracted more and more partners to the system. Consistent with the dynamic model of effectuation mentioned in 2.3.4, stakeholders made commitments "that on one hand increase the resources available to the network, but on the other, constrain future sub-goals and goals that get embodied into particular features of the artifact" (SARASVATHY 2008, p. 109).

Table 15 shows the list of the projects presented in the end of the CISB inauguration. At this point, the criteria to be included in CISB's project portfolio was that the project should involve at least one Brazilian and one Swedish organization and at least one industry of each country. Ideally, the projects should include as many actors from the triple helix of both countries as possible and projects that were purely academic should be avoided. Among the projects ideas proposed, 12 were industry led, 14 universities led and 3 projects municipality led.

Table 15 – CISB Project Portfolio right after the Inauguration

#	List of Projects	Thematic Area
1	Coastal Radar for Brazilian / Global market	Defense
2	ICT and Electronics for Brazilian/Global market	Defense
3	Nano - Engineered CFRP for tough mechanical applications	Defense
4	Transport Security - Preventing theft from commercial vehicles	Transport and Security
5	Hybrid Bus Brazil	Transport and Sustainable Energy
6	COSMOS - Collaborative Engineering for Sustainable Mobile Systems	Transport
7	UAV - Cattle Tracking System	Aerospace for civil application
8	UAV - Urban Security	Aerospace for civil application
9	UAV – Forest Fire Monitoring	Aerospace for civil application
10	UAV - Security support for large events	Aerospace for civil application
11	Visual City Plans	Urban Future
12	Sensor technology for real-time water monitoring	Urban Future
13	Waste Recovery - International Partnership	Urban Future

14	Bioenergy for sustainable development	Biorefineries
15	EU Project NOVEMOR - Future Air Transport	Transport
16	Cognitive SDR - Better use of frequency space	Defense
17	Fusion Research	Sustainable Energy
18	Further strengthening of Brazilian Forest Industry	Biorefineries
19	Thermo-chemical conversion of biomass & waste	Biorefineries
20	Synchrotron Radiation Science	Sustainable Energy
21	Climate benefits of expanding bioenergy systems	Sustainable Energy
22	Systems for promoting attractive bioenergy development	Sustainable Energy
23	Expansion models for bioenergy that are attractive from socioeconomic and environmental perspectives	Sustainable Energy
24	Secure & Efficient City with Real-time monitoring	Urban Future
25	Intelligent Transport System	Transport and Logistics
26	Microgrids	Sustainable Energy and Urban Future
27	Defense and Security Systems Integration Demonstrator	Defense and Security
28	Wind turbines	Sustainable Energy
29	Mining water and energy optimization	Urban Future

Source: Developed by the author with collected data from interviews

That list of projects ideas organized in thematic areas would help CISB refining its scope and provide its partners with a direction for the next actions. The material was a concrete starting point for the management team to start working in the straightforward next step, which would be to make the projects happen. *But, in practical terms, what could CISB do to make these projects get started?* As stated by one entrepreneur of CISB:

> Projects need detailed plans and allocation of resources. Collaborative projects often require a governance model to assure all partners work well together, in many cases one of the organizations involved takes the lead as the project manager. Collaborative R&D projects very often demand intellectual property rights agreements. And, especially when the project involves public organizations or universities governmental funding is frequently required. [SB3]

The first approach was to define the prioritization criteria. CISB team should not work in all projects at once. *But how to define criteria among participants if at that point Saab was the only entity investing capital in CISB?* At that moment Saab requested a second step commitment from CISB's partners. Partners were requested not only to participate giving project ideas but to contribute to funding and running projects, by becoming members, or even by taking executive board seats. Figure 31 reproduces the levels of commitment to CISB, categorized hierarchically as *project participants*, *center membership* or *board membership*.

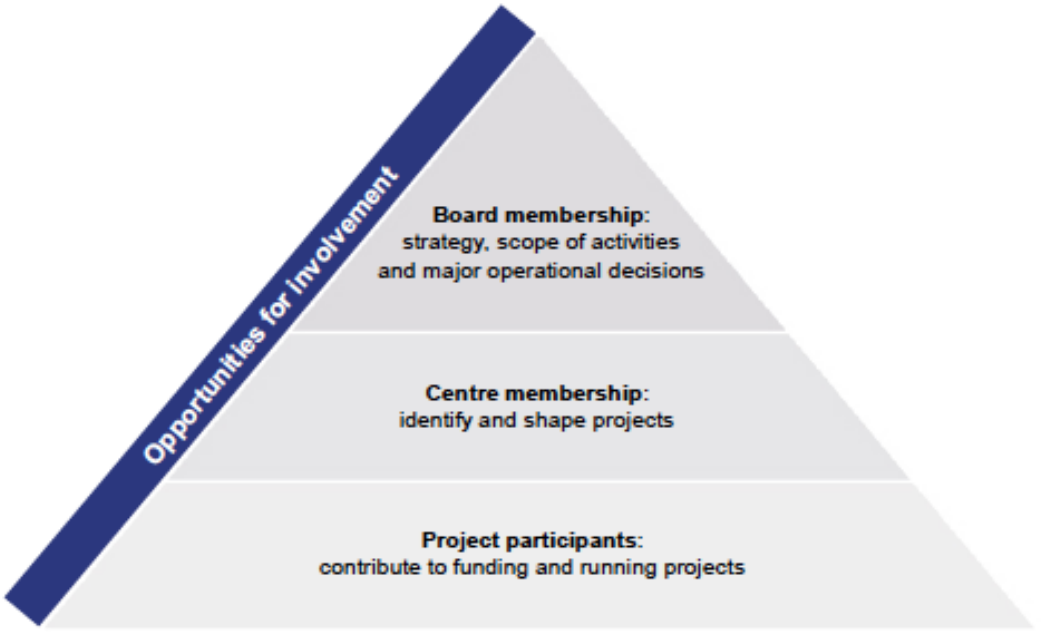

Figure 31 – Levels of commitment to CISB
Source: Material obtained during the interview, provided by SB2

While waiting for other partners' commitment, Saab concomitantly reaffirmed their own commitment to CISB:

a) To assure investments of USD 50 millions on collaborative projects for the next 5 years;
b) To offer 100 scholarships for Brazilian researchers and specialists within the framework of the Brazilian National Program Science without Borders; and
c) To fund all the costs related to the creation of CISB and guarantee its first year of full operation with a total budget of USD 3 millions from Sept/2010 to July/2012.

Consistent with Sarasvathy observation on effectual networks, in most cases, at the start of a network's creation, actors just cannot predict the motivations of those they interact with nor can they always predict their own incentives. That is why it makes sense for effectuators to trust on actual commitments rather than on estimates based on past behavior or promises validated by third parties. Only those who make real commitments become members of an effectual network. This provides a substantial restriction to opportunists. Additionally, by requiring much willingness to change the shape of CISB without any warranty of larger shares of the eventual market, the effectual network tends to select out opportunists and select in intelligent benefactors, including those who persuade others to become benefactors. It does

not mean that members of the effectual network who behave in an intelligent altruistic manner in the early stages will not behave opportunistically as the market combines into more foreseeable and realistic business opportunities. All the effectual network does is clue in intelligent altruisms at the beginning, leaving open possibilities of opportunistic behavior later on. (SARASVATHY, 2008)

4.2.3 New members admission

Right after the inauguration event, CISB had 29 project ideas and 95 entities interested in joining the initiative. The great interest CISB had been receiving was, at this point, an issue that had to be managed. From June to July 2011, while waiting for all legal credentials and registrations to officially start its operation, a team of consultants (from CISB, hired by CISB) worked to revisit all interest parts in order for them to become members and all the leading organizations of each project; as well as in the setting up of all internal management processes.

During that period CISB *entrepreneurs* selected 11 Swedish organizations to formally present a membership proposal. The idea was that in a first moment only few Swedish companies would be invited to become members and work together with Saab to define the next steps for CISB. The selected companies had to demonstrate special interest in developing collaborative R&D in Brazil. Those proposals were sent out in September (right after the entity was officially registered) and five agreed to become members from the beginning of 2012. Table 16 presents all the companies that received in September 2011 a membership proposal to become a Member (Category B) or an Executive Board member (Category A) from January 2012. Each company that received a membership proposal was contacted and questioned why they accepted or refused to become members of CISB.

Table 16 – Organizations that received a proposal to become members of CISB

	Institution	Response	Explanation
1	SP	Accepted Cat A	CISB fits very well in the internationalization strategy of SP. Very good timing
2	Volvo	Not accepted	Volvo requested more time to answer. They were going through a company restructuring process
3	Innventia	Accepted Cat B	CISB fits very well in the internationalization strategy of Innventia. Very good timing

4	Scania	Accepted Cat A	Brazilian new tax regulations for automotive sector and interest in participating in Science without Borders program
5	ABB	Not accepted	Proposal need to be further discussed in the headquarters of ABB in Switzerland
6	Electrolux	Not accepted	No plans in investing in R&D in Brazil at the moment
7	Ericsson	Not accepted	Ericsson has been working in a similar model for years in Brazil. Did not see value added in CISB to justify membership
8	Second	Not accepted	No response on time
9	Stora Enso	Accepted Cat B	Plans to start R&D activities in 2012. Good timing to join CISB
10	Kapsch	Not accepted	No concrete projects in the short term for Brazil
11	FCC	Accepted Cat B	CISB fits very well in the internationalization strategy of FCC. Very good timing

Source: Developed by the author with collected data from interviews

According to the interviews, CISB's selling speech for attracting members was based on the following main arguments:

a) **Increased market access:** commitment to Brazilian R&T and developing Brazilian branded solutions increase market opportunities, and market access is facilitated by connecting R&T community and partners of the center;

b) **Government support for the center**: it is viewed as a tool under Swedish and Brazilian bilateral agreements related to innovation. For instance, governmental institutions such as ABDI and VINNOVA support the venture. This political support shall be reflected in funding, financing, tax incentives, governmental purchase orders and regulation opportunities;

c) **Identify new R&D opportunities:** the center would help in the access to soft governmental financing of R&D projects; access to R&D networks in Brazil and Sweden including users, partners companies and universities, and support to set up and/or administrate new projects; and, finally,

d) **Serve as a neutral arena for open innovation:** CISB is a neutral meeting place of governmental agencies and industrial customers setting the requirements for R&D projects, acting as an impartial coordinator and supervisor of projects and funding.

In addition to those arguments it was also stated that while the center intends to remain open for other organizations to join later, the first members to join would have their project ideas prioritized by CISB management team.

We interviewed all members' representatives to understand what were the reasons and how they decided to join CISB. Those new members representatives are expert R&D and innovation managers, and form the group we called *entrepreneurs* of CISB.

As mentioned previously, the founding members of CISB are Saab AB and Saab do Brazil. In summary, the main reason for them to be part of CISB were stated, in their own words, as an example from the protocols:

> Saab is one of the contenders in the FX-2. We have to prove our commitment to Brazil. Also, Saab is interested to develop a long-term market position to participate in other major bids such as Sisgaaz and Sisfron. The challenge for CISB is to establish a solid collaboration network and a pipeline of important projects with local industry and academia such as coastal radar, remote towers and defense for cyber-attacks with local industry. Also, we are interested to build local infra-structure for R&D and technology demonstrator like the *Capability Development Center* we proposed in São Bernardo do Campo. [SB3]

The third official member to join as an executive board member was Scania Latin America Ltda. Scania is operating in Brazil since 1957 and since 2009, Brazil is its biggest market worldwide. Additionally, Brazilians sectorial regulations have changed at the end of 2011, forcing foreign automotive producers to invest in local contend for production and R&D. The reasons for joining CISB, as extracted from the interviews with a Scania executive, were:

> The biggest business challenge for Scania now is how to deal with the stable market in Europe and at the same time with the high growth rate in Latin America. Also, new markets for ethanol engines are emerging and Brazil is a key player in this field. This summed up with the new regulations for the automotive industry in Brazil helped us to decide to join CISB. What we expect from CISB at the first moment is to help us find external R&D opportunities. CISB umbrella agreement in the program Science without Borders is also attractive. [SC1]

SP Technical Research Institute of Sweden was the forth member that also decided to accept the invitation to join an executive board seat. The Swedish State is the sole shareholder of the SP. As stated in SP website, its mission is "to create, use and provide world class expertise for innovation and the creation of added value both for the corporate sector and for a sustainable society". With around 1100 researchers, SP is in the forefront when it comes to sustainable development. In Brazil, the company is interested to work with residue management together with local governments, since SP has technology on this field. SP sees CISB as a facilitator to access the Brazilian market of R&D contracts. The initial target are the existent SP Swedish clients Sweden starting R&D activities in Brazil (subsidiaries of Swedish companies) and the Brazilian companies looking for competences that are either unavailable in Brazil, or where SP believes they are more competitive. As a sample of the protocols, this is how SP understands CISB:

> To access Brazilian market, SP needed a Brazilian partner. CISB was the natural choice. We believe CISB can support us with information about business opportunities, help us understand the Brazilian Innovation System and the cultural aspects in general. We are also interested in receiving Brazilian researches in the framework of Science without Borders program. Aligned with our core competences, the opportunities we see for SP in Brazil are related to smart grid, waste management, biofuels and fire safety. [SP1]

Besides the four Category A members, Stora Enso do Brasil, Innventia AB and Fraunhofer Chalmers Center decided to join CISB as Category B members. Category A members have the right to appoint Executive Board Members, while Category B altogether have limited representation of 15% of the total members. Moreover, Category A members have 10 votes while Category B members have only one vote during the General Meetings. The cost to be a category B member is 1/10 of category A (CISB, 2011a).

Stora Enso is a major global pulp and paper manufacturer. It is considered the world's oldest public company and has approximately 30 thousand employees in more than 35 countries. In Latin America, the company is in Brazil since 1998, producing cellulose (state of Bahia), editorial paper (state of Paraná) and is building a new factory in Uruguay. It is working in Brazil since 1998. The challenge for Stora Enso is to deal with the decreases in volumes due to the changes in the customers' behavior regarding the use of paper and with the decreases in the profitability of the business due to lower productivity of European forests compared to South America. As a result, Stora Enso is transferring its production base to South America. This movement requires the company to also develop technical competence in the region. For instance, Stora Enso has planned to build R&D capabilities in Brazil in the following years. The company is exploring other innovation opportunities related to the commercial use of biomass. In this field Brazil is particular important not only as a productive base, but also because of the quality of its scientific community. As one example from the protocols, Stora Enso executive declares:

> We decided to join CISB because it seems an important public initiative. Stora Enso will start R&D activities in Brazil in the following years and CISB could be a starting point to establish the first scientific connections. Other benefits of joining CISB are not clear at the moment, that is why we decided to join as regular members [not executive board members]. [SE1]

Another member is Innventia, a research institution dedicated to the study of cellulose, paper, graphic media, packets and biorefinery. As state in their marketing material, their motto is "boosting business with science". The institute is owned by six companies that

together own 51%, namely: Billerud, Holmen, Korsnäs, M-real, Stora Enso and Södra. The other 49% is owned by the Swedish government. Its major project in Brazil is called Polynol – Integrated Production of Polymers and Ethanol from Forest and Sugar Cane Industries. This project is led and originated by Innventia but was being constructed together with many other large companies such as Tetrapak, Scania, Novozymes and Brazilian industry such as Klabin, Fibria, Braskem and ethanol producers. The venture requires a period of five to ten years for implementation and may generate important results in value-chain optimization. As Innventia respondent has stated:

> Innventia has been working together with Brazilian paper and pulp industry for many years now. Clients in Brazil are getting stronger in R&D investments and they are requesting us to establish ourselves in Brazil. CISB is a quick way for us to start operations in Brazil. We designed Polynol project in this context. CISB serves to Polynol as a neutral environment. We can use CISB offices to set up meetings with companies that are not used to talk to each other. CISB can also support the project mainly in the funding strategy for the Brazilian side. [IN1]

Finally, the last member to join CISB is Fraunhofer-Chalmers Center (FCC), a result of a joint venture between the German institute Fraunhofer and the Swedish university Chalmers. FCC works with research in industrial mathematical modeling, and it sees mathematics as a technology tool that can benefit industry. In Brazil, FCC intends to develop collaborative projects with research centers and industry partners, especially in the medical and automobile sectors:

> We decided to send one researcher to Brazil in the second semester of 2012. CISB comes with a very appropriate timing and valued proposition. We expect CISB to help us with local contacts and supporting our researcher to find the good partners. [FC1]

All new members accepted to join CISB without requesting any formal analysis on expected returns. They decided to join by making a fixed investment for one year as a way of "playing the game and waiting to see what the next card is". This behavior clearly relates to our second proposition of affordable loss *vs*. expected returns. Members made a decision on how much they were willing to lose with CISB, rather than having clear expected results.

At the same time, by opening to new members, Saab entrepreneurs tried to reduce the risk of their actions through external partnerships rather than through well-set contingency plans. This refers to our third proposition of reduce *vs.* identify uncertainty. Again, new members add new resources to the venture, but they also constrain it with their own bias. This

understanding can explain why Saab decided to only invite 11 Swedish organizations before opening CISB for less known Brazilian partners. Quoted from the protocols:

> We had to show to our Brazilian partners that we Swedes believe in the model CISB is being set up. At the same time, we Saab, needed help from other Swedish organization with more experience in Brazil to help us building CISB. [SP3]

That statement led our focus on the understanding of how CISB plans to continue building its stakeholders' network and attracting other members. As a result of multiple interviews we produced Table 17 that summarizes CISB's strategy to attract new members. Members were divided in 13 different categories. Only entities that fit in one of these categories were target to become CISB members.

