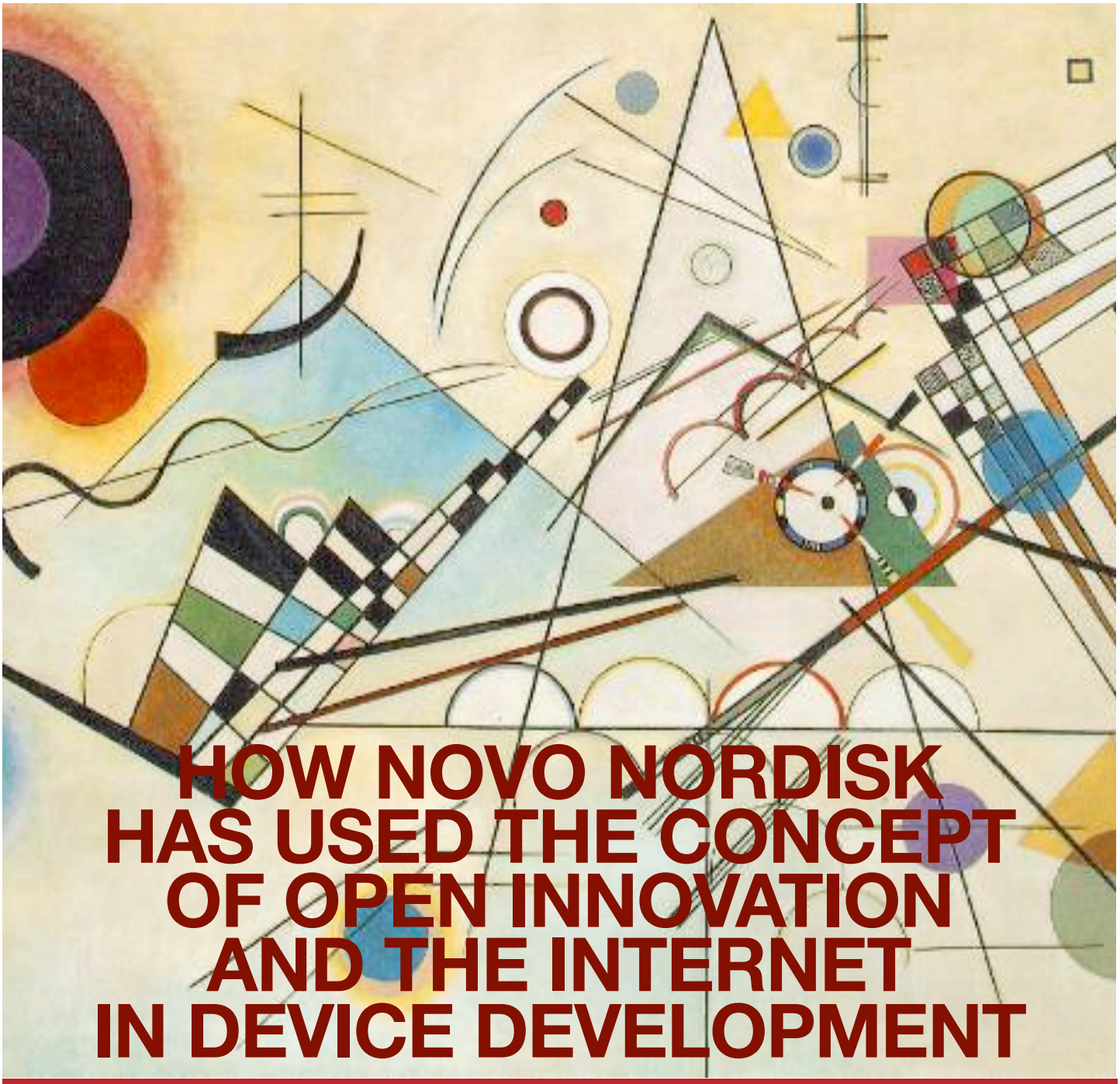

HOW NOVO NORDISK HAS USED THE CONCEPT OF OPEN INNOVATION AND THE INTERNET IN DEVICE DEVELOPMENT

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Abstract

Open Innovation is one of the most discussed topics in recent years. Inspired by the researches of Henry Chesbrough, it has been perceived as a useful tool for solving the problems of lack of innovation and idea generation. More precisely, Open innovation is a paradigm that assumes that firms can and should use external ideas as well as internal ideas, and internal and external paths to market, as the firms look to advance their technology. The boundaries between firms and their environment have become more permeable, and innovations can be easily transferred inward and outward. In a world of widely distributed knowledge, companies cannot afford to rely entirely on their own researches, but should instead buy, license and sell processes or inventions from and to other companies. One possible way to improve the innovation capability is to explore the opportunities within the so-called Open Innovation concept, and especially to identify the opportunities involving external actors and exploring the potentialities of the Internet. Based on the empirical evidence from the R&D medical device department in Novo Nordisk, a Danish pharmaceutical company, the thesis focus is on understanding if it is effectively implementing an open innovation strategy, and which are the opportunities of using the Internet as an tool for increasing the innovation rate. The result of the empirical studies shows that the theory of Open Innovation (OI) is a very flexible concept, that can be used and implemented in many different ways. The results shows that OI is used in different projects. On a scale closed innovation and OI, Novo Nordisk and the different applications of OI is placed somewhere in the middle. The analysis also show that one way to expand a closed innovation model is the use of the web (Internet), and that there are several options that Novo can exploit further, as also some of the competitors are doing already in different ways. Among the recommendations are especially, to continue to make experiment with OI, as that seems to be one way to expand the innovative capabilities of the device development within Novo Nordisk, and also to expand the use of the web in different ways.

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I count myself in nothing else so happy
As in a soul remembering my good friends.
William Shakespeare

1.1 Introduction