Table 17 – Strategy for Attracting New Members in 2012

	Type of Organization	Lesson Learned in 2011	Action for 2012
1	Brazilians private companies	Will become members if there is an important project and if the funding arrangement pushes for it	Work on more structuring projects such as Polynol, Microgrid, CDC to attract the Brazilian partners
2	Brazilians regulated or state-owned companies	Will become members if there is an important project pushing for it and if there is a clear counterpart for joining CISB	Can be seen as funding and challenges sources for CISB at the first moment. CISB should present project on their calls as it was done with CEMIG
3	Brazilian universities and research institutes	Are very open to CISB but very hardly they would become paying members. The cost to attract them will surpass any investment they can make in CISB	Connect with them by evolving them in the SwB agreements with Swedish universities and other funding arrangements. They can participate in Arena boards. Propose membership only for universities that are already benefiting from CISB action
4	Brazilian funding agencies	Will only become members if there are Swedish funding agencies as members as well	In a first moment, funding agencies should be called to seat in CISB executive board meetings or to the advisory board rather than propose formal membership. On the other hand, specific agreements (such as SwB with CNPq) are feasible. Other action is to formally invite them to participate in Arena Boards or Funding Committees for programs
5	Brazilian municipalities	Main focus is being given to São Bernardo do Campo and we believe it is not obvious for them to become members. They can be partners in different ways	CISB is a founding member of the São Bernardo Technological Park. We can have the same type of relation with different municipalities even without physical presence
6	Other Brazilian governmental agencies	Will only become members if there are important projects pushing for it	CISB could facilitate partnerships among peers, for instance Swedish Transport Agency with State Secretariat of Transport of São Paulo for exchange of experiences and technologies. They can be invited to participate in Arena boards

7	Swedish companies with industrial footprint in Brazil	Whenever they are willing to have R&D activities and projects running in Brazil they will see CISB as their natural partner	Keep track of them in using the Swedish Chamber, Swedish Trade Council and Swedish Embassy: use Swedish R&T network via CISB members.
8	Swedish companies with no footprint in Brazil	If they see innovation and R&D as a business strategy to get to the Brazilian market, CISB should be seen as their natural partner. Newsletter should be our contact tool to be kept in their mind	Swedish Hub should be promoting CISB as their natural partner in Brazil. Communication actions like newsletter and events in Brazil
9	Swedish universities	CISB can attract them with the Science without Borders program at the first moment	Continue Saab SwB initiative with the other members and create a deep partnership with the Swedish Ministry of Education
10	Swedish research institutes	As proven by Innventia, SP and FCC, this type of organizations are potential members for CISB and we should continue trying to attract them directly as members	Work closer with RISE (Research Institutes of Sweden)
11	Swedish funding agencies	They would hardly become CISB members at the first moment	Can be close to CISB via the Arenas agreement
12	Other Swedish governmental agencies	They could become CISB members over time	Can be close to CISB via the Arenas agreement
13	Multinational companies with R&D in Brazil and Sweden	Companies like Siemens, Motorola could become members if they get involved in SwB and structuring projects	Communication strategy to attract them and making CISB known

Source: Developed by the author with collected data from interviews

After evaluating the strategy for attracting new members and identifying those 13 different categories, it was clear to us that some categories are more willing to join CISB than others. Consequently, we wanted to understand if CISB entrepreneurs had any strategy regarding their sales effort focus. A summarized answer was given by one of the respondents:

> We believe that starting 2012 with 6 members is a good number to learn and develop the first experiences that will provide us with a clear view of how to proceed in the future. We believe that before producing first results to these recently joined members we should not put much effort in attracting more members now. That means it should also be our main objective for 2012 to focus our efforts on providing all the help we can for our Swedish members to define and establish collaborative projects with Brazilian organizations. We will also try to persuade them to join the Science without Borders agreement since it is a door opener for future initiatives and an important quick win for everyone interested in building our innovation network. [SP3]

As a conclusion for the process of creating CISB, we present Figure 32. Clearly, the first step entrepreneurs had to go through was to define the organization and create a brand for the project in a way it would attract partners and project ideas. With the first group of self-selected partners and a project idea portfolio, some partners joined CISB as members and they financially committed with it. Next step was to select the first projects, find funds

and get started. The belief was that by showing results to the first organizations that joined CISB, it would be possible to attract new members in the future and eventually make it become an innovation network.

Figure 32 – CISB starting-up process
Source: CISB (2012b)

By the end of the first year, CISB staff produced the figure represented in Figure 33 depicting the phases CISB entrepreneurs have established for the setting up of CISB. In Phase 1 (2011) CISB got known and attracted attention. During phase 2 (2012) the focus is to set up regular exchange of people between Brazilian and Swedish organizations, develop or reinforce bilateral connections and work on bilateral funding arrangements for projects. In phase 3 (2013) it is expected that CISB will have an innovation network between the two countries set up with well-established innovation management processes.

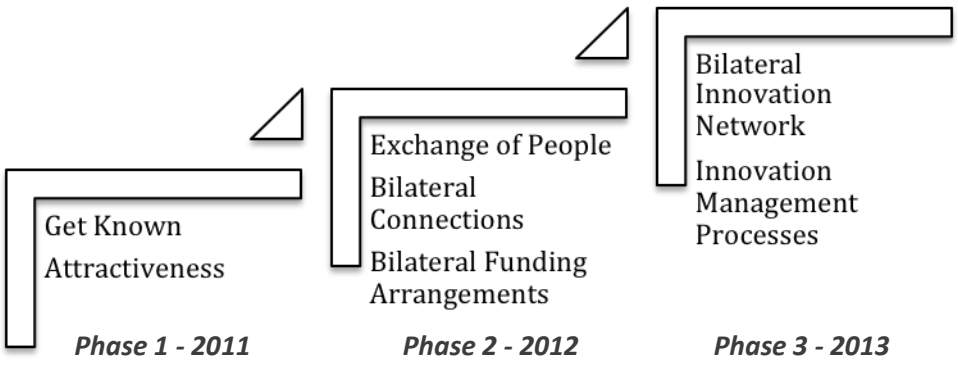

Figure 33 – CISB starting-up phases
Source: CISB (2012b)

When the respondent Lindholmen Science Park was asked to validated the phases as presented in Figure 33, he provided us with the following reflection:

> The fundaments underlying the birth of CISB are not trivial. Concepts such as triple helix, open innovation, innovation networks and challenge-driven innovation were taken as references to help CISB entrepreneurs trigger the start-up process. The successful Swedish experience in managing *science parks* also served as a reference. Lindholmen Science Park (LSP) was chosen to be the role model for CISB and its managers to serve as a coach for CISB team. Also, LSP was chosen by VINNOVA to be the Swedish Hub for CISB and a senior full-time professional was hired to be

> CISB contact point in Sweden. Anyhow, the bilateral dimension and the fact that CISB is not a physical 'park' makes that approach also partial. Unarguably, the creation and development of CISB has a great deal of uncertainty. In such a context, predictive planning is by logic very difficult. [LPS]

LSP's CEO is an openly declared an *effectuator*. With the experience he has participating in the setting up of LSP management organization he was very well aware of the challenges to build such a network and the additional difficulties the bilateral dimension would bring to the endeavor. With that in mind he proposed (altruistically) to be a host of CISB in Sweden as a way to assure the commitment of LSP.

4.2.4 The Swedish hub

When CISB was created, its principles stated that it should be an equally balanced Swedish and Brazilian organization. As Saab took the lead to create CISB, this point was stressed many times, and Brazilian and Swedish organizations were invited to join at the same time. As a result, the 40 partners presented during the inauguration were equally distributed between Brazilian and Swedish organizations. In the same sense, right after inaugurating CISB offices in São Bernardo do Campo, CISB entrepreneurs started to work in the establishment of a Swedish hub for CISB.

As mentioned before, the approach adopted by CISB entrepreneurs was via partnerships. When Saab made the decision to explicitly use Lindholmen Science Park as its main role model, the company encouraged LSP to be the *Swedish hub* for CISB. In the words of LSP's CEO:

> Saab chose to design CISB from Lindholmen Science Park's model. But we thought we could help more actively than just being a model; we offered then to serve as its 'hub' in Sweden. Saab seeks commitment and support from other Swedish partners (industry, academia and social actors). Their goal is to spread the ownership and operation of CISB in Brazil to several industrial partners with strong interests in Brazil. To be successful, it is vital that CISB holds a physical presence in Sweden so they can drive this process also 'from a Swedish soil'. The operation in Sweden shall naturally work with CISB in Brazil. [LSP]

CISB entrepreneurs very well received this idea. With their support, LSP decided to submit a funding proposal to VINNOVA. The proposal was delivered in July 2011 and

approved in September of the same year. The CISB hub in Sweden was then created in November 2011.

The proposal indicated that CISB-Sweden would be organized within the Lindholmen Science Park AB[1]. LSP would offer an appropriate working environment, which partially means that high costs would be avoided. At the same time, the environment would provide an effective national and international network for CISB.

LSP requested a full-time senior innovation manager in Sweden. The main tasks proposed for this person were, between others, to provide a natural and easy accessibility for the Swedish actors with interests in cooperation with Brazilian partners and assist the process of developing effective partnerships between the public financing system bi-laterally together with CISB in Brazil. It would also include developing, assisting and monitoring the Swedish part of the project portfolio as well as assist partners and projects with project brokerage, consulting, financing options and information. The hub would so be a branch of the Brazilian CISB in Sweden.

CISB entrepreneurs took the initiative to compile a project portfolio, which was considered the starting point for the person recruited by CISB-Sweden. It contained about 30 project ideas that extended over a wide range of stakeholders in Sweden. However, it was clear that such proposals needed to be further processed in order to categorize and to find its relevance for being funding. At the same time, the project portfolio should be reconciled with CISB-Brazil so those proposed projects would meet the interest, commitment, funding and relevance in Brazil as well. For that purpose, CISB-Sweden decided to work on four main actions:

a) **Identify new project proposals**: taking the existing project portfolio, CISB-Sweden would contact the Swedish partners in order to make it happen and help partners to build stronger connections by discussing project opportunities together right away.
b) **Present project proposals**: sharing LSP experience and capabilities, CISB-Sweden would provide the necessary support for project proponents to define proposal better suited to attract private and/or public funding.
c) **Implement projects**: once projects are approved and funded, they shall be implemented. At this stage, organizations and partners would meet a variety of small and large practical problems, especially given that the projects are bilateral.

[1] AB stands for Aktiebolag, literally “share company”, it is the Swedish term for “limited company” or “corporation”. Lindholmen Science Park AB is the official Corporation that manages the Science Park.

CISB-Sweden will provide partners with project support on its implementation. Essentially, this means solving practical problems that often arises.

d) **Report and disseminate results**: CISB-Sweden should assist projects to produce progress and final reports, including demonstrators and demonstrations, and spread it to the possible extent. Specifically, this could mean seminars, newsletters, mails, visits, and conferences, among others.

The above process implies that the projects need to first establish relationships with a variety of actors in Sweden, such as universities, institutes, small and large businesses and relevant government agencies. In parallel, it becomes essential that the project creates a good working relationship with Brazilian CISB, and gradually builds knowledge about science, technology and innovation in Brazil. As stated by LSP's CEO:

> Cooperative projects often require 'arrangements' to assure cohesion among partners. When bilateral cooperation is sought, this need is even greater. It is practically impossible for CISB in Brazil (and eventually a host of other players) to drive the work required in Sweden. The experience Lindholmen acquired over the last six or seven years underlines the need for resources that can drive the process forward. It is not obvious to all Swedish parties what actually a really collaborative project requires. [LSP]

LSP's CEO believes that, unless the role of CISB is created both in Sweden and in Brazil, there is a great risk that this bilateral cooperative project takes too long to get started and becomes fragmented and non-transparent in Sweden. The presence of CISB both in Sweden and Brazil creates conditions for "real-time" communication and provides a valuable overview in political, business and technical terms.

Following the common procedures of getting public funds, LSP had to promise VINNOVA some clear targets in order to get the project approved. The targets presented by LSP to VINNOVA regarding CISB-Sweden activities in a three-years term were:

a) To have created collaborative projects with a value of 15 million USD;
b) To ensure an appropriate balance between private and public funding on the basis of laws and regulations in each country;
c) To have at least 10 completed projects of cooperation with Brazilian organizations, which would ultimately result in new business for Swedish companies;
d) To help creating more knowledge about Brazil for Swedish players;
e) To help establishing Sweden as a gateway to Europe for Brazilian players;
f) To contribute to the transfer of knowledge regarding joint projects with Brazil;

g) To set up at least 50 new partnerships or agreements between Swedish and Brazilian players;
h) To help creating exchanges between the Swedish and Brazilian Universities and Institutes; and
i) To conduct an annual conference in which results, best practices and new projects are presented and discussed. The conference would also eventually become a forum for connecting new partners.

Additionally, LSP had to prove to VINNOVA that it would establish a national hub to the whole Sweden, not limiting or giving preferences to local partners in Gothenburg. Governance and management of the Swedish hub should guarantee that CISB-Sweden would in fact be an impartial national hub in Sweden. In that sense it was proposed a steering board formed by two other science parks located in different regions. As explained by LSP CEO:

> CISB-Sweden shall be a sustained effort to strengthen cooperation between Sweden and Brazil. Thus, it is very important to organize a stable governance and management. In bilateral arrangements like the one proposed by CISB, it is impossible to predict future trends as industrial, academic and governmental relations develop. Therefore, we believe it is important that the creation and further development of CISB-Sweden is also neutral regarding Swedish partners. This is also relevant from the Brazilian perspective. [LSP]

After having presented the main actions aiming the setting up of the organization and its international hub, in the next sections we will describe and discuss the first concrete actions performed by CISB that are more specifically related to its mission.

4.2.5 International exchange program

During the visit of the Swedish Prime-Minister on May 17, Brazilian president Dilma Rousseff declared her ambition to launch in the following months the program of 75,000 scholarships in science and technology. On July 26, Brazilian Minister of Science and Technology officially announced the *Science without Borders* (SwB) program. The program objective is to open vacancies for Brazilians in foreign universities, and to host foreign researchers in Brazil. Between 2012 and 2017, 101,000 scholarships will be granted to

program participants, which will be funded by the government (75,000) and the industry (26,000).

In this context, CISB entrepreneurs have seen a great opportunity for a quick win. On September 6, CISB and Saab presented to the Brazilian Minister of Science and Technology, Aloizio Mercadante, a proposal to join the program. CISB and Saab would start co-funding 100 scholarships with Sweden in the fields of aeronautics, defense and security. Saab strategically placed CISB as the articulator for this agreement, so that different companies could also join the umbrella agreement with its specific addenda. That would help promoting CISB and attracting members. According to Saab's CSO:

> The scholarships will be coordinated by the newly established Swedish-Brazilian Research and Innovation Centre. The industrial involvement in CISB will ensure that the scholarships will have a clear innovation focus contributing to strengthen both nations industrial base. The close cooperation between academia, industry and public institutions to meet new innovation challenges is one of the trademarks of the Swedish Innovation System and of CISB. Saab will also encourage our Swedish industrial partners in CISB to do similar commitments in support of the 'Science without Border's initiative. [SB1]

On November 24, 2011, CISB and CNPq (National Council of Technological and Scientific Development) signed the above mentioned umbrella agreement, in which CISB would work together with CNPq to attract Swedish companies and universities to the program. The first addendum for the program was the agreement with Saab for the first 100 scholarships.

On the same date, CISB signed the agreement with CNPq and Saab, CISB also signed five other letters of intention with three Swedish universities: KTH Royal Institute of Technology, Chalmers University of Technology and Linkoping University and - members of CISB - SP Technical Research Institute of Sweden and Innventia. In the words of SP representative, the reasons for joining the Science with Borders program via CISB were:

> We see this program as a platform for technology transfer, researcher exchange and learning in both sides. This could be a quick way to start to collaborate with Brazilian organizations and CISB could be a great help facilitating the agreement with CNPq and the Brazilian partners. [SP1]

In the words of the representative from Innventia, when asked the same question:

> To get Polynol project started we could make use of some scholarships offered by the program. CISB existent agreement makes it very attractive to join with a few scholarships to begin with. [IN1]

The other members, i.e., Scania, Stora Enso and FCC, have also shown interest in the program but did not decide to join before the end of data collection due to Feb 29th, 2012. Nevertheless, the prompt decision made by CISB entrepreneurs to join Science with Borders has been producing very important effects for CISB. First, it gave CISB a great publicity on the media as being one of the first to join the Brazilian government as SwB partner. Second, it helped to attract new members that could see in the program a good return for their membership investment. Third, it provides CISB with a soft start funding mechanism for its projects.

The first call for proposals was scheduled to be launched in March 2012, and besides the original three Swedish universities presented as partners in the first proposal, five other universities were willing to join the call. Three others from Sweden: Lund University, Swedish Institute of Computer Science and University of Skövde; one from the USA, George Mason University, and another from South Africa, University of Pretoria. It is also important to mention that those three first Swedish Universities that joined Saab and CISB (KTH Royal Institute of Technology, Chalmers University of Technology and Linkoping University) have decided to become members of CISB in the second semester of 2012, once they were interested in a longer relationship.

4.2.6 Energy & urban development project

After having accomplished to find resources to start operations both in Brazil (from members of the association) and in Sweden (from VINNOVA and LSP), and having signed its first funding agreement for the exchange of researchers between Brazilian and Swedish institutions, CISB also managed to raise funds for its first concrete bilateral and multi-institutional R&D project. In January 2012, a proposal sent by CISB to a public call from FAPEMIG and CEMIG together with the Federal University of Minas Geris (UFMG) and KTH Royal Institute of Technology was approved. FAPEMIG is the research-funding agency of the State of Minas Geris and CEMIG is the electrical energy company of the same state. The call was announced on May 30, 2011 and the deadline for submission of projects was on August 12.

The title of the project is *Intelligent Urban Electrical Networks – a Brazilian model of international constellation*. This project is part of a larger context of three project proposals submitted and approved in the current CEMIG's R&D program. The main goal is to build a futuristic vision of a "microgrid"[1] anticipating some scenarios. This view refers to a grid that can be isolated from the utility network, is self-sufficient, and can create some technical challenges to be deployed. Besides the technical aspect, there is a business model issue of how to build a distributed generation endeavor. The regulatory aspect has to be exploited and it is expected that new opportunities will arise within the potential threat that these developments pose to the dealership, since, in a first instance, it implies a loss of revenue.

This project fits very well in CISB mission to "search for solutions of complex global and societal problems that cannot be solved by individual organizations and that need to be addressed by open innovation and multi-institutional innovation network arenas" (CISB, 2011b). CEMIG launched a call for R&D project proposals giving their vision to the challenge of microgrids and the partnership between CISB, KTH and UFMG together with two other groups of partners (that also submitted their proposals to the same call) arose with the conjunction of interests and complementarity of the expertise of each individual partner. In the words of CEMIG's project manager for this specific project and the coordinator from KTH:

> Sweden is one of the most advanced countries when it comes to distributed generation with alternative sources of energy. Their expertise is highly consolidated and KTH can help us to train Brazilian engineers. It is great to have them as partners. [CEMIG]
>
> CISB has been very instrumental for KTH to make this partnership [with CEMIG] feasible. For many years we have tried to cooperate with Brazilian industry but it was never possible due to the lack of mechanisms. [KTH]

CISB role in this project is divided in three different tasks. The first is to perform an extensive international research aiming to identify what is happening in the world

[1] "Microgrids" systems can be considered energy distribution medium (MT - 13.8 kV) and low voltage (BT - 220/127 V) that have their own sources of generation, storage devices and controllable loads. They can operate connected to the mains utility power or separately, in a coordinated and controlled. The concept is based on the natural evolution of electric distribution making them capable to accommodate diverse sources of distributed generation such as microturbines, fuel cells, solar photovoltaic, small diesel generators, wind, among others, and storage devices, such as batteries. "Microgrids" can increase the reliability of supply and quality of energy, promoting, potentially, the inclusion of sources "clean" (renewable) energy matrix and the reduction of electrical losses in the system. The introduction of distributed generation of electric utilities in the system becomes greatly simplified when provided in the form of "microgrids". (collected from the interview with KTH)

regarding the goals of the project. This analysis should focus on business model and regulatory aspects, without thereby disregarding the technical constraints. The second step will consist in organizing international workshops in a complementary way to subsidize the activities of the first task. The goal is essentially to exchange information and not to disseminate such. The third and final stage will be consolidated with some deliverables that compile the data and information obtained in the form of models of business plans and reports that will clearly demonstrate the opportunities that may arise.

A second group of partners, formed by the companies GAS ENERGY and CONCERT, will have the task of installing a distributed generation plant. This plant will serve to study the co-generation of energy from the binomial natural gas and sunlight. The plant should be initially sized to satisfy the study of co-generation and generation necessary for the existence of a "microgrid", but it should be designed in a way that will allow modular expansion, in order to correspond to the suggested business models that will also be studied.

The third group is formed by the research institute LACTEC and the companies HITACHI and CONCERT. They will be responsible for the technical implementation of the distributed generation grid and for all the issues related to the engineering tasks.

Other partners are expected to be incorporated to the project depending on the choice of the location for the implementation of the infrastructure. They could be local providers of infrastructure, telecommunications and gas. Also, other companies from the CEMIG group might join, such as CEMIG TELECOM and GASMIG.

For the purpose of this research, it is important to ask *how CISB managed to be part of this project.* When the call was launched by CEMIG and FAPEMIG, CISB was not yet fully registered and accredited as a legal entity. CISB entrepreneurs had to work very fast and effectively to have all legal documents and a concrete proposal to join the project. Nevertheless, this was the first clear funding opportunity for one of the project ideas in CISB portfolio and CISB entrepreneurs were very interested in producing quick wins as a way of showing practical results from the initiative.

Although they were not completely sure if CISB would have all official credentials to participate in such call, CISB entrepreneurs decided to produce and deliver a proposal anyhow. That case is a good example of situations in which individual effort makes the difference. One Brazilian researcher living in Sweden, who had just graduated from an MSc program, heard about CISB in the press and decided to contact the Center looking for opportunities, as many others did. In this case, CISB entrepreneurs offered him that if he could coordinate with KTH and UFMG the setting up of a proposal for the CEMIG call he

could be granted with a PhD scholarship within the framework of the same project. And that was exactly what happened. With an external help for an individual contributor from "CISB network" the involved parties managed to produce a competitive proposal before the deadline.

4.2.7 Capability development center

The second project to take from within CISB framework is called Collabora, which includes, among other ideas, the establishment of a Brazilian Capability Development Center (CDC). Inspired in the Swedish and South African experience, the proposed Brazilian CDC is a facility and an open innovation arena[1] aimed to connect military forces and civil society, perform industry R&D collaborations, enable early *proof-of-concept* demonstrations and support functional chain testing in a secure network and based on realistic conditions.

CISB is leading the implementation of this Brazilian CDC because it is an open project capable of providing industry, universities and government with a tool to develop, integrate and demonstrate solutions for applications. Those applications include maritime security (protect the "Blue Amazon"); border protection (inhibit drug traffickers, smugglers and terrorists from penetrating); protection and security of oil reserves and large events (e.g. World Cup 2014 & Olympic Games 2016); and improve interoperability of systems (connect existing systems to future systems by means of simulation).

The CDC proposed by CISB has three main characteristics. It is (1) an integration center, (2) a secure network environment and (3) a showroom.

a) *Why an Integration Center?* Because it is a neutral environment for testing, integrating and validating systems operated by different organizations (such as the armed forces with the State military police force) in a secure network environment.
b) *Why a Secure Network?* Because governments will not share sensitive data if it might be the subject of unauthorized access; companies will not allow their products to be used in an unsafe environment due to the risk of theft and industrial espionage, and the developed capabilities will be used to protect society against external threats and must in turn be protected.
c) *Why a showroom?* Because showrooms serve as a natural focal point where members from different projects and areas meet and exchange ideas. The CDC will

[1] The concept of "open innovation arena" emerged during the data collection and will be further discussed in section 0.

support education and collaboration between industry, universities and government institutes; joint exercises for specific area of interest, and complex demonstrations and lectures.

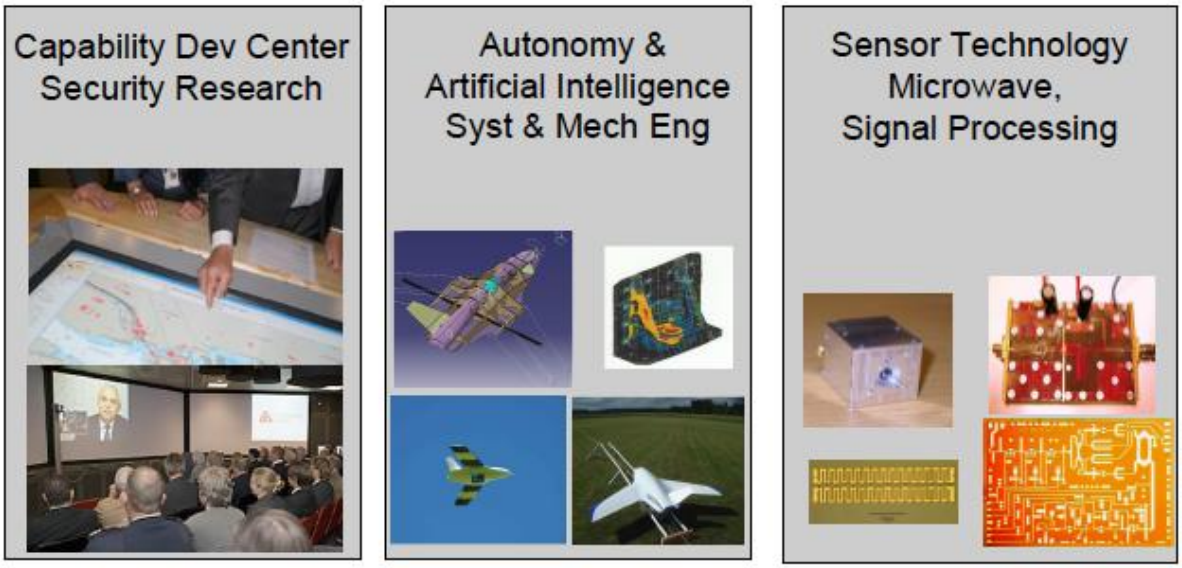

Figure 34 – Potential demonstrators presented by Saab
Source: Material obtained during the interview, provided by SB2

The first to propose the CDC project idea was Saab. This idea was first shown during presentations made by Saab on September 2010 when they first announced the creation of an aerospace R&D center in São Bernardo do Campo. Figure 34 is the representation of Saab's three ideas of potential demonstrators that could be deployed in Brazil.

The discussions about the idea of building a CDC continued along all the previously mentioned subsequent workshops. Similar to the development of CISB, Saab opened this project idea for external collaboration, and invited Swedish and Brazilian organizations at the same time. By November 2011, during the CISB 1st Annual Meeting, it was publicly announced the plans for the creation of the Brazilian CDC in the city of São Bernardo do Campo. Led by CISB, this initiative was presented together by Saab, UFABC, the Municipality of São Bernardo do Campo, Lindholmen Science Park and Council for Scientific and Industrial Research (CSIR) and a South African governmental research institute. All those five organizations signed a Memorandum of Understanding (MoU) with CISB where they pre-committed to the project with a specific role and contribution.

Besides promoting the project, CISB role would be to manage the network and guarantee the synergy among participants. UFABC committed to create a research line in the field of CDC and to host and maintain the facility, keeping it open for external collaborations.

Interested in attracting the defense industry related to investment in the city, the Municipality of São Bernardo do Campo committed to support UFABC in providing them with the infrastructure and by providing project ideas and challenges related to urban civil security. Lindholmen Science Park joined the project at the CISB Swedish-hub mainly because it was also working on a similar process of setting up a CDC facility focused on civil security and transport applications. CSIR committed to join the project by sharing their experience to build and use a CDC for military applications and World Cup 2010, areas in which they intend to collaborate with Brazilian organizations.

Finally, Saab offered their knowledge of how to build up a demonstration environment and showroom; their experience in "systems-of-systems" integration; a well proven cross-domain information exchange solutions (including legacy systems); their understanding of setting up demonstrations; of international standards and interoperability requirements, and of network and system security. As mentioned before, Saab is very interested in developing business in Brazil in the fields of maritime security, border protection, protection and security of oil reserves and large events.

This announcement was made in a way to attract great attention from other potential partners, funding agencies and the specialized press. It was organized during a conference called "Open Innovation Seminar". CISB offered an equipped room for Saab and CSIR to make real-time demonstrations of CDC applications. Saab focused on military applications while CSIR presented their experience during the World Cup 2010. The demonstrations were made to industry, research institutes, universities, other municipalities, armed forces and funding agencies. About 40 different organizations had the chance to see the demonstrations that day.

The next step was to present the project for funding. CISB management team organized a technical description of the facility being proposed and the budget required for the first phase of the installation. The first institution to receive the project was FINEP, a federal funding agency linked to the Ministry of Science, Technology and Innovation (MCTI). The first comment the project received from FINEP was that it would be important to present it directly to the Ministry of Defense and of Science, Technology and Innovation. The reasons for that are that is a very strategic project and in a very different format from what the regular programs from FINEP are used to.

On February 2011, the executive secretary of the MCTI accepted to officially receive the proponents of the project. The Swedish Ambassador, a representative from the South African Embassy, and all other partners participated in the audience with the Secretary.

At this point, the main feedback to the project proponents was that it should integrate the main *innovation network* initiatives from the MCTI, namely: Brazilian System of Technology (SIBRATEC[1]) and the National Institutes of Science and Technology (INCT[2]). MCTI wanted to make sure that if they help to fund this project in São Bernardo do Campo, it will be open for the use of other centers in Brazil.

It is important to highlight the fact that the project was originally proposed by Saab, transferred to CISB and transformed into an international project with a very high local involvement. Saab had the experience in having set up a CDC in Sweden as a marketing tool for its products and in South Africa as part of a technology transfer outset obligation because it had signed military contracts. In Brazil Saab choose to take advantage of CDC's best practices as a strategy to access Brazilian market through the setting up of an R&D and innovation network. Saab does not have enough capital to sustain a CDC on its own in Brazil, neither an offset obligation for doing so. But Saab saw the opportunity of attracting other partners and putting the efforts to make the Collabora project a consistent project, very attractive to the Brazilian government by making it open. Open in a way that they would be interested to support and fund it. In the end, the idea is that Saab would not own the Brazilian CDC, but by placing CISB as the network hub, Saab would guarantee to itself some level of control and access to the center.

[1] SIBRATEC (Brazilian System of Technology) is a federal program established by an decree in 2007 to support the national industry to enhance its technological development capabilities. SIBRATEC financially supports the creation of R&D and innovation networks in line with the priorities of the industrial, technological and foreign trade. The ultimate goal of SIBRATEC is to increase the competitiveness of Brazilian companies. The members of SIBRATEC entities are organized into three networks, namely innovation centers, technological services and technology extension network. There are currently 14 SIBRATEC networks established and the program is operated by FINEP (MCTI)

[2] The National Institutes of Science and Technology (INCT) is a federal program that aggregates the best existent research groups in scientific networks focusing on strategic fields for the sustainable development of the country. The objective of INCTs is to stimulate the development of scientific research and technological development associated in close collaboration with innovative companies in the areas of the Brazilian System of Technology (SIBRATEC). There are currently 77 National Institutes and the program is operated by CNPq in cooperation with Capes/MEC, Fapeam, Fapespa, Fapesp, Famemig, Faperj, Fapesc and BNDES.

4.2.8 Biorefinery project

The third aggregating project to emerge within CISB context is called *POLYNOL – Integrated Production of Polymers and Ethanol from Forest and Sugar Cane Industries*. Innventia brought this project idea to CISB. The idea was created outside of the CISB context, but Innventia found in CISB a better environment to continue its development.

As mentioned before, Innventia is a research institution dedicated to the study of cellulose, paper, graphic media, packets and biorefinery. Although not physically present in Brazil, Innventia made it possible to have some Brazilian companies participating at their "Cluster Research Program". For that matter, a cluster consists of several projects that are run under the banner of a common theme for 2 to 4 years. The research is spread over several areas of expertise with groupings of companies, preferably with similar or complementing operations. In those clusters, Innventia partner customers collaborate to solve problems in common and generate new possibilities, using the resources and expertise available at the Institute.

Ideally, the results of projects within the context of each cluster are further developed and then applied to create competitive advantages for the private companies. The reasoning behind this open innovation approach is that by sharing the investment costs in R&D, and therefore cooperating, the participating companies would reduce their risks, and benefit many times over from the investment made. As explained by Innventia, some important characteristics for a project cluster are that they:

a) Carry out application-oriented research, thereby developing new knowledge or new combinations of knowledge to be used for new technical solutions and applications;
b) Consist of several projects with a common theme;
c) Combine several competence areas within and outside Innventia;
d) Are strategically important for Innventia partners and for Innventia itself;
e) Are an important basis for Innventia's international scientific and technical profile, and
f) Give results and knowledge that can be developed further to industrial reality through client projects.

Although very applauded in the beginning, Brazilian companies that joined some of these clusters requested Innventia to give more focus on issues related to Brazilian

challenges and opportunities. They complained that the clusters were too focused on the Nordic industrial needs and little attention was given to their own interests and the reasons why they have joined the clusters. With that in mind, Innventia approached CISB workshops and helped it to build the thematic area of Sustainable Energy and Biorefineries. Polynol project was a result of the workshop discussions developed within the CISB context. In the words of our respondent from Innventia:

> Our Brazilian clients wanted us to be present in Brazil and develop themes more connected to their needs. That's why we came up with the idea for Polynol project. We found in CISB an appropriate environment to continue discussions regarding this project. [IN1]

The goal of the project is to facilitate large-scale production of renewable polymers and cellulosic ethanol through the cooperation between forest and sugar cane industries, and between producer and end-users. It is based upon the assumption that one of the greatest challenges for both pulp and paper, and sugar cane mills in the coming years is to maintain or improve profitability despite the increasing cost of energy and raw materials. There are good opportunities for those industries to reduce production cost by replacing fossil fuels with internal biofuels and to increase revenues by processing by-products and side streams into commercial products. The market for renewable energy increases much more rapidly than that of the conventional products and there is therefore a strong need to understand how low-cost raw materials available in the production chain can be converted into biorefinery products with a higher value, such as biofuels or renewable polymers. Figure 35 depicts the project value chain.