The future is the continuum of the past, the present being the dividing line between the two

Albert Szent Györgyi

Nowadays, innovation is necessary for companies to survive and improve their competitive positioning, and to sustain long-term growth and profitability.

As Homburg and Gruner (2000) stated, "After a decade of restructuring and reengineering, with an emphasis on cutting assets and personnel, the new priority is renewal and growth through innovation." Some of the new questions often raised are related to understand the dynamics of innovation inside companies.

Frequently, companies look for sources of innovation outside the company to improve the innovation inside of it. As Chesbrough affirmed (Chesbrough, 2003), internal R&D is no longer the strategic asset it once was. Companies have changed the way in which they generate new ideas and bring them to the market. A new mindset is necessary to be part of the new philosophy of open innovation (from now, OI). Organizations are hungry for innovation and for this reason it is necessary to have a set of flexible tools for making innovation happen. This may include taking old ideas from other fields and reshaping them according their specific needs. To make it feasible, companies have to recognize that internal skills and knowledge exist not only within the company, but also externally. It becomes necessary to look for knowledge externally and embed it in the company's routines. A winning solution is to mix both internal and external ideas in a clever way. External R&D can create significant innovative value. Internal R&D is still needed to maximize the value. A focus of OI is to build a better business model instead of getting to the market first. At the present time, it is not possible to think about the companies as separate

entities: they are tied in a network that helps to create and increase innovation within the company. In this business environment, companies can no longer produce and manage knowledge autonomously. Thus, literature (Chesbrough, 2003, 2006; Gassmann, 2006; Pisano, 2006) affirms that it is important to recognize the necessity to unlock up the IP, thereby profiting from the use that others make of the technology.

Changes have occurred not only in the external relationships, but also internally: the perspective has shifted from a hierarchical and traditional perspective, in which there is a clear separation between bad and good ideas, to an open perspective. It is necessary to find a new organizational model in which firms co-operate with the partners, customers and suppliers to create new products.