Figure 35 – Project value chain
Source: Material obtained during the interview, provided by IN2

Ideally, the consortium for Polynol project shall include partners with complementing competences and with the understanding of different parts of the value chain. During the idea definition, Innventia and CISB gathered the following partners to start-up with the discussions:

a) Innventia: Swedish research institute specialized in pulp, paper, packaging and biorefinery;

b) Centro de Tecnologia Canavieira – CTC: Brazilian research institute specialized in sugarcane and ethanol;
c) TetraPak: Swedish company with strong industrial footprint in Brazil, global producer of liquid packaging;
d) Fibria: Brazilian company, pulp producer;
e) Klabin: Brazilian company, producer of liquid packaging board;
f) Novozymes: Danish company, global producer of enzymes;
g) Braskem: Brazilian company, global producer of polymers;
h) Scania: Swedish company with strong industrial footprint in Brazil, global manufacturer of ethanol engines, and
i) Sekab: Swedish company, cellulosic ethanol pilot plant.

The project will aim to collaborate with universities in Sweden and Brazil. Innventia and CISB have identified complementary competences in the following research groups and areas:

a) UNICAMP/CTBE: materials and systems analysis;
b) USP/ESALQ: biomass processing;
c) USP/EEL: biomass processing and new products;
d) Chalmers University: process integration and lignin separation;
e) Lund University: hydrolysis and fermentation, and
f) UFRJ: fermentation and pretreatment.

The Polynol project tackles a number of challenges that no individual organization would have the capabilities or resources to address in isolation. As example, for expert readers on the field:

a) Ethanol production from lignocellulose generates multiple streams: (1) Requires polygeneration approach; (2) By-products must also have high value (e.g. lignin, C5 sugars); (3) Benefits from integration with other industry; (4) Large scale required for profitability, and (5) Value chains must be understood by stakeholders.
b) Liquid packaging is partly made from non-renewable materials: (1) Requires efficient large-scale production of polyethylene from renewables, and (2) Polylactic acid (PLA) can become new component in packaging;

c) Fossil fuels are used in the production and transportation of biomass: (1) Requires high-performance heavy duty engines that can run on biofuels, and (2) Requires lighter materials in vehicles for reduced use of fuels

The technical approach chosen for conducting the project is to focus on the use of raw materials available in or near existing pulp mills and sugar mills (rejects, bagasse, forest residues, etc) to increase revenues. This can be done through a combination of activities, from characterization and analysis of raw materials and products, through experimental work on fractionation, hydrolysis, fermentation and conversion to product evaluation and system studies. An important part of the approach is to adapt and develop the production processes so that they can benefit from the integration with the pulp mill or sugar mill.

The benefits expected for the project are: (1) increased value of side streams and by-products as fuels or polymers; (2) understanding of the whole value chain from lignocellulosic materials to finished products, and (3) the systematic evaluation of how new processes can be integrated.

With the ambition of starting up Polynol, Innventia decided to become a member of CISB and requested its support. The first formal meeting to start with the discussions on Polynol were on November 22nd, 2011 at CISB office. This meeting quickly revealed that regardless technical and business matters (which gets back to our research objectives), for Polynol to get started and implement, *open innovation management* issues (or challenges) should also be tackled. The issues identified in our interviews were:

a) Leadership: as the proponent, Innventia was clearly leading the project. But, as a research institute that needs to be contracted to do research it could not be considered a neutral entity. In principle, Innventia would compete for resources with other institutes in such a project. Also, as a Swedish institute, it creates a problem for Brazilian funding agencies that are not willing to finance R&D activities not performed in Brazil;
b) Neutrality: Innventia realized the need to involve CISB in Polynol for the following reasons. (1) Innventia was being pressured by their clients to give a more significant attention to its Brazilian partners, so CISB was assuring that presence by having Innventia as a member and (2) CISB was open to all other partners to join as well. (3) CISB is a Swedish-Brazilian organization politically supported by both countries. (4) CISB offices are physically neutral for hosting project meetings. (5)

As a not-for-profit organization, CISB has no interest in owning patents or performing R&D activities directly.

c) Project funding: due to the number of partners, the different business models of each partner (research institute, university, private company) and their location and nationality, the possible funding arrangements for Polynol are not straightforward. Besides, there are other dimensions that must be considered. Each partner will have a different perception on risks, expected return from the project and R&D contribution and allocation.

d) Confidentiality and competition: although the project is open for partners to join, in some cases certain partners will have restriction if their competitors are also invited. That also means that the group might be requested by other partners to sign confidentiality agreements that can limit the possibilities for the project.

e) R&D distribution of activities and management: R&D results are often unpredictable and lead to different directions from what was originally planned. Since Polynol has a group doing separate R&D activities, there is a great risk of divergence and partners might want to leave the project if they do not achieve the expected individual result regardless the overall objectives. Therefore, complementarity in the R&D work packages among participants and good management is critical.

f) Business models and intellectual property rights (IPR): each partner has a different business interest in the project. This means that IPR must be differently adjusted as well as the expected results to each of the partner's interests. On the other hand, unexpected innovations might appear along the process of R&D, that is why clear rules must also be established in order to have a common understanding of how to deal with these situations.

How CISB approached Polynol project? It was clear to everyone that Polynol was the type of project that fits very well with the center's mission and CISB entrepreneurs quickly realized that Polynol could attract the attention of many potential members for CISB. At the same time, it was also clear that it would be very expensive for CISB to get involved in such a complex framework.

After evaluating the technical material produced by Innventia and after having participated as a listener in all the meetings and conference calls related to Polynol, CISB management team proposed the following steps to the partners:

a) To develop a first scheme of how the project could be funded by combining governmental mechanisms in order to foster innovation, namely tax incentives, grants, soft loans and matching funds for research institutes and universities;
b) To arrange individual meetings with each partner located in Brazil in order to discuss their interests in: (1) participation in performing R&D activities; (2) participation in financing the project internally and externally, with or without the support of public mechanisms to promote innovation, and (3) participation in the project results (business models for exploitation of results);
c) Gathering all the information from the previous meetings and based on the individual interviews with all partners, produce a complete and detailed project proposal following the generic templates usually requested by funding agencies (technical description, schedule, budget and business plan), and
d) Produce the first minute of an agreement to be discussed among all partners. Those minutes would serve the purpose of showing and making the idea clear for everyone interested rather than defining general agreement for the project to come, at least for this moment.

In order to do so, CISB requested from partners to equally finance the costs involved on those activities. This was also a symbolic act to give the chance for the companies to show some commitment to the project. Out of the eight partners that have demonstrated great interest in participating to the project and had being involved in the previous meetings, six of them accepted the conditions and two denied. The reasons for the denial were that the project was not yet mature enough to start any investment, business cases had to be worked out first. CISB argument was that it was not possible to continue the discussions without investing on the construction of the proposal and that CISB could not do it for free for non-members.

In any case, with six partners willing to share the cost, CISB continues in this direction. The denial from the two companies did not mean that they were not interested in the project. But of course, they sent the message that they were not yet financially committed to the idea, meaning that their competitors were still allowed to join the group anytime.

From the Swedish side, Innventia took the lead and talked to one of the funding agencies to start the process of funding at the Swedish side. It is interesting highlighting the requests made by the funding agency to produce “a good market description” and “to stress the benefits” for each company joining the project. As stated by an Innventia representative:

> We had a very good meeting with our funding agency in Sweden […] however, they required us to include more Swedish companies in the project. They also pointed out that it is very important to have a good market description within the proposal and to stress the benefits for each company in taking part in the project. [IN1]

CISB team was producing the detailed project and the minutes of the contract agreement when we finished our data collection. Nevertheless, it was enough to understand the following aspects of CISB's strategy:

a) By charging a small amount of money, CISB could test partners commitment to the project and at the same time create a precedent in how to finance its own activities;
b) With a detailed project in hands and the commitment from partners, CISB could work it out politically in a way to attract public funding;
c) With a first minute of agreement, CISB could startup the negotiation process and expose the interest from each partner in a way that the critical points could be early identified and solved.

As explained by the CISB management team, this approach was inspired in the advices given by the Lindholmen Science Park's CEO. Very used to multi-institutional project arrangements, LSP accumulated knowledge in how to set up and manage what they call *open arenas*. The Polynol project can be understood as an open arena and LPS proposed to CISB to create another two arenas: one for Security and another for Transport. In the next sections we describe those other CISB actions.

4.2.9 Security & transport arena

> *A difficult issue is to translate and transform human needs and societal problems into functional requirements that can satisfy needs and solve problems. In order to achieve this, it is important to organize meeting arenas, research projects and focus groups. Such forums should involve potential users, consumers, producers, etc. If the forum is a research project, the composition should be interdisciplinary and include marketing researchers, economists, psychologists, etc. These forums should contribute to the articulation of needs and problems and communicate preferences and demands to the potential supplying organizations. (EDQUIST, 2009, p. 16)*

Open Arena Lindholmen is a concept and working method for projects at LSP in which emphasis is placed on collaboration. The park also serves as a base for programs and projects initiated and conducted at LSP, with a physical address. The environment at Open

Arena provides workstations, lab environments and other advanced IT infrastructure necessary for the projects. There are eight projects or programs run within Open Arena Lindholmen, namely: Security Arena, Safety Arena, Media Arena, Visual Arena, Test Site Sweden, TUCAP, Closer and CISB Sweden.

At the Security Arena, LSP works on research and development that aims to improve disaster management skills and making society better equipped to deal with serious threats and disruptions. LSP pursues development projects and research in several public security fields, such as information and communications security, transportation security and surveillance, and early warnings. Some of the projects are pilot projects in which users can test new technologies in an early phase.

Since its inception in 2006, the Security Arena has become an established national arena for projects in societal security. Partners include the Swedish Civil Contingencies Agency (MSB), Chalmers, the University of Gothenburg, Ericsson, Saab AB and AB Volvo. In addition, end users, teams of experts, and collaboration partners are involved in the projects. The Security Arena has four themes:

a) Transportation security: research and development into greater security of supply chains, transports of dangerous goods and safer, more efficient transport flows.
b) Mobile broadband for security in society: research and development into how commercial communication technologies can give authorities better support for information distribution during emergencies.
c) Surveillance and early warning: research and development of technology for surveillance, detection of deviations and early warnings applied to critical facilities such as ports.
d) Methods and systems for robust and secure crisis management: research into methods and technologies for preventive crisis management, including data and information security.

In cooperation with LSP, CISB opened the Security Arena for Brazilian organizations to propose and participate in projects in partnership with the Swedish organizations. Likewise, by the name of Transport Arena, other LSP arenas also opened for cooperation in Brazil via CISB, namely:

(1) Safety Arena[1];

(2) Test Site Sweden[2];

(3) Closer[3]; and

(4) Visual Arena[4].

As mentioned before, CISB was designed after the LSP model. Moreover, LSP is not just a partner, it is CISB itself in Sweden. Since November 2011, LSP has a project manager to work on business development for CISB. One of her missions is to establish Security and Transport Arenas in Brazil.

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[1] Safety Arena: Chalmers's competence center SAFER coordinates research projects and activities related to automotive and traffic safety at Safety Arena. SAFER makes decisions about cross-disciplinary research projects conducted in collaboration between universities, industry, institutes and authorities. SAFER also coordinates applications for EU projects. Approximately 50 projects and feasibility studies are currently being coordinated by SAFER within the framework of the Sweden Michigan Naturalistic Field Operational Test (SeMiFOT). Among the fastest-growing research fields in traffic and automotive safety are naturalistic studies and field operational testing (FOT), which study driver behavior during normal car driving and document chains of events in crisis situations. SAFER is the leader of the project Sweden Michigan Naturalistic Field Operational Test (SeMiFOT), a Swedish-American collaboration between 15 parties including the University of Michigan Transportation Research Institute (UMTRI), the world leader in this field. The project's primary funder, Vinnova, has entered an agreement with the Michigan Department of Transportation to promote development in joint research areas. Vinnova is also actively involved in EU applications for Field Operational Test projects. Several projects from the research programme Intelligent Vehicles and Safety Systems have been conducted under the auspices of Safety Arena Lindholmen. Students working on their theses under these projects are offered access to the arena and to the laboratory equipment utilized in the projects. (LSP, 2012).

[2] Test Site Sweden: is a national project and a neutral meeting place for joint research projects in safety, the environment and Intelligent Transportation Systems (ITS). Its purpose is to promote the growth of knowledge and the development of new technology in the field. Test Site Sweden will also promote a strong international reputation and a showcase of Sweden's expertise in the automotive industry, road safety and the traffic environment. LSP has been commissioned by VINNOVA to manage and develop Test Site Sweden since 2006. Lindholmen Science Park AB is responsible for administration, while functional management is provided by a strategic steering group with representatives from VINNOVA, AB Volvo, Saab Automobile, Volvo Cars, Scania AB and the Swedish National Road Administration (LSP, 2012).

[3] Closer: is a meeting place for collaboration among business, academic and public sectors in the field of transport. The goal is to provide a powerful demonstration and innovation environment with expertise in transportation efficiency. Closer supports research and development projects for industry, and promote a Swedish vision for increased transportation efficiency. It is mainly focused on initiating, supporting and coordinating demonstration projects. Closer is a national resource and bring together competence within Sweden. It also leads larger demonstration projects within Europe. Closer is a part of the creative collaboration environment at LSP. It is seen run as a project within LSP on behalf of VINNOVA and Trafikverket since 2011 (LSP, 2012).

[4] Visual Arena: it is gathering the resources in the field of visualization in western Sweden. The vision is to create a world-class visualization environment that offers academia, business and public stakeholders a common arena for interaction and innovation. They want to make advanced visualization technology accessible, promote interaction and create new partnerships. Visual Arena will offer an open and neutral collaborative environment for innovation trough visualization, where people can meet use high-tech visualization equipment, facilities with lobby, studio, lab environment, workspaces and meetings places. Visual Arena is the result of a successful collaboration between LSP, Chalmers, Business Region Gothenburg and the Center of Visualization. The first five years are funded by the City of Gothenburg and the arena is a program within LSP (LSP, 2012).

We now propose to answer the following question: *How to start up a Lindholmen Open Arena in Brazil?* The approach adopted by CISB was to launch the Security and Transport Arenas at the 1st CISB Annual Event. CISB event was held inside the three-days event Open Innovation Seminar that was also disseminating the concept of open innovation arena. On the first day, LSP's CEO had the chance to explain to a public of around 600 people (mainly R&D and innovation managers in Brazil) the Lindholmen way of working. Similarly, VINNOVA preceded LSP's presentation with a speech on Challenge-Driven Innovation. During the next day, three LSP arena managers came down to Brazil and conducted the two separated Security and Transport Arena meetings with Brazilian partners. Each meeting counted with the presence of about 12 different institutions that were individually invited from a list made by CISB according to the LSP arena manager criteria.

As a result from the meetings, some project ideas were proposed and they helped to fill up CISB projects idea portfolio. Nevertheless, until the end of February – when we concluded our data collection - those ideas were not further developed. Instead, during the months of December and January, CISB team gave more focus on other running actions (e.g. CDC, Polynol, Science without Borders) and to the production of an Action Plan for 2012.

Before going to the section in which we explore how CISB entrepreneurs decided on the Action Plan and Budget for 2012, we will describe very briefly two other project-related actions performed by CISB.

4.2.10 Technology transfer projects

During the period we observed and collected data from CISB activities, two other revealing project-related actions emerged. Both projects have in common the technology transfer aspect, but they were developed in very different ways. The two projects were proposed by Saab and are based on existing products.

The first project is related to a software and system solution for civil security application. It refers to a very complex technology developed for Sweden and being used in Europe. To access Brazilian market, Saab needed to identify a competent software development partner willing to build an application version of the product for the Brazilian needs. Saab requested CISB to identify such partner and eventually attract it to become a CISB member.

The second project refers to a new product family of radar sensor that after important sums of R&D invested, Saab decided that the resulting product was not aligned with the companies' strategy nor with its business model. The business opportunity was therefore sent to Saab Ventures, a business unit that deals with spin-in or spin-out opportunities for the group (as described in section 0). Saab Venture's report stated that the Swedish market was not big enough to sustain the business, and was not even big enough to sustain it from its startup phase to maturity phase. Therefore, potential external entrepreneurs that would take this business forward could not be based in Sweden but rather in a country with a bigger internal market. Consequently, Saab requested CISB to evaluate the business case for Brazil and provide feedback information to help Saab decide on how to proceed.

In both situations, CISB approach was to perform detailed market analysis before taking any action. With the result of the market analysis and the identification of potential partners, CISB organized visits for inspection in order to define prospective partnership. It did not disclose information to anyone before short-listing the subjects (potential partners) for a very small group of candidates.

4.2.11 Action plan and budget 2012

In the beginning of January 2012, CISB team has produced an Action Plan to be presented and discussed with CISB members by the end of the month. After a year very full of activities, it was time to settle down things and reflect on the balance of the year and define 2012 priorities. As stated by one of the respondents:

> We believe that for next year we should evaluate the opportunities we are facing, the resources CISB members are willing to dispose, take the lessons learned from our previous actions and based on that, define the next actions for 2012. These next actions shall aim to produce new outcomes that will make us move forward in our mission. Although there is a lot to be done, we start the year with a complete and integrated team including the Swedish hub, an internal processes, the communications tools set up, a good number of partners and a consolidate mailing, six paying members and some pillars from where to build the long term results. [SB3]

CISB entrepreneurs have defined their actions for 2012 based on three pillars:

a) Science without Borders: The Science without Borders umbrella agreement with Cap provides the framework for the connection and involvement of people. These people will staff and will be the critical mass to work on future collaborations and

projects among Brazilian and Swedish organizations. The use of scholarships is a quick start for new projects and institutional bilateral connections.

b) Open Arenas: The arenas provide the institutional framework in which triple helix actors will be connected and working on focused and defined programs. As a starting point, CISB has launched the Security and Transport Arenas in partnership with Lindholmen Science Park.

c) Demonstrators: Finally, CISB will also work on building facilities to serve as demonstrators and meeting places for partners to work together in certain phases. In this sense, CISB is working in the creation of a Capability Development Center in Brazil that is suited for both Security and Transport arenas.

Figure 36 represents graphically the main drivers for CISB actions in 2012. According to the original plan, the focus of 2012 should be (1) the exchange of people, (2) the bilateral connections, and (3) the bilateral funding arrangements. While the Science without Borders exchange program deals with the exchange of people, the setting up of the Open Arenas and Demonstrators are related to the formation of bilateral connections and to the definition of funding arrangements. In other to keep management focus, CISB decided to give priority to the project ideas coming from its members.

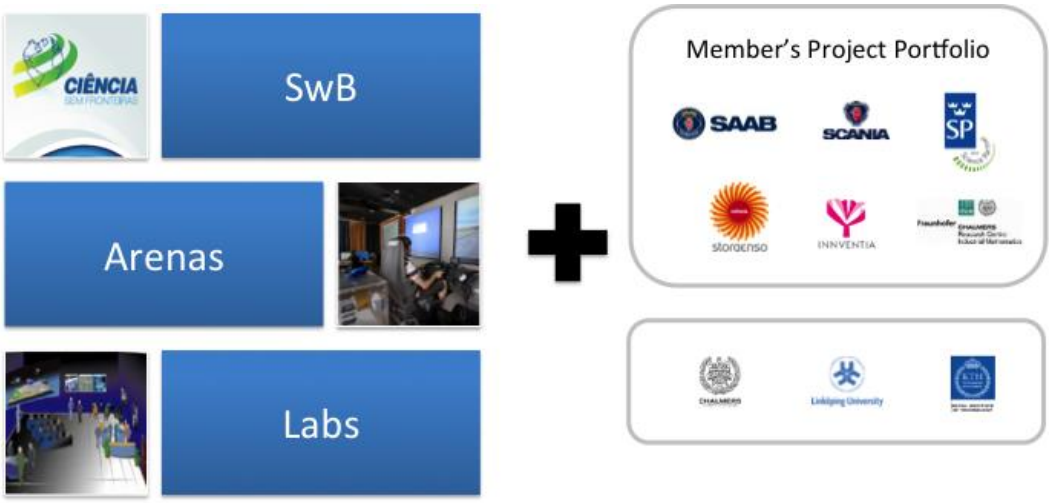

Figure 36 – CISB opportunities for 2012
Source: CISB (2012b)

As one of the respondents argued:

> We believe that starting 2012 with 6 members is a good number to learn and develop the first experiences that will provide us with a clear view of how to proceed in the future. We believe that before producing first results to these recently joined

> members we should not put much effort in attracting more members now. That means it should also be our main objective for 2012 to focus our efforts in providing all the help we can for our Swedish members to define and establish collaborative projects with Brazilian organizations. We will also try to persuade them to join the Science without Borders agreement since it is a door opener for future initiatives and an important quick win for everyone interested to build our innovation network. [SB2]

CISB action plan for 2012 includes some goals and objectives. Nevertheless, it is explicitly written in the official internal documents that those objectives are references and should not be understood as fixed. As stated by one of CISB entrepreneurs:

> The objectives defined are references for our action plan and should not be understood as fixed. They might change and be adapted depending on the opportunities we create along the year. [SB3]

CISB defined objectives for the number of new members, objectives related to funding for projects; to each of the main actions started in 2011 (Science without Borders, Collabora, Polynol, Microgrid, Open Arenas); to the project portfolio from members, and to new initiatives to the launched in 2012.

CISB Action Plan and Budget for 2012 was approved on February 2nd, 2012 in the first Executive Board meeting organized at CISB headquarters with all the six independent formal members.

4.3 Analysis of the Case Study

In the previous sections we described the case study of the starting up of CISB. In our extensive description we covered the type of organization that was created; we went through all the first steps of its creation; we considered the fundamentals of the type of organization being created; we identified the key elements of the context it was embedded in and the interests of its creators, and, finally, we collected data from all CISB's first main actions after its creation from May 2011 to February 2012.

Recollecting that our research goal is to validate effectuation as a useful methodology utilized by entrepreneurs involved in the startup of an organization dedicated to open innovation management and innovation network, we have to check the following assumptions: (a) is CISB really doing open innovation as to be considered an OIMO? (b) Can

we observe evidences that CISB entrepreneurs used effectuation as a method of decision-making during the startup phase?

CISB as an open innovation management organization

Although CISB have been created explicitly referring to *open innovation* as one of its fundaments, for our case study to provide valid answers for our research objectives we need to verify that CISB actually is an OIMO from what it does rather from what it declares it would do. For that purpose we took the first part of Table 9 (Section 2.5) and, for each mode of open innovation, we linked what was actually done by CISB to its members. The summary of this examination is presented in Table 18.

Table 18 – Evidences of Open Innovation Actions performed by CISB

Open Innovation mode	Description	Evidence
Outside-in process	Integrating external Knowledge, Customers and Suppliers	- CEMIG Microgrid project integrates external knowledge from KTH [section 4.2.6] - Polynol project interconnects companies in the value chain to develop new product (e.g. Klabin/Braskem suppliers of Tetrapak) [4.2.8]
	Acquisition/Spin-in with/out VC	No evidences
	Inward technology transfer	No evidences
Inside-out process	Bringing ideas to market, selling/licensing IP and multiplying technology	- Innventia technologies for lignin extraction and valorization and Alkaline fractionation integrates renewable packging and energy industries by producing biomaterial, biochemical and biofuels from forestry residues, bagasse and pulp wood [4.2.8]
	Spin-out/off with/out Internal VC Fund	- Saab Ventures project opportunity directed to CISB [4.2.9]
	Out-licensing	- The set up of Collabora requires technology from Saab and CSIR [4.2.7]
	Outward technology transfer	- Saab civil security product offered to Brazilian software development company [4.2.9]
Coupled process	Couple outside-in and inside-out process, working in alliances with complementarities	- The participation of companies from different industries such as Scania, Klabin and Tetrapak in Polynol [4.2.8]
	Joint development, joint-venture, strategic alliance, networking	- Collabora [4.2.7], Microgrid [4.2.6] and Polynol [4.2.8] projects have joint-development, strategic alliances and networking

Source: Developed by the author using data collected from interviews

For the purpose of this work, we define open innovation as “the use of purposive inflows and outflows of knowledge to accelerate internal innovation, and expand the markets for external use of innovation, respectively” (CHESBROUGH, 2006b, p. 1). Noticeably, the projects described in the case study (Polynol, Microgrid, Collabora and the technology transfer projects from Saab) are open innovation projects in essence, in which participants purposively join so as to share knowledge and consequently accelerate innovation. By providing resources for the exchange of people, Science without Borders program is an instrument to support the cooperation agreements between the different organizations. Finally, Security & Transport Arena provides an institutional framework for open innovation projects to be proposed and executed.

The role of CISB as the coordinator of those projects and actions makes it fit properly in our definition of an open innovation management organization. CISB is therefore an OIMO not only in its conception but also in its practices. Having said that, yes, it is possible to refer to CISB as an OIMO.

Evidences of effectuation in the startup of CISB

Next step now is to analyze the evidences that CISB entrepreneurs used effectuation as a method of decision-making during its startup phase. Table 19 presents a summary of evidences of effectuation in CISB entrepreneurs actions extracted from the descriptions of the Case Study. We linked evidences of effectuation to the research propositions defined in section 3.3.3.

Table 19 – Evidences of Effectuation performed by CISB Entrepreneurs

#	Proposition	Evidence
1	**Means vs. goals.**	- CISB was created without ever a definition of its specific goals. Saab was covering the costs for the workshops and fixed a schedule until the inauguration, and the resources were fixed beforehand [section 4.2.1] - Partners were called to help building CISB that at the time was just a vision [4.2.2 and 4.2.3] - CISB joined Science without Borders program by defining the resources available (100 scholarships) before defining what exactly those 100 researchers would do. As the project within CISB started to emerge, the scholarships were also defined [4.2.5] - Collabora was created with fixed means rather than fixed objectives. As Collabora evolved and new partners were added in, targets also changed

#	Proposition	Evidence
		to incorporate new ideas [4.2.7]
2	**Affordable loss vs. expected returns.**	- Saab offered to maintain CISB for three years and defined a fixed budget for that period expecting that with the attrition of other members the costs would be shared. This was done before CISB could even define the thematic areas it would focus [4.2.3] - Members joined CISB for a fixed annual fee without knowing exactly what they could expect from CISB. Every next year members can decide to stay or to leave depending on the results [4.2.3] - Saab offered 100 scholarships for the Science without Border program without having a clear idea what exactly they would do [4.2.5]
3	**Reduce vs. identify uncertainty**	- Saab invites all potential partners in its network to support the development CISB. CISB entrepreneurs believed that the success of the initiative relied on their capacity to attract project ideas and funding opportunities [4.2.1] - Polynol and Collabora projects evolved by adding new partners to build a more solid project that could be easily funded and executed. Both projects were made in a way that they were attractive to partners and funding agencies [4.2.8 and 4.2.7]
4	**Acknowledge vs. overcome the unexpected**	- The date for the inauguration of CISB was delayed for two weeks from what was originally planned in other to be combined with the Swedish Prime Minister visit to Brazil. As a result, CISB was announced by the Brazilian president herself, which produced broad media coverage [4] - Science without Borders suddenly became an important tool for attracting new members and partners, which was completely unexpected for CISB. Nevertheless, it became one of the main strategic actions for the setting up of CISB [4.2.3 and 4.2.5] - Klein and Fibria criticism regarding Innventia clusters in Sweden pushed for the setting up of Polynol project. As a result a wider number of partners were involved [4.2.8]
5	**Create vs. exploit opportunities**	- In order to attract partners and members to collaborative innovation frameworks, CISB joined the Center for Open Innovation – Brazil to promote the concept of "open innovation arena" [4.1.4] - The initiatives proposed by CISB projects Microgrid, Collabora and Polynol are in essence the creation of new markets [4.2.6, 4.2.7, 4.2.8]

Source: Developed by the author using data collected from interviews

As presented along the description of the case study and the summary above, evidences of effectuation in the startup of CISB are numerous.

Although we can unarguably identify effectuation in CISB entrepreneurs' main actions and this logic of reasoning extends to the management team as a cultural aspect of the organization, causation cannot be rejected. As we could identify from the technology transfer projects briefly presented in section 4.2.10, in which the targets were clear, risks could be evaluated and the market was known, effectuation did not fit. Instead of organizing open discussions, open meetings and develop open actions to attract partners; CISB performed detailed market analysis and inspectional visits to potential partners. At the same time, the

transfer of technologies projects can also be defined as open innovation projects. This observation led us to another point of verification that shall be answered in our data analysis: *to what extent do CISB entrepreneurs effectuate?*

Moderators of effectuation in CISB case

As proposed by Sarasvathy (2010), "career paths of entrepreneurs and the life cycles of the firm they start will depend on and influence their use of effectual logic" (p.132). Sarasvathy suggests novice entrepreneurs will vary their use of causal and effectual logics and as they become experts, they will tend to be more effectual. Also, that the more resources novice entrepreneurs dispose, the more *causal* their actions are likely to be. Regarding life cycle, Sarasvathy proposes that firms that have transformed industries and opened-up new markets would have begun effectually. But, as they survive and grow, their management will need to become more causal, particularly in exploiting the new markets they have created and building long-term competitive advantages.

Nevertheless, Sarasvathy also reckons that effectual decision-making can in some situations marble with causal decision-making. Rather than smooth evolution toward nearly pure causal thinking over time, "we can envision a more nuanced approach to how these relative types of reasoning manifest in practice" (p. 56). She provides one example of a situation where the organization's relative success in resolving uncertainty dictates how quickly a goal emerges to energize causal decision-making. Based on how well the initial use of effectual principles resolves the uncertainty, further decisions may either take causal aspects, or if uncertainty persists, continued effectual reasoning may be appropriate. This is where Sarasvasthy concludes that even in a corporate setting, effectuation can have a role to play in the process of opportunity search as companies seek ideas that will bring success.

Furthermore, Kuepper (2009) has also shown that effectuation is moderated by the degree of innovativeness of projects in the context of R&D management. The results of his research suggest that non-predictive control approaches consistent with effectuation are an important predictor of successful highly innovative R&D projects. At the same time, causation proves to significantly enhance performance of projects that involve a low level of innovativeness.

In our research, we observed an important moderator for the use of effectuation in the context of open innovation. First, as expected from previous studies, we noticed that the less the targets were defined, the more effectual reasoning was used. At the same time, the

more open the projects were for external collaboration, the more we found evidences of effectuation. On the other hand, also consistent with Sarasvathy propositions, the better the targets were defined, the easiest managers know what to do next and plan their future actions. Table 20 presents a summary of our observations.

Table 20 – Moderators of Effectuation in CISB

Project	Target definition	Degree of Openness	Level of Effectuation
Technology Transfer projects	Very well defined, hardly changed	Open for specific and selected partners (1 or 2 for each project)	No effectuation evidences
Microgrid	Well defined, possible to adjust	Open for specific and selected partners (5 to 10 partners)	Little effectuation evidences
Polynol	Preliminary defined, open for new targets	Open for invited partners (5 to 20)	Effectuation prevailed at the beginning to build the draft idea of the project and as the project evolved, causation reasoning started to emerged
Collabora	Preliminary defined, open for contributions	Open for self-selected partners (unlimited number of partners)	Effectuation prevailed along all the period of observation
Science without Borders	Broadly defined, open for contribution	Open for self-selected partners (unlimited number of partners)	Effectuation prevailed at the beginning with Saab's call, other members approached the opportunity in a casuistic way
Security and Transport Arenas	Broadly defined, open for contribution	Open for self-selected partners (unlimited number of partners)	Effectuation prevailed along all the period of observation
Creation of CISB	Broadly defined, open for contribution	Open for self selected partners (unlimited number of partners)	Effectuation prevailed along all the period of observation

Source: Developed by the author using data collected from interviews

It is worth noticing that the degree of openness does not depend on how many suspects or prospect partners are contacted for a specific initiative, but how open the initiative is to collaboration with these external partners. For instance, the technology transfer projects might have involved a great number of companies that were contacted but only one will be chosen. In this case the degree of openness is low.

In conclusion, we observed that the less the target was defined and the more open the project was for external collaboration, the more effectual reasoning was used. Thus, the moderator of effectuation in CISB case is**:** *target definition* and *degree of openness*.

4.3.1 Responses to the research propositions

In order to conclude our data analysis, we shall rescue the research propositions presented in 3.3.3 and contrast them with the data found in the case study. For each proposition we present our response after a justification.

P1: Means vs. goals. Open innovation management organizations are rather defined on the basis of given means or resources than on the basis of fixed targets.

The ultimate goal of open innovation management organizations is to facilitate and coordinate collaboration between individuals and organizations so as to create innovations by purposive inflows and outflows of knowledge. This implies that knowledge is the fundamental resource to be shared and that these expected innovations are not fixed targets.

In our case study we observed that members and partners would be more motivated to gather around CISB if they were able to build new opportunities together than if they had a fixed agenda. It was clear for most participants of CISB network that it would be more of an environment where they could connect and interact with others to develop new ideas and opportunities than to achieve any specific goal.

In that sense, CISB was built and defined based on what partners and members could bring to the table (resources) rather than based on what they could have planned to achieve (fixed targets). This means, proposition 1 is valid.

P2: Affordable loss vs. expected returns. Open innovation management organizations actions are rather defined considering acceptable losses (costs) and risks rather than expected returns provided by forecasts.

While knowledge is the fundamental resource to be shared within the context of open innovation networks, the extent of how much this knowledge will be shared depends on the willingness of other participants to also share their knowledge. The concept of open innovation argues that the future belongs to those who do the best job of integrating the best of their internal ideas and capacities with the best external ideas and capacities. Designing and orchestrating a global network of capacities is the basis for a brighter future for those who are willing to open up their innovation process.

Within the CISB context we observed that more often leading participants would make offers to others such as sharing specific knowledge or providing free information for the sake of building a specific opportunity step-by-step. After having offered something, the participant would only give another step forward – extend the offer or make another one – after receiving a positive feedback from someone else in the group.