The OI paradigm allows the firm to benefit from the faster generation and realization of new ideas, thank to the relationships with the partners, reducing consistently the risk and the cost associated with the new product development (Chesbrough 2003, 2006).

The traditional perspective and the OI perspective lie in a continuum. In the line there are many intermediate positions, such as licensing, communities of practice and lead users, collaborative innovation and market for technology.

My conceptual foundation is based on the concept of OI, collaborative marketing, collaborative innovation, market for technology and the theoretical foundation is the resource based view. According to Cooke (2001), Penrose could be considered the source of inspiration of the concept of OI.

As a number of other organizations, Novo Nordisk has recognized that innovation in product pipeline is fundamental, and it is even more important how it is possible to provide leadership in the medical device area. Recent studies (Sawnhey, Verona and Prandelli, 2005) indicate that the pharmaceutical industry relies heavily on innovation to sustain a competitive advantage. The average cost to discover and develop a new drug is more than $500 million, and the average length of time from discovery to patent is 15 years. To sustain the competitive advantage, a new

philosophy is necessary to compete and make the innovation process more distributed, both in the front end (Ideation and Concept) and in the back end (product design and testing). Moreover, competition now is focusing on selling the drug in a medical device to people that have to use it. User mare most likely to compare the medical devices, not the drugs inside.
Although a very high amount of the company IP on innovation is still generated in-house, it is trying to use an OI as a complementary strategy to sustain leadership aspirations. More than cultivating closer ties with academia, research institutions and external partners, in March 2009 the company has restructured the insulin and medical device area, isolating the medical device department, to make it more productive and not dependent on the insulin area's decisions. The present task in Novo and Open Innovation has been defined as an establishment of a structured approach to OI to ensure and to boost innovation input from external communities, device R&D partners and current suppliers and online communities. The increasing globalization of the economy as a whole, and the non transferability of intangible assets across the open markets are under the managers' scrutiny. A particular attention has been dedicated to the role of the Internet and virtual communities in the innovation process: the Internet has started to become an integrated tool to sustain the OI approach in many industries, and Novo is considering the possibility to use the web to increase its productivity.

My research was motivated by the desire to understand if a company that is stating it will implement an OI strategy is actually executing it. I also analyzed some websites and blogs of not for profit companies and Novo's direct competitors to understand the practices in the industry and the potentialities of using the web for an OI approach.
The approach adopted is the case study analysis. Consequently, it is not aimed as a mean of validation of the theory, but rather as an important initial empirical example in which it focuses to analyze on opening the firm's boundaries and understand if it was a total radical decision or if it was the result of the previous projects that brought about the decision to

apply the OI strategy. The online part is studied to understand the untapped possibilities of the web.

1.2 Problem statement

What is Open Innovation? What elements constitutes the concept of Open Innovation and how does a particular company in the pharmaceutical industry apply it?

1.2.1 Research questions

✦How is the OI theory explained in the innovation management literature? Which is its theoretical framework?

✦How do companies exploit the potential of the Internet and how does it relate to the concept of Open Innovation?

✦Internet has been more and more integral part of the current business and used as flexible tool for product innovation, especially in involving external parties. Which are the advantages of the Internet in a context of OI?

✦How companies and not profit organizations exploit the potentialities of the Internet?

✦How is Novo Nordisk implementing the concept of OI and is there one dominating approach or is it a flexible concept?

1.3 Methodology

A precise and robust distinction between qualitative and quantitative research is not easily derived, but for qualitative approaches are seen as characterized by an emphasis on gathering rich, elaborate, meaningful, language or image-based data amenable to an interpretative description. Quantitative approaches in contrast are aimed to generate numerical data amenable to statistical analysis, with an emphasis on generalizability, validity and reliability. Qualitative researchers are essentially concerned with questions about how people construct meanings, and how these meanings may vary over different historical, cultural and individual contexts.