Nevertheless, we observed in many occasions participants adopting a very different approach and before offering something to the group they would first condition their participation on a specific action only after receiving more information (such as market analysis) in a way they could internally evaluate if they would like or not to join the action. What happened in such situations was that the group eventually would leave behind whoever made this type of request or they would deliberately leave the group if they did not receive the requested information.

Thus, CISB main actions were defined on the basis of offers made by participants (affordable loss) rather than expected returns provided by forecast. In other words, proposition 2 is also validated.

P3: Reduce vs. identify uncertainty. Expert entrepreneurs of open innovation management organizations try to reduce risk of an action through internal or external partnerships and agreements rather than well-set contingency plans.

Open innovation presumes partnerships and collaboration. However, open innovation partnerships and collaboration are sought to increase the value creation of an opportunity. The actions of an open innovation management organization are mainly to provide participants with an appropriate environment to build and conduct these partnerships.

We observed that CISB entrepreneurs would often prefer to initiate actions with a group of partners rather than alone. This mindset was part of the basic definition of CISB as

one key belief rather than a decision to be taken each time. Again, this indicates proposition 3 is accepted.

P4: Acknowledge vs. overcome the unexpected. Open innovation management organizations startup process is flexible enough to be adjusted to new alternatives and opportunities rather than being focused on reaching the project target without any delay. Expert entrepreneurs of open innovation management organizations allow the startup process to evolve as opportunities emerge – even though the opportunities have not been in line with the original target and potential setbacks or external threats were used as advantageous as possible.

While creating CISB, entrepreneurs had very clear in their minds that there was no fixed plan to follow and that CISB would be built from the opportunities that would arise along the journey. It was already expected that members and partners attracted to CISB would make and shape it through their actions and the impact of such actions. Plans were therefore very short termed and not rich in detail; new actions were constantly defined after having observed the results of the previous one.

New opportunities were constantly sought and proposed to actual and new partners. It can be said that CISB was created to attract unexpected opportunities and to be flexible enough to adjust in other to benefit from them. Furthermore, CISB actively tried to create new opportunities by compelling partners into new situations.

Along the process of actions gaining form and body, more detailed plans were produced and causal reasoning would also fit in many situations. Proposition 4 is therefore valid.

P5: Create vs. exploit opportunities. Before starting an action, expert entrepreneurs of open innovation management organizations do not carry out detailed analyses concerning future trends; they rather start a new trend than exploiting exogenous trends.

CISB was created having in mind all the possible synergies between the two countries. This scope of action was too wide and impossible to manage. Very quickly, CISB entrepreneurs realized they had to narrow it down. The first approach was to define four thematic areas in which CISB would concentrate its efforts. The areas were defined in a way

it could communicate to the external public with the necessary focus in order to attract key participants, but at the same time broad enough to keep CISB scope as wide as from the beginning.

The first opportunities to gain shape within CISB context were the results of numerous interactions among participants of its own network. They were never the result of analytical efforts made by CISB and presented to members. Although it was many times suggested that CISB should do such work, it was never feasible to invest in detailed analyses concerning future trends or competence mapping between the two countries so as to find areas of synergy. This means, we can also validated proposition 5.

P6: Open innovation vs. Effectuation: The more an organization relies on external collaborations to innovate (that means on resources that the firms does not fully control) the more effectual reasoning is suitable.

We observed from our case study that projects that had less defined targets were more open to external collaboration and, at the same time, that effectual logic prevailed. But from that assumption, we could not extrapolate that the more open the project, the more effectual reasoning is appropriate. We also observed that the less the target was defined, the harder it was for managers to take action. The sole inclusion of more partners was not enough to provide a way forward for the decision-making process.

Instead, what we have learnt is that in such cases in which targets are widely defined and partners are more open to collaborations, both effectual and causal reasoning coexist. They do so in a way that when the group is relatively successful in resolving one uncertainty with an effectual approach, a goal emerges and the group quickly moves to a causal decision-making approach until it faces another uncertainty. In summary, based on how well the initial use of effectual principles resolves the uncertainty, further decisions may either take causal aspects, or if uncertainty persists, continued effectual reasoning may be appropriate. In other words, proposition 6 can only be partially accepted.

4.4 Reference Model

What can we learn from the CISB case study? CISB case study allows us to underline essential aspects of open innovation management and at the same time identify how

effectual approach can be useful for the setting up of new initiatives in the open innovation field. Although open innovation practices are becoming very popular, as we mentioned before, there is not yet a consistent body of best practices to guide managers. CISB case study helps us identify some essential aspects of collaboration for innovation and by contrasting it to effectuation theory we can provide future researchers with microfoundations to these practices. In the current section we propose the possible generalizations found in the case study of CISB that will lead us toward a reference model for setting up open innovation management organizations.

The first question that corporate R&D and/or innovation managers must answer before opening up their innovation process is "why" should they do it. As we discussed previously open innovation is "the use of purposive inflows and outflows of knowledge to accelerate internal innovation and expand the markets for external use of innovation" (CHESBROUGH, 2006b, p. 1). More pragmatically, open innovation practitioner could answer that open innovation might increase the company R&D efficiency and create new business opportunities that could be hardly developed by their companies. R&D efficiency could be increased by (1) reducing development costs through collaboration; (2) offering cheaper access to new technologies developed elsewhere, and (3) reducing time-to-the-market by acquiring or connecting with partners rather than researching or developing from scratch. At the same time, new business opportunities can be generated in an open innovation framework by exploiting internal knowledge in alternative ways to the markets such as licensing or transfer of technology and new venturing.

The second question R&D and/or innovation managers should ask themselves before adopting open innovation practices is "how" to do it. We presented in section 2.2.1 different modes of open innovation mentioned in the literature, namely: internal development, employee involvement, R&D contracts or outsourcing, joint venturing, joint- or co-development, external equity participation, in- or out-licensing, selling of technology, corporate venturing, customer involvement and external networking.

Each of those practices requires different management capabilities that are not at all straightforward. As mentioned before, open innovation has some important challenges such as the ones identified in OECD (2008), namely: the extra costs of managing cooperation with external partners, the lack of control, the adverse impact on flexibility, the (over)dependence on external parties and the potential opportunistic behavior of partners. Chesbrough himself adds to this list other inherent issues in practicing open innovation. He identifies five challenges related to accessing external information: the Arrow Information

Paradox, the problem of contamination, the difficulties in fostering a two-sided market and scaling efficiency with volume (CHESBROUGH, 2006).

As described in section 2.5, the increasing popularity of open innovation practices has induced the emergence of innovation and technology markets. These intermediate markets are constituted by *innovation intermediaries* (see section 2.2.2) and, as it is the focus of our work, by open innovation management organizations (OIMO). In many cases, the third question for managers is if they need or not an innovation intermediary, and if so, what type would me more appropriate.

CISB case study stresses the situation when mature and highly innovative organizations decide to connect in a cooperative way with a local innovation system in which they have no relevant presence or have not been open to external collaboration. Many types of innovation intermediaries' business models presume the existence of pre-established ideas or technologies that could match predefined problems or needs. Open innovation management organizations on the other hand must also tackle situations in which member companies share poorly defined needs and try to match competences and capabilities in order to co-create opportunities rather than simply identifying them, as we observed in CISB case.

Furthermore, CISB case study helps us understand that there are common open innovation management practices more suited to a causal approach and others which effectual approach would fit better. We observed that this choice depends on how well targets are defined and how open to external networking the initiative is in a specific moment. However, we also admit that in many cases causal and effectual approaches might coexist during an open innovation initiative depending on the phase it is.

In Table 21 we propose some possible generalization for our findings. We extended to the open innovation management practices identified in the literature the same observations we obtained for the group of practices found in CISB case. For each open innovation practice we present our comment of how we could expect managers to decide whether to approach it with a more causal or with a more effectual reasoning.

Table 21 – Open Innovation Practices vs. Decision-Making Approach

Management practice	**Target definition**	**Degree of Openness**	**Causation vs. Effectuation**
Technology scout, brokering or prize-driven innovation: active scouts search for technologies or passive online	Usually targets are well defined	Usually solutions are found in one organization after having searched in many or received proposals from	Causation approach is more useful to define the problem, plan the actions, plan resources, filter suspects and identify where to find

Management practice	Target definition	Degree of Openness	Causation vs. Effectuation
platforms where individuals can submit their ideas to meet or solve predefined needs or problems		many	solutions or what solutions to select.
Analytical method of monitoring, planning and identifying technologies such as technology intelligence, technology roadmap and technology prospection	Usually targets are well defined	Broad analysis of all possible prospects, openness will depend on specific opportunities, but in general are very focused	Causation approach shall be more suited
Technology transfer and IP commercialization: find partners to exploit inside-out or outside-in opportunities	Usually targets are well defined: find partners to exploit unused technologies or access external knowledge	Usually technologies are transferred, licensed or sold to one or a limited number of partners	Causation approach shall be more suited
Internal R&D: believe that competences are inside the organization	Usually targets are well defined	Closed innovation projects	Causation approach shall be more suited. If the project finds a challenge that cannot be solved with the internal competences it can open for external sources and rely on one open innovation practice
Employee involvement: initiatives that break down the hierarchical structure of the firm to produce unexpected results from ideas coming without management filtering	Targets might be or not well defined	In the level of individuals it is often very open	Causation and effectuation might be suited depending of the target definition
R&D contract: usually the contractor believes the contracted organization possesses the required capabilities	Targets are usually well defined	Limited to the contracted partners previously defined	Causation and effectuation might be suited depending of the degree of innovativeness. If contractor believes the contracted firms possess all capabilities required, it will manage in a causal approach. Contracted might effectuate internally if required. It would be preferable that contractor and contracted share the same view on the decision-making approach
Joint-venture or co-developing: defined by complementarities of capabilities	Targets are usually well defined	Limited to organizations that formed the joint-venture	Causation approach shall be more suited
Spin-off venturing: sell a technology to external entrepreneurs	Targets might be or not be well defined	Limited to one group of entrepreneurs that will pursue the opportunity	In the perspective of the seller, causation approach shall be more suited in other to find a god deal. In the perspective of the entrepreneur as a new business creation, causation

Management practice	Target definition	Degree of Openness	Causation vs. Effectuation
			and effectuation might coexist and depend on the expertise of the entrepreneur and the level of uncertainty effectuation might prevail
Spin-out venturing: equity participation in a new venture to exploit a technology	Targets might be or not be well defined	Limited to one group of entrepreneurs that will pursue the opportunity	In the perspective of the mother company, causation or effectual approach might be suited depending on the level of uncertainty of the opportunity. In the perspective of the entrepreneur as a new business creation, causation and effectuation might coexist and depend on the expertise of the entrepreneur and the level of uncertainty effectuation might prevail
Spin-in venturing: acquisition of a startup company to increment corporation's capabilities	Targets are usually well defined	Limited to one group of entrepreneurs that will pursue the opportunity	Causation approach shall be more suited
Start-up incubator	Targets are usually not well defined	Usually a large number of candidates are expected	Effectuation approach shall be more suited
Science and Technology Park	Targets are usually not well defined	Usually a large number of organizations are expected to join	Effectuation approach shall be more suited
Customer involvement	Targets are usually not well defined	Usually a large number of organizations are expected to join	Effectuation approach shall be more suited
Research associations: not coupled R&D	Specific targets are usually not well defined	Limited number of associates for each research Project or Program	Causation and effectuation approach shall coexist in different stages of the research
Open call for projects and ideas	Specific targets are usually not well defined	Usually a large number of submission are expected	Effectuation approach shall be more suited
Open innovation arenas	Specific targets are usually not well defined	Usually open for self selected partners (unlimited number of partners)	Causation and effectuation approach shall coexist in different stages

Source: Developed by the author using data collected from interviews

As we learn from our case study, we believe that R&D and innovation managers shall be trained to explicitly decide when to approach a situation according to a causal or effectual logic. Our objective in presenting Table 21 is to emphasize the relation between an open innovation management practice and a decision-making approach. Our observations and comments are examples of an exercise any manager should do before initiating an open innovation process.

The *modus operandi* of CISB brings light to the case study presented by Chesbrough (2006) defined as "membership-based innovation community". Chesbrough described the case of InnovationXchange (IXC), defined as an intermediary that helps member companies share poorly defined needs and tries to match them with technologies and initiatives residing in other members companies. IXC model constructed an innovation network among its member companies in which each member company is assigned to a trusted intermediary employed by IXC. This trusted intermediary spends significant time with the member company, building greater understanding and trust. Finally, those trusted intermediaries meet and exchange ideas with each other very frequently. Besides, the trusted intermediaries quickly understand that they could also be very useful to the members scouting connections not only within the membership, but also scouting potential connections with firms outside the membership.

As observed in CISB case study, some aspects such as "neutrality of the intermediary", "intermediary specific understanding on member", "trust among members and intermediaries" and "face to face meetings" (Chesbrough, 2006) are essential for the setting up of an innovation community. Additionally, other dimensions such as "governance", "funding arrangements", "appropriation of results" summed up with the observed patterns of how programs initiate helped us build a referential model for setting up open innovation management organizations.

As depicted in Figure 37, our model adapts the dynamic model of effectuation presented in Figure 12 (section 2.3.4). It is the basic model for triggering the process of boosting the synergy needed to justify the creation of an OIMO by bringing up opportunities for collaboration. The first effectual cycles are needed to create enough opportunities and define the first actions that will justify its creation and shape it. The first step is given by a group of highly motivated organizations interested in the creation of the OIMO. When this group starts its creation. They must have it clear that the organization will be the result of future interactions and commitments from other partners and cannot be anticipated beforehand if they really want it to be an OIMO. This does not mean that the founders cannot have specific and well-defined targets when they decide to establish an OIMO. Instead, those targets are actually means in the perspective of an OIMO, once it can be translated into open innovation opportunities to other partners in order for them to be willing to join the network.

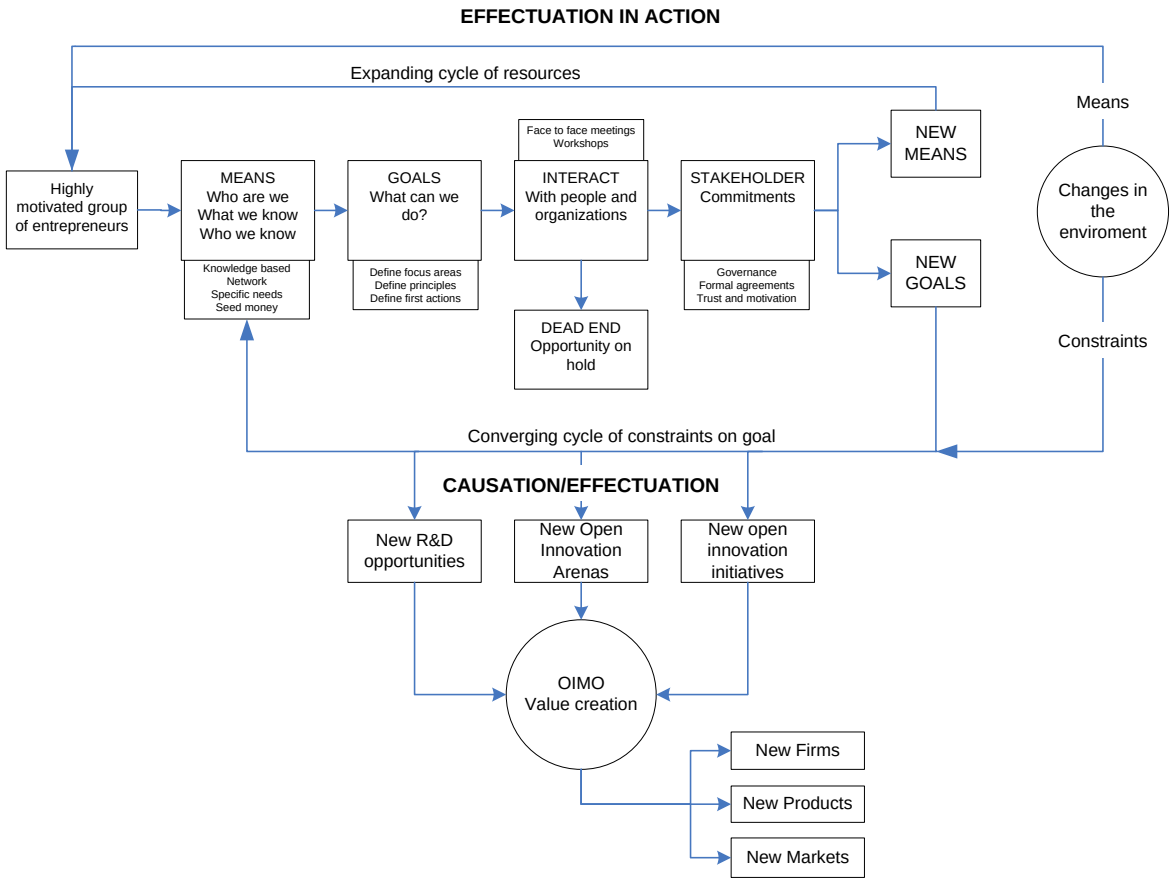

Figure 37 – Referential model for starting-up OIMOs
Source: Adapted from Sarasvathy (2008)

OIMO entrepreneurs start by asking "who they are", "what they know" and "whom they know". Their corporate knowledge base, network, specific needs and seed money are the means available to start-up the process. Next step is to begin to imagine and implement possible effects that could be created with the available means and move into action without an elaborated planning. These first actions will help entrepreneurs define the focus areas and the principles of the organization.

Open innovation actions require building partnerships. OIMO entrepreneurs focus their actions on building partnerships right from the start. Furthermore, obtaining pre-commitments from key stakeholders will help them reduce uncertainty in the early stages of the creation of their innovation network. With the pre-commitment of new stakeholders, the organization can be set and aspects related to governance resolved. New stakeholders bring new means and new goals to the cycle. While new means expand the resources available, new goals constrain the next actions that will produce the first results such as a pipeline of project ideas and open innovation initiatives. Changes in the environment also add new means and goals to the effectual cycle.

The result of this process is the definition of the first actions the organization shall manage, such as collaborative R&D project, open innovation arenas and other open innovation initiatives such as technology transfer, joint-ventures, corporate venturing, etc. The OIMO shall manage the opportunities generated in through the effectual process of its creation and depending on the type of each opportunity, it can be done with a more causal or effectual aspect as presented in Table 21.

5 CONCLUSION

This study sought to provide valid microfoundations for open innovation by proposing effectuation theory as a valid method of decision-making perfumed by expert R&D and innovation managers when facing uncertainty. At the same time managers have been exploring open innovation management practices in different ways, academic research has spread its focus into different topics such as innovation management, business strategy, organizational behavior and public policies. Due to the variability found on open innovation practices and the existent body of knowledge on innovation management, open innovation research agenda was still vast. As a way to contribute to open innovation theory, our work provided information about the decision-making process of expert managers.

The main objective of our research was to validate effectuation as a useful methodology utilized by expert R&D or innovation managers involved in the startup of an open innovation management organization. In general, managers of every functional area of mature business are trained on causal or predictive reasoning. Our interest was to understand how expert R&D and innovation managers behave when facing an effectual problem.

We chose to perform an in-depth investigation on expert managers involved in the startup of an open innovation management organization. By performing the case study of CISB, we examined the decision-making processes of 13 expert R&D and innovation managers representing eight independent organizations. We called this group *the entrepreneurs of CISB* and we followed-up their decisions regarding the setting up of CISB and their first main actions along 18 months in a series of 51 interviews.

In order to conclude our work, we recollected the research problem and questions presented in section 1.1. The answers we present here in a summarized format were previously discussed in section 4.3 and are re-exposed to verify the compliance with the objectives initially proposed.

Research problem: Is it possible to identify and describe a decision-making methodology used by expert open innovation managers?

As a way to approach this problem we look into the emerging theory of effectuation as a possible guide to our study in the search of microfoundations of open innovation. We observe that mainstream theories on innovation management gave little attention in providing insights to how managers should act while facing an effectual problem.

At the same time, the pursue of innovation often brings managers to such situations. With this in mind we developed our research questions and we summarize below our findings.

Research question 1: Is it valid (and to what extent) to refer to effectuation as a method for decision-making performed by expert open innovation managers facing uncertainty?

As a result of our case study we were able to observe that effectuation is a valid approach performed by expert open innovation managers. Patterns of effectuation logic were found in our case study, which corroborates previous studies. Nevertheless, we also observed that effectuation and causation might coexist even during the startup phase of an open innovation management organization.

Research question 2: How entrepreneurs involved in the startup of an organization dedicated to open innovation management and how innovation network decided on defining their objectives, organizational structure and resources needed?

We have learnt form our case study that goals of an OIMO can be defined depending on the means entrepreneurs dispose at the beginning and on their ability to attract other partners that will bring in new means. The notion of effectual commitment was clearly observed in our case study. Objectives were defined and developed as long as partners would make new commitments to the network. At the same time commitments increased the resources available, it helped defining and constraining future sub-goals and goals. Yet, we observed that an open innovation management organization requires a minimum level of investment to be able to trigger a network. In our case study one organization assured the seed money to startup CISB and guarantee to the other partners that the organization was assured for a certain period of time. This was also part of the strategy to attract others to commit to the same endeavor.

Research question 3: How entrepreneurs attract, select and define their projects, raise funds for their execution, systematize their management processes, identify and select partners to participate in their projects, and how they build and manage innovation networks?

In our case study we went deep in describing how entrepreneurs started up the organization. We did not limit our observations on actions directly related to the setting up and the creation of the organization, we also paid attention to the first actions of the organization and how they evolved. We tried to identify patterns during the decision making process of entrepreneurs in the different situations they faced in the first 18 months. It became clear after our data analysis that causation and effectuation coexisted as decision-making methods, and in some situations effectuation prevailed and in others causation prevailed.

Research question 4: What factors moderate or determine the degree of openness to external collaboration in multi-institutional arrangements of open innovation projects?

As a key aspect of open innovation, we wanted to understand what defines how open an R&D project or an innovation management practice could be. Also, we searched for evidences that could help us understand if openness was or not a moderator for effectuation. From our case study we identified one important moderator that is how well a target is defined. We observed that the less the targets were defined, the more open to external collaboration they were. On the other hand, we also observed that the less the targets were defined, the harder it was for a manager to take action, meaning that managers would work in defining goals by attracting new partners to the project. Nevertheless, we observed that just by adding new partners it was not enough to provide managers with a way forward. In such cases, both effectual and causal reasoning coexisted based on how well the initial use of effectual principles resolves the uncertainty. Further decisions may either take causal aspects, or if uncertainty persisted, continued effectual reasoning was still appropriate.

5.1 Contributions

As a young research field, the knowledge body of open innovation is being consolidated by contributions that are often still fragmented and restricted to one dimension, for example, user innovation or supplier integration (GASSMANN; ENKEL; CHESBROUGH, 2010). Gassman *et al*. (2010) argue that there is the need for a consistent open innovation theory elaborated in a new perspective capable of integrating these disparate observed elements of evidence into a larger theory. We believe that by performing the in-

depth case study of CISB, we could be able to demonstrate how effectuation theory can contribute to open innovation theory into a new perspective.

We claim that our work provides us with two main theoretical contributions to build a more solid open innovation theory and four practical ones more directed to open innovation managers or entrepreneurs. Finally, regarding the methodological perspective, we also believe that we have been successful in demonstrating the utility of single case studies for theory building, not only in early stages of a yet-to-come theory, but also in providing new insights into preexisting theories in a new perspective.

Starting by the theoretical contributions, firstly, we have shown that by dividing the multiplicity of observed practices in open innovation into Category I and Category II we can better relate them to causation and effectuation approaches as a preferable decision-making method used by managers. We argue that this distinction is observed in the case of CISB, found by 13 experts R&D and innovation managers, namely:

a) **Category I open innovation practices**: focuses on the strategic need companies have to systematically identify the available technologies and ideas inside the company as well as in the environment. Managers are induced to embrace practices such as technology and market scouting, technology intelligence, technology transfer and well target prize-driven innovation. It presumes the preexistence of knowledge, technologies or ideas outside the firm that must be located and retrieved. In such cases *causation reasoning* might be often more appropriate for managers;

b) **Category II open innovation practices**: emphasizes the recognition of companies that need to be part of a community or network that is exchanging knowledge to develop new technologies and ideas. In opposition to Category I, it will induce managers to team up with external partners who have complementary competencies and interests and, therefore, create synergy to build the future in common directions. It indicates that new knowledge, technologies or ideas could be co-created among partners. *Effectual networks* play an important role in these situations.

Furthermore, we verified effectuation in another area of inquiry different from where it was developed. Sarasvathy's (2000) initial work on effectuation has focused on the study of entrepreneurship, Kuepper (2009) has introduced effectuation to the filed of R&D

and we believe we have been successful to observe effectuation in the context of open innovation.

Regarding our practical contributions, we indicate four that could help managers involved in the creation of open innovation management organizations. They are:

(1) The identification of a method of decision-making adopted by expert R&D and/or innovation managers in the creation of organizations dedicated to the systematization of open innovation practices and the setting-up of innovation networks;
(2) The proposition of a decision-making framework according to effectual logic to be used by R&D and/or innovation managers when setting-up effectual networks combined to Category I type of open innovation practices;
(3) The identification of *target definition* as a moderator of openness in innovation project and *target definition* and *openness* as a moderator of effectuation, and
(4) The identification of *open innovation processes* vs. *decision-making approach* presented in Table 21 (section 4.4).

Ultimately, concerning the methodological perspective, we believe that this work also offered arguments in favor of the use of single case studies. Besides the theoretical and practical contribution mentioned above, this work is also intended to provide meaning to the stakeholders involved in CISB's effectual network. By helping to provide them with shared interpretations, we hope this work will help CISB succeed and share lessons to be learnt by other similar initiatives.

5.2 Limitations of the Study

As a single case study our research has some important limitations. The findings of our research were not meant to test any aspect of open innovation or effectuation theories. We did not seek to provide anyone with empirical generalization based on our findings or representativeness of the case study. On the contrary, our case study sought to reveal exactly what would be impossible to do if we were looking for empirical generalizations: something that is unique and specific in our case.

Our research has also two other practical limitations. First, as we had the opportunity to observe our case for 18 months only, we focused on the startup phase of the creation of CISB. We had no chance to cover subsequent maturation phases where we could have seen how effectuation *vs*. causation evolves as a preferred decision-making approach. Secondly, we did not consider aspects related to effective performance in our case study nor the impact of the decision made by the entrepreneurs in the innovativeness of the resulting technologies, products and services.

5.3 Future Research

Open innovation research agenda is still vast and little attention has been paid to understand how individual stakeholders act. Our work proposes some insights of how managers should approach open innovation problems and better define its practices. Future work in this direction could be concentrated in analyzing if the correct use of causation or effectuation has any impact or if it helps explaining success in open innovation management. In this sense we propose four research themes for future works:

First, we propose the study of *open innovation management organizations for international cooperation*: in the present work we conceptualized and identified a new type of innovation intermediate called *open innovation management organization*, which is being promoted by *triple helix* actors of both Brazil and Sweden. As an emergent topic in the field of *global innovation networks* (OCDE, 2008), *internationalization for R&D* (DUNNING, 2009) and *internationalization of Triple Helix frameworks* (RAUCH; WAPPLER, 2011), it might be interesting to verify and go deeper in the study of similar initiatives around the world.

Secondly, we believe the theme of *effectuation and the microfoundations for open innovation* has a great potential in helping to constitute a larger theory on open innovation. Scholars to the decision-making process of open innovation managers have given very little attention. We believe that the conceptualization of effectual networks are very appropriate to Category II open innovation practices and should be further investigated.

Thirdly, we foresee that *effectuation and performance of open innovation* might be a relevant theme to help identifying how human action impacts the success of open innovation initiatives.

Finally, as a topic developed in the field of entrepreneurship, we understand that *effectuation, open innovation and firm size* is another promising research theme. Researchers on open innovation have realized that SMEs are relevant for innovation processes and have been moving attention to the adoption of open innovation in SMEs. Effectuation might provide researchers with tools to develop interesting constructs while trying to understand the impact of firm size in the practices of open innovation.

REFERENCES

Brazilian Agency for Industrial Development. ABDI (2011). Brasil e Suécia inauguram centro de pesquisa e inovação. Available at: http://www.abdi.com.br/Paginas/noticia_detalhe.aspx?i=884. Acesse on: May 20th, 2011.

ABCD Maior (2010). São Bernardo terá Centro de Pesquisa da Saab. Available at: http://www.abcdmaior.com.br/noticia_exibir.php?noticia=24016. Acessed on: November 20th, 2011.

Acs, Z. J. & Audretsch, D. B. (1990). Innovation and Small Firms. Cambridge: The MIT Press.

Amable, B., Barré, R. & Boyer, R. (1997). Les Systèmes d'Innovation à l'Ere de la Globalisation. Paris: Economica.

Arnold, E. & S. Kuhlman (2001). RCN in the Norwegian Research and Innovation System. In the Evaluation of the Research Council of Norway, Oslo: Ministry for Education, Research and Church Affairs. Report No 12

Arthur, W. B. (1994). Increasing Returns and Path Dependence in the Economy. Ann Arbor, Michigan: University of Michigan Press.

Barbara, W. (2002). Integrating Models of Diffusion of Innovations: A Conceptual Framework. *Annual Review of Sociology* (Annual Reviews) 28, 297–306.

Bell, M & Pavitt, K. (1995). *The development of tecnological capabilities. In: Trade, Technology and international competitiveness.* (1st ed.). Washington, DC, World Bank.

Benner, M. J.& M. Tushman. (2002). Process management and techno- logical innovation: A longitudinal study of the photography and paint industries. *Admin. Sci*. (Quart.)47 676–706.

Berg, B.L. (2001*). Qualitative Research Methods – For the Social Sciences*, (4th ed.). Pearson, Harlow.

Blekman, T. (2011). Corporate Effectuation: What managers should learn from entrepeneurs, (1st ed.), S. D. U. Uitgeverij, Netherlands.

Chesbrough, H. (2000). Designing Corporate Ventures in the Shadow of Private Venture Capital, *California Management Review*, (42) (Spring), 31-49.

Chesbrough, H. (2002). Making Sense of Corporate Venture Capital, *Harvard Business Review*, 80 (3). March, 90-99.

Chesbrough, H. (2003a). Open Innovation: The New Imperative for Creating and Profiting from Technology. Boston: *Harvard Business School Press*.

Chesbrough, H. (2003b). The Governance and Performance of Xerox's Technology Spin-off Companies. *Research Policy*, 32 (3), 403-422.

Chesbrough, H. (2004). Managing open innovation. *Research-Technology Management*, 47(1): 23-26.

Chesbrough, H. & Crowther, A.K. (2006a). Beyond high-tech: early adopters of open innovation in other industries. *R&D Management*, 36 (3), 229–236.

Chesbrough, H., Vanhaverbeke, W. & West, J., (2006b). In: *Open Innovation: Researching a New Paradigm.* Oxford University Press, Oxford.

Chesbrough, H. (2006a) *Open Business Models: How to Thrive in the New Innovation Landscape*, Harvard Business School Press, Boston, MA, USA.

Chesbrough, H. (2006b). Open Innovation: A new paradigm for understanding industrial innovation. In H. W. Chesbrough, W. Vanhaverbeke & J. West (Eds.). *Open innovation: Researching a new paradigm*, 1-12. Oxford University Press, Oxford, UK.

Chesbrough, H. (2006c). New puzzles and new findings. In H. W. Chesbrough & W. Vanhaverbeke & J. West (Eds.). *Open innovation: Researching a new paradigm*: 15-33. Oxford University Press, Oxford, UK.

Chesbrough, H. W., Vanhaverbeke, W., & West, J. (Eds.). (2006). *Open innovation: Researching a new paradigm.* Oxford University Press, Oxford, UK.

CISB. (2011a). By-Laws, May 2011, internal document.

CISB. (2011b). About CISB presentation, September 2011, internal document.

CISB. (2011c). Action Plan, internal document produced on July, 2011.

CISB. (2012a). Executive Board Minutes of Meeting form Feb 2nd, 2011.

CISB. (2012b). Action Plan, internal document produced on January, 2012.

Christensen, C.M. (1997). *The Innovator's Dilemma: When New Technologies Cause Great Firms to Fail*. Harvard Business School Press, Boston, MA, USA.

Christensen, C.M. & Raynor, R.E. (2003). *The inno-vator's solution: creating and sustaining successful growth* , Harvard Business School Press, Boston, MA, USA.

Cohen, W.M. & D.A. Levinthal (1990). Absorptive Capacity: A New Perspective on Learning and Innovation, *Administrative Sciences* 35, 569-596

Cooper, R. G. & Kleinschmidt, E. (1986). An Investigation into the New Product Process: Steps, Deficiencies, and Impact, *Journal of Product Innovation Management* 3(2), 71–85.

Dalziel, M. (2010). Why do innovation intermediaries exist? *2010 DRUID Conference*, London, UK. Available at http://www2.druid.dk/conferences/viewabstract.php?id=500976&cf=43. Acessed on: December 15th, 2011

De Jong, J. P. J., W. Vanhaverbeke, T. Kalvet & H. Chesobrugh. (2008). *Policies for Open Innovation: Theory, Framework and Cases,* Research project funded by VISION Era-Net, Helsinki: Finland.

Dew, N., Sarasvathy, S. D. & Venkataraman, S. (2004). The economic implications of exaptation. *Journal of Evolutionary Economics.* 14(1), 69-84.

Dewar, R. D. & J. E. Dutton (1986). The Adoption of Radical and Incremental Innovations: An Empirical Analysis. *Management Science,* (32), 1422-1433.

Docherty, M. (2006). *Primer on Open innovation: principles and practice.* PDMA Visions, XXX (2), 13-17.

Dosi G. (1997). Opportunities, incentives and the collective patterns of technological change. *Economic Journal*, 107(444), 1530-1547.

Dunning, J.H. & Lundan, S. M. (2009). The Internationalization of Corporate R&D: A Review of the Evidence and Some Policy Implications for Home Countries. *Review of Policy Research*, 26 (1-2), 13-33.

Dushnitsky, G. & Lenox, M.J. (2005). When Do Incumbents Learn from Entrepreneurial Ventures? Corporate Venture Capital and Investing Firm Innovation Rates. *Research Policy* 34(5), 615-639.