I carried out a field study using interviews, observations and documents as sources. The qualitative analysis is the most suitable examination for the thesis because it is flexible, subjective, ideal for writing a case study, speculative and grounded on the field. This method has already been successful with continuous innovation (Daneels, 2002). Other authors have also adopted this approach in the field of innovation, in particular many researches in CBS (Chistiansen and Varnes, 2007, 2008) and Ravasi and Verona (2003) in their paper about the Oticon case. According to Yin (2003), a case study is "an empirical inquiry" that investigates a contemporary phenomenon within its real-life context especially when the boundaries between the object of study and the context are not clearly defined. An advantage of using this method is that the case study is not manipulated: it is a real life context. The case study satisfies the three tenets of the qualitative method: describing, understanding and explaining (Yin, 2004).

I decided to analyze Novo Nordisk, in particular the medical device area. To conduct my analysis, I used interview as a method for collecting primary data. The analysis of information obtained through face-to-face interviews started by transcribing the outcome within two days after the discussion. However, as Yin (1994) pointed out, such information gained through interviews can be subjected to problems of bias, imprecise articulation and modest recall. Case study copes with the technically distinctive situations in which there will be many more variables of interest than data point, it relies on multiple sources of evidence, benefits from the prior development of theoretical propositions, and data need to converge in a triangulating fashion. ""(…) one real strength of qualitative research is that it can use naturally occurring data to find the sequences ('how') in which participants' meanings ('what') are deployed and thereby establish the character of some phenomenon" (Silverman 2006, p.44).

Thus, I confronted information obtained through individual interviews with information from secondary sources, counterbalancing the weaknesses or the distortions of one method with the other one. The triangulation discloses a convergence of relevant facts for the study. The quality of the

empirical study is influenced by the criteria of validity (construction validity refers to construct the correct variables of the investigations; external validity to the possibility of generalizing the results; the internal validity to inclusion in the research design of the relevant factors), and reliability (if future investigations could give the same results as the current one).This method has been criticized for lacking in rigor: the context independent knowledge is considered more valuable than the context dependent knowledge, because it has meant to have the basis for scientific generalizations. Case study, instead, cannot contribute to the scientific development.

I used several sources of data to provide a rich case description and analysis. A qualitative questionnaire has been used to interview the project managers of the projects involving OI. Interviews commonly lasted from 30 minutes to 2 hours, recorded and typed within two days, generating 15 pages of transcripts. The data collection was aimed to understand the project, the actors involved, the role of IPs, the positive achievements as well as the problems, challenges and difficulties encountered during the process and the evaluation of the experience. I enlarged my data obtained through interviews with observations: the device department has been visited in various intervals and during special events, monitoring also the actions, interactions and social situations. I was introduced to other employees as a researcher for Bocconi and CBS, and everyone was aware of my role and my research topic. During the meetings and daily activities, I was a passive presence, working and silently observing, without interfering with their activities. Furthermore, I got access to organizational documents and Globalshare (the company's intranet).

To analyze the OI in the web, I decided to compare the state- of- art of Novo activity, and the web's best practices, forums, and social networks in the pharmaceutical industry and diabetes sector. Compatibly with the exploratory nature of the research, I decided to observe the online communities, to acquire an adequate insight into online communities. This contribute to gain a basic knowledge on online communities (language, norms, interests, hot topic, rules) and avoid some misunderstandings.

First, in the social network, the strong sense of being part of a larger group can be a relevant factor of success for the people who feel lonely or isolated, contributing to the active engagement in discussions. The perceived similarity of other members of the online social group can even be increased by the anonymity of the online interactions.

I conducted also online conversations with persons involved actively online, and exchanged e-mails with persons working in Novo communication department. I have to specify that I id not take part in Novo's community "change diabetes" because I was required to provide my sensitive information and declare I am a patient, and I did not wanted to give fake information.

The possibilities for conducting online synchronous interviews, as described above, does not impose the constraints that any discussion must precede in entirely text based format. Thus the type of non verbal and paralinguistic cues which are typically present in face-to-face context are not available in online interview. During my research, I recognized the existence of ethical issues. These include how to deal with informed consent and how to maintain data security and confidentiality.

To test the reliability of my data's interpretations, I asked for feedbacks from the members of the department where I was sitting and I made the presentation of my findings to the manager of the device area. The added conversation was useful for the analysis and findings discussed below.

1.3.1 Organization of the thesis

The thesis is organized in 7 chapters.

In chapter 1 the field of research, the problem statement and the research strategy are stated. I present the methodology, the main theories and the methods used in the relation to the case study.

In chapter 2 there is the answer of my first research question, analyzing the literature review to have an overview of the process of OI. The review of the theory discloses that OI is a quite young subject. It is mainly based on case studies and it is quite difficult to provide general guidelines valid for many industries.

In chapter 3 the Internet possibilities for innovation and potentialities of social networks and online communities are explained. The chapter is aimed at understanding how this tool can be useful for the OI.

In chapter 4 the company and the industry is presented.

In the chapter 5 the projects are evaluated on the base of the OI theory individuated in the literature review.

In the chapter 6 the conclusions that answer my research question are provided. Based on my analysis, I can argue that Novo, even if it is committed toward OI, it is not fully using it. It is more involved in market for technology rather than in market of OI. This is a strategy that ensures the competitiveness on a more global scale. This shows that an intermediary model between close innovation and OI is applied. Moreover, concerning the Internet part, Novo is not exploiting the potentialities of applying an OI strategy using the web.

In chapter 7, managerial implications and suggestions for further researches are suggested.

2.1 Literature Review On Open Innovation

"It's easy to come up with new ideas; the hard part is letting go of what worked for you two years ago, but will soon be out of date."
Roger von Oech

In this section, a literature review about open innovation is presented. The literature review is an overview of the research field on OI and the path in the innovation literature that culminated with the OI. To get a better understanding of the researches done on OI, I did a systematic research on the major library's databases up until March 2010, inserting Open Innovation and "open innovation" as search criteria in the title, keywords or abstracts. Then, I searched in Amazon and I identified 12 books useful for the research. I have excluded from the searching criteria working papers and papers presented in conferences. This is to enable a in depth analysis of the articles present in the database.

In the following table, I have divided the articles and books I found in the databases and in Amazon into different themes that I have chosen as guidelines to be followed in the first chapter of the Chesbrough's book "Open Innovation: researching a new paradigm".

Focus	Topic	Authors
Historical perspective	Evolutionary theory; dynamics of science-based technological changes; interdependencies and different stages in maturation	Schumpeter, 1976; von Hayeck, 1946 Danneels, 2002; Katila and Ahuja, 2002; Khurana and Rosenthal, 1998; Tushman and smith, 2002; Metcalfe and Gibbons, 1989; Kline and Rosenberg, 1986; Gambardella A. , 1995; De Luca, Verona, and Vicari, 2009; Severi Bruni and Verona, 2009; Roberston and Verona, 2006; Verona G., 2000; Gambardella, Giuri, and Luzzi, 2007; Pavitt, 1990; Amour and Teece, 1980; Bower and Christensen, 1995; Malerba, 2000; Malerba, 2005; Malerba and Orsenigo, 2001;Malerba, Mancusi, and Montobbio, 2007; Malerba and Busoni, 2007; Gambardella A., 2009; Gianfrate, 2004, 2009; Cobbenhagen, 2000; Christensen and Bower, 2004
Open innovation	Theories; studies on innovation	Chesbrough 2003, 2006; Huston and Sekkab, 2006; Lakhani and Jeppesen, 2007; Gassmann, 2006; Jeppensen and Panetta, 2006; Laursen and Salter, 2006; Gandal, Greenstein and Salant 1999; Chesbrough, 2003; Chesbrough, West and Vanhaverbeken 2006)

Focus	Topic	Authors
Knowledge	Economic attributes of knowledge; implication for appropriability; knowledge flow; strategy to build knowledge networks to identify, acquire, consolidate, share and reuse knowledge	Cohen and Levinthal, 1990; Vega-Jurada, Gutierrez- Gracia, and Fernandez-de-Lucio, 2009; Verona and Ravasi, 2003; Pisano 2006; Boisit, 1998; Cohen, Nelson, and Walsh, 2000; Harryson, Kliknaite and Dudkowski, 2008; Cassiman and Veugelers, 2006; Malerba, Mancusi, Montobbio, 2007; Dankbaar, 2003; Leonard- Barton, 2004; Kim and Mauborgne, 2004; von Krogh, Nonaka and Aben, 2004; Kim, 2004; Brown and Duguid, 2004
Customer involvement	Lead user method; who is a lead user, integration of lead users ideas in new product development	Franke, von Hippel Schreier, 2006; Hienerth, Potz and von Hippel, 2007; Homburg and Gruner, 2000; Jeppesen and Frederiksen, 2006; Lilien, Morrison, Searls, Sonnack and von Hippel, 2002; von Hippel, 1988, 1994, 2005; Franke and Shaha, 2003, Luthjeand Herstatt, 2004; Prandelli, Verona, and Di Stefano
Networks	Involvement of external actors; clusters; geography; urban policies; spin- off; academia involvement	Borija de Mozota, 2008; Cooke, 2001; Porter, 1998; Harryson, Dudkowski and Stern, 2008; Arora and Gambardella, 1990; Garud and Kumaraswamy, 1993; Tanriverdi and Lee, 2008; Studt, 2003; Breschi and Malerba, 2005; Gans, Hsu and Stern, 2002; Harryson, Kliknaite and Dudkowski, 2008; Hardagon and Sutton, 2004; Handfield, Ragatz, Petersen and Monczka, 2004; Chesbrough and Socolof, 2004; Chesbrough, 2000

Focus	Topic	Authors
Market for technology	Twin role of patents in innovation; incentives for RandD; facilitation technology trade; implication for entry and technology	Arora, Fosfuri and Gambardella, 2001a, 2001b, 2001c; Gambardella, 2002, 2005; Fosfuri, 2006; Jennewein, 2005
Open source	Collaboration; free IPs, accessibility; peer Production; decision making	von Hippel and von Krogh, 2003; Fosfuri, Giarratana and Luzzi, 2008; Henkel, 2006; Goldman and Gabriel, 2005

Table 1 Literature review of external sources of innovation

Many researchers have written about innovation contributed to create the territory for developing the ideas and concepts of OI.

A pioneer in this discipline could be considered Schumpeter. In 1934, he gave an important élan in studying the relationship between innovation and entrepreneurship. Schumpeter's central message is the process of creative destruction, described in the book Capitalism, Socialism and Democracy. The process of creative destruction is a process of transformation that comes out with radical innovation. Von Hayek in 1945 was the first to theorize a concept of OI, describing it from a macro level perspective. He sustains that knowledge is unequally distributed in society and the centralized models for economic planning and coordination are prone to failure due to the inability to aggregate this distributed knowledge. Armour and Teece (1980) in their article discuss a kind of integration that is different but complementary to the research of Lawrence and Lorsch (1967), which identifies an important linkage between a firm's success at technological innovation and the degree to which research and development activity is effectively coupled to the marketplace. The integration for the authors is between the several phases of a production process, enhancing innovation through

the sharing of common technological information, and through facilitating the widespread of new technology when interdependencies are involved. Also having common research objectives could increase the integration among processes. Katz and Allen (1982) identify and give a definition of a problem that has been pretty common in many big organizations. The authors essentially describe a situation where members of an organization are not accepting outside knowledge. This could be considered a quite powerful virus in blocking the innovation process inside the company, because it avoids the use or the purchase of already existing products, research and knowledge due to its different origins. The Not Invented Here syndrome can prevent people in organizations from accepting knowledge that comes from the outside, blocking them from absorbing outside knowledge or, even worst, refusing to implement or use new knowledge. Nelson and Winter (1982) present the belief that organizational knowledge is real and a phenomenon of central importance to understand the modern world. Their studies explore the role played by organizations in linking the general fund of knowledge in a society to its practical affairs. They modeled the firm's decision to search for a new technology outside of its own organization. The evolutionary research program is defined by three main principles. The first one is a process of diversity creation amongst a population of firms, technologies or institutions. The second, a process of selection which causes the varieties of firms, technologies or institutions having the best economic outcome to be selected and the growth of population occurring to the detriment of less varieties of alternatives. The third, a process of reinforcement of selected units, which implies the transmission of selected unit characteristics to other units. Particularly forecasting is the article by Rosembloom and Spencer (1996) in which they recognize the end of the era in which the laboratories and the R&D department are the leading forces in the firm innovation. As the 20th century nears its end, the two authors affirm that the U.S. economy faces this paradox: while scientific research looms larger than ever as a stimulus to economic growth and a major component of American competitive advantage in the global marketplace, many leading American corporations are altering and shrinking the research organizations that should help to sustain that advantage. As a consequence of this paradox, economic theory today emphasizes the stimulus to growth that is provided by increasing returns characteristic of

knowledge created by R&D. Even if a firm is opening its boundaries to the market, relying on external ideas, according to Rosenberg and Steinmueller (1998) it still conducts internal R&D. They found out that internal R&D is critical to enhance the ability of the firm to use external knowledge. Exploiting external R&D is important because firms that fail to use such external R&D may suffer from a competitive disadvantage. From a network perspective, Porter, Batista and Swann (1998) and Kenney (2000) describe the geographic location as the result in knowledge spill over between firms and from university research and, in particular, in the high technology sector. The focus of the study is the "geographic concentration of interconnected companies, specialized suppliers, service providers, firms in related industries and associated institutions. In particular in the fields that compete but also co-operate" (Porter, 1998).

Concerning a precious characteristic that firms should have to be innovative, Cohen and Levinthal (1990) write about the importance of investing in internal research to be able to utilize external technology, developing an important capability called "absorptive capacity". The production and dissemination of knowledge has significantly enlarged and cannot be kept only behind the doors of the organization. Outside sources of knowledge are often critical to the innovation process. But, to keep and utilize the external knowledge, it is important to develop a so- called absorptive capacity. The premise of the notion of absorptive capacity is that the organization needs prior related knowledge to evaluate, assimilate and use new knowledge, transforming themselves into receptors and active users of it. In this respect, organizations' search processes are rooted in its previous experience as past success conditions for future behavior: prior related knowledge confers an ability to recognize the value of new information, assimilate and apply it to commercial ends. It includes basic skills, shared language, knowledge of the most recent scientific or technological developments in a given field. Three types of knowledge are essential for developing a superior capability to innovate, understand, anticipate and influence the emergence of new product meanings: knowledge about user needs, knowledge about technological opportunities, and knowledge about product and service languages. The use of different knowledge sources by an individual firm is partly shaped by the external environment, including the availability of technological opportunities, the degree of turbulence

in the environment, and the search activities of other firms in the industry. Highly educated labor forces allow knowledge to spill over to other enterprises, for the reason that education strengthens the absorptive capacity of organizations. At the same time, it is important for companies to not crystallize too heavily on prior knowledge because they could run the risk to become sufficiently overlapping and specialized, impeding the incorporation of outside knowledge and results in the pathology of the not-invented-here (NIH) syndrome. Some intensity of experience in each of the complementary knowledge domains is necessary to put an effective absorptive capacity in place and breadth of knowledge cannot be superficial to be effective. Background knowledge permits the assimilation, the exploitation and the creative utilization of the new knowledge, while the possession of related expertise permits firms to better understand and therefore evaluate the importance of intermediate