Earl, P. E. (1998). *Consumer Goals as Journeys in to the Uknown.* London, UK: Routledge.

Edmondson, A. C. & S. E. McManus. (2007). Methodological Fit in Management Field Research. *The Academy of Management Review*, (32) 4.

Edquist, C. (1997). *Systems of Innovation. Technologies, Institutions and Organizations.* London, UK Pinter.

Edquist, C. (2001). The Systems of Innovation Approach and Innovation Policy: An account of the state of the art. *DRUID* Conference, Aalborg University, June 12-15. Available at http://www.druid.dk/wp.

Edquist, C. (2004). Systems of Innovation – Perspectives and Challenges. In Fagerberg, J., Mowery, D., & Nelson, Richard (ed.) *Oxford Handbook of Innovation*, Oxford University Press, Oxford, November 2004, 27 p.

Edquist, C. (2009). *Public Procurement for Innovation (PPI) – a Pilot Study.* CIRCLE Working Paper no. 2009/13. Lund: Lund University.

European Industrial Research Management Association. EIRMA (2004). Technology Access for Open Innovation. Paris. WG63 Report.

Eisenhardt, K. M. (1989). Making fast strategic decisions in high-velocity environments. *Academy of Management Journal*, 32 (3), 543-576.

Eisenhardt, K. M. (1991). Better stories and better constructs: The case for rigor and comparative logic. *Academy of Management Review*, 16, 620–627.

Eisenhardt, K. M. & Graebner, M. E. (2007). Theory building from case studies: Opportunities and challenges. *Academy of Management Journal*, 50 (1). 25-32.

Elmquist, M. & Ollila, S. (2011) Managing Open Innovation: Exploring Challenges at the Interfaces of an Open Innovation Arena. *Creativity and Innovation Management*, 20 (4), 273–283.

Etzkowitz, H.& Leydesdorff, L. (1995). Universities in the global economy: a triple helix of university-industry-government relations. London, Cassel Academic.

Etzkowitz, H. (2005). *Reconstrução criativa: hélice tripla e inovação regional.* Rio de Janeiro: Inteligência Empresarial/CRIE/COPPE/UFRJ, (23).

Fargerberg, J., (2005) Innovation: A Guide to the Literature. In: Fargerberg, J., Mowery, D. & Nelson, R. (Ed.). *The Oxford handbook of innovation.* Oxford Universtiy Press, New York, USA

Freeman, J., and Engel, J. (2007). Models of innovation: Startups and mature corporations. *California Management Review*, 50 (1), 94 -119.

Freeman, C. (1987). *Technology Policy and Economic Performance: Lessons from Japan.* London, UK. Frances Pinter

Gassmann, O. & Enkel, E. (2004). Towards a theory of open innovation: Three core process archetypes. *R&D Management Conference (RADMA).* Lisbon, Portugal.

Gassmann, O.; Enkel, E.& Chesbrough, H. (2010). The future open innovation. *R&D Management*, (3) 40, 213-221.

Geroski P. (2003). *The Evolution of New Markets*. Oxford University Press, New York, USA.

Ghoshal, S. & Bartlett, C. (1990). The multinational corporation as an interorganizational network. *Academy of Management Review*, 15 (4), 603–625.

Godoy, A. S. (1995a). Introdução à Pesquisa Qualitativa e suas Possibilidades. *Revista de Administração de Empresas*, 35 (2), 57-63. São Paulo.

Godoy, A. S. (1995b). Pesquisa Qualitativa: tipos fundamentais. *Revista de Administração de Empresas.* 35 (3), 20-29. São Paulo.

Granstrand, O., Patel, P., & Pavitt, K. (1997). Multi-technology Corporations:Why They Have 'Distributed' rather than 'Distinctive Core' Competencies. *California Management Review* (39): 8–25.

Gugler & Brunner. (2007). *FDI effects on national competitiveness: a cluster approach International Advances in Economic Research*. Available at: http://www.entrepreneur.com/tradejournals/article/167512256_1.html. Acessed on: September 9th , 2010.

Grossman, G. & Helpman, E. (1991). *Innovation and Growth in the Global Economy*. Cambridge: MIT Press.

Gupta, A.K., Tesluk, P.E. & Taylor, M.S. (2007). Innovation at and across multiple levels of analysis. *Organization Science*, 18 (6), 885–897.

Hagedoorn, J. (1996) Trends and Patterns in Strategic Technology Partnering Since the early Seventies. *Review of Industrial Organisation* (11), 601–16.

Hagel, J.& Seely Brown, J. (2006). *Creation Nets: Harnessing the Potential of Open Innovation.* Available at: http://www.johnhagel.com/creationnets.pdf. Accessed on: January 5th, 2012.

Hällbrant, M. & Ingvarsson, J. (2012). *Creation of Open Innovation Arenas, Master Thesis, Chalmers.* Available at: http://publications.lib.chalmers.se/records/fulltext/154956.pdf. Accessed on: 05 Feb 2012.

Hansen, M. (1999). The search transfer problem: The role of weak ties in sharing knowledge across organizational subunits, *Administrative Science* (Quarterly) 44, 82-111.

Hellstrom, T. (2008). Transferability and Naturalistic Generalization: New Generalizability Concepts for Social Science or Old Wine in New Bottles*? Quality and Quantity* (42), 321-337.

Howells, J. (2006). Intermediation and the role of intermediaries in innovation. *Research Policy*, (35) 715-728.

Hubert, F., & Pain, N. (2001). Inward investment and technical progress in the United Kingdom manufacturing sector. *Scottish Journal of Political Economy*, 48(2). 134-147.

Huizingh, E.K.R.E. (2010). *Open innovation: State of the art and future perspectives*. Technovation, v. 31, n. 1, p. 2-9, 2011.

Kazanjian, R.K., Drazin, R. & Glynn, M.A. (2002). Implementing strategies for corporate entrepreneurship: A knowledge-based perspective. In: Hitt, M., Ireland, R.D., Camp, M.S. & Sexton, D.L. (eds.). *Strategic entrepreneurship: Creating a new mindset* , Blackwell, Oxford, pp. 173–99.

Kuepper, D., Aachen, R. & Burkhart, T. (2009). Effectuation in the Context of R&D Projects: Characteristics and Impact on Project Performance. *Annual Meeting Procedeeing*. The Academy of Management Proceedings. 2009.

Lancaster, K. (1971). *Consumer demand: a new approach*. Columbia University Press. New York, USA

Langlois, R. N. & Cosgel, M. M. (1993). Frank Knight on risk, uncertainty, an the firm: a new interpretation. *Economic Inquiry*, 31(3), 456-65.

Lee S., Park, G., Yoon, B. & Park J. (2010). Open Innovation in SMEs – An intermediated network model, Research Policy, (39), 290-300.

Leifer, R. et al. (2000). *Radical Innovation: How Mature Companies Can Outsmart Upstarts* , Harvard Business School Press: Boston, MA. Leonard-Barton.

Lewis, J., & Ritchie, J. (2003). Generalizing from qualitative research. In: *Qualitative Research Practice*. London: Sage.

Lichtenthaler, U. (2008). Open innovation in practice: an analysis of strategic approaches to technology transactions. *IEEE Transactions on Engineering Management*. 55 (1), 148–157.

Loasby, B. J. (1999). Knowledge, Institutions and evolutionary dynamics: why connections matter. *Journal of Evolutionary Economics*, (11), 393-412.

Lopez, H. & Vanhaverbeke, W. (2009). *How innovation intermediaries are shaping the technology market? An analysis of their business model.* Unpublished. Available at: http://mpra.ub.uni-muenchen.de/20458/ MPRA. Accessed on: November 15th, 2010.

LSP. Lindholmen Science Park. (2011). Available at: http://www.lindholmen.se/en/activities-3. Accessed on: January 15th, 2012.

Lundvall, B.A. & Borras, S. (2005). Science, Technology and Innovation Policy. In Fagerberg, J., Mowery, D.C. & Nelson, R. (eds.) *The Oxford Handbook of Innovation*, Oxford University Press

Lundvall, B. A. (1992). National Systems of Innovation: Towards a Theory of Innovation and Interactive Learning, London: Pinter.

Lundvall, B. A. (2007). National Innovation Systems – Analytical Concept and Development Tool. *Industry and Innovation*, 14 (1), 95–119.

Malerba, F. (2005). Sectoral Systems, How and Why Innovation Differs across Sectors. In: Fagerberg, J., Mowery, D.C. & Nelson, R. (eds.). *The Oxford Handbook of Innovation*, Oxford University Press.

March, J. G., Sproull, L. S., & Tamuz, M. (1991). Learning from samples of one or fewer. *Organization Science*, 2 (1).

Maula, M.V.J., Keil, T., & Zahra, S.A. (2003). Corporate venture capital and recognition of technological discontinuities. *Proceedings of the Annual Meeting of the Academy of Management*, Seattle, WA, USA.

Maula, M.V.J. (2001). *Corporate Venture Capital and the Value-Added for Technology-based New Firms.* Doctoral dissertation, Institute of Strategy and International Business, Helsinki University of Technology.

Metcalfe, J. S. (1998).*Evolutionary Economics and Creative Destruction*. London, UK, Routledge.

MIGUEL, P.A.C. Estudo de Caso em engenharia de produção: estruturação e recomendações

para sua condução. *Produção* (17) 1, p. 216-229, Jan/Abr. 2007.

Müller, S. (2010). *Causation and effectuation Processes: Opportunity discovery and Exploitation logics of habitual entrepreneurs*. Working Paper. Presented on the 16th Nordic Conference on Small Business Research, nr. 16.

Narula, R., (2004). R&D collaboration by SMEs: new opportunities and limitations in the face of globalisation. *Technovation* (25), 153–161.

Nelson, R. & Winter, S. (1982). *An Evolutionary Theory of Economic Change.* Cambridge MA: The Belknap Press of Harvard University Press

Nelson, R.R. (1993). *National Innovation Systems: A Comparative Analysis*. Cambridge University Press, New York.

Nelson, R. (1995). Recent evolutionary theorizing about economic change. *Journal of Economic Literature*, 33(1), 48-90.

Organisation for Economic Co-operation and Development. OECD. (2005). Oslo Manual: Guidelines for Collecting and Interpreting Innovation Data (3rd) Available at: http://www.oecd-ilibrary.org/science-and-technology/oslo-manual_9789264013100-en. Accessed on: September, 11th, 2011.

Organisation for Economic Co-operation and Development. OECD. (2008). Open Innovation in Global Networks. OECD, Paris, France.

Patton, M. Q. (2002). Qualitative Research and Evaluation Methods. 3rd ed. Thousand Oaks: Sage Publications.

Pavitt, K. (1984). Patterns of Technical Change: Towards a Taxonomy and a Theory. *Research Policy* (13) 343–74.

Platt, J. (2007). Case Study. In: Outhwaite, W & Turner, S. *The Sage Handbook of Social Science Methodology*. London: Sage.

Pianta, M. (1988). New Technologies Across the Atlnatic, Hemel Hempstead: Harvester & Wheatsheaf.1988.

Popper, K. (2000). *The logic of scientific discovery* (6th ed.). London: Routledge.

Rogers, E. M. (1962). *Diffusion of Innovations*. New York: Free Press.

Rosenberg, N & Mowery, D. (1978). The influence of market demand upon innovation: a critical review of some recent empirical studies. *Research Policy*, 8 (2), 102–153.

Rousseff, D. (2011). Presidenta Dilma Rousseff e o primeiro-ministro da Suécia em brinde no Itamaraty. YouTube, May 17th. Available at: http://www.youtube.com/watch?v=w8LnVMEcj60on. Accessed on: January 5th, 2012.

Sarasvathy, S.& Kotha, S. (2001). *Effectuation in the management of knightian uncertainty: evidence from the realnetwork case.* UW Business School Working Paper.

Sarasvathy, S. D. (2001a). What makes entrepreneurs entrepreneurial? Available at http://www.effectuation.org/sites/default/files/What%20makes%20entrs%20entl%20note.pdf. Accessed on: May 14th, 2010.

Sarasvathy, S. D. (2001b). Causation and effectuation: Toward a theoretical shift from economic inevitability to entrepreneurial contingency. *Academy of Management Review*, 26(2), 243-263.

Sarasvathy, S. D. (2003). Entrepreneurship as a science of the artificial. *Journal of Economic Psychology*, (24) 2, 203.

Sarasvathy, S. D. (2008). *Effectuation: Elements of entrepreneurial expertise.* Cheltenham: Edward Elgar.

Schumpeter, J. (1943). *Capitalism, Socialism and Democracy.* New York, Harper.

Schumpeter, Joseph A. (1949). *Economic Theory and Entrepreneurial History.* In: Change and the Entrepreneur. Prepared by the Research Center in Entrepreneurial History, Harvard University, Cambridge, Mass.: Harvard University Press, 63-84, reprinted in: Schumpeter, Joseph 1989: Essays on Entrepreneurs, Innovations, Business Cycles, and the Evolution of Capitalism. Ed. by Richard V. Clemence, New Brunswick / London: Transaction Publishers, 253-271.

Siggelkow, N. (2007). Persuasion with Case Studies. *Academy of Management Journal*. (50), pp. 20-24.

Singer, J., 1961. The Level-of-Analysis Problem in International Relations. *World Politics*, 14(1), 77-92.

Stake, R. (1982). Naturalistic generalization. *Review Journal of Philosophy and Social Science*, (7), 1-12.

Stake, R. (1995). *The art of case research*. Thousand Oaks, CA: Sage Publications.

Teece, D.J. (1986). Profiting from technological innova- tion. implications for integration, collaboration, licen- sing and public policy. *Research Policy*, (15) 285–305.

Tidd, J.; Bessant, J. & Pavitt, K. (1997). *Managing innovation: integrating technological, market and organizational change.* West Sussex, John Wiley & Sons.

Tsoukas, H. (2009). Craving for Generality and Small-N Studies: A Wittgesteinian Approach towards the Epistemology of the Particular in Organization and Management Studies. In: Buchanan, D. A. & Bryman, A. *Organizational Research Methods*. London: Sage.

Utterback, J. M. (1994) *Mastering the dynamics of innovation: How companies can seize opportunities in the face of technological change Boston*: Harvard Business School Press.

Van de Ven, A. (1986). Central problems in the management of innovation, *Management Science*, 32 , 590-607.

Van de Vrande et al. (2009). Open innovation in SMEs: Trends, motives and management challenges, *Technovation* 29, 423–437.

Van Dijk, C. & Van den Ende, J. (2002). Suggestion systems: transferring employee creativity into practicable ideas. *R&D Management* 32, 387–395.

Vanhaverbeke, W., Van de Vrande, V. & Chesbrough, H. (2008). Understanding the Advantages of Open Innovation Practices. *Corporate Venturing in Terms of Real Options. Creativity & Innovation Management,* 17 (4), 251-258.

Vanhaverbeke, W. & Peeters, N. (2005). Embracing Innovation as Strategy: Corporate Venturing, Competence Building and Corporate Strategy Making. *Creativity And Innovation Management*, 14 (3), 246-257.

Vanhaverbeke, W. (2012). Open Innovation and Public Policies in Europe http://www.exnovate.org/gallery/documents/open-innovation-in-smes.pdf

Vinnova (2011). Challenge-Driven Innovation. Available at: http://www.vinnova.se/upload/EPiStorePDF/vi-11-07.pdf. Accessed on: April 21st, 2011

Von Hippel, E. (2005). Open source software projects as user innovation networks - no manufacturer required. In: Feller,J., Fitzgerald, B., Hissam, S. & Lakhani, K. *Perspectives on Free and Open Source Software*. Cambridge: MIT Press.

Von Hippel, E. (1977). Successful and failing internal corporate ventures: An empirical analysis' Industrial Marketing Management, 6, 163-174.

Vossen, R.W. (1998). Research note-relative strengths and weaknesses of small firms in innovation. *International Small Business Journal* ,16 (3), 88 - 94.

Voss, C.; Tsikriktsis, N. & Frohlich, M. (2002). Case research in operations management. *International Journal of Operations & Production Management,* 22 (2), 195 - 219.

West, J., Vanhaverbeke, W., & Chesbrough, H. (2006). Open Innovation: A Research Agenda In Chesbrough, H. W.; Vanhaverbeke, W. & West, J. *Open innovation: Researching a new paradigm.* Oxford: Oxford University Press.

Whitley, R. (1994). The internationalization of Firms and markets: its significance and institutional structuring, Organization 1(1), 101–24.

Whitley, R. (1996). Business systems and global commodity chains: competing or complementary forms of economic organisation? *Competition and Change* 1(4), 411–25.

Wiltbank, R., Read, S., Dew, N., & Sarasvathy, S. D. (2009). Prediction and control under uncertainty: Outcomes in angel investing. *Journal of Business Venturing.* 24 (2); 116-133

Winter, S. (1984). Schumpeterian Competition in Alternative Technological Regimes. *Journal of Economic Behavior and Organization*. 5, 287-320.

Yin, R. K. (2009). *Study Research: Design and Methods*. (4th ed.). SAGE Publications. California.

Zanni, P. P.; Moraes, G. & Mariotto, F. L. (2011). Para que servem os Estudos de Caso Único? *XXXV Encontro ANPAD.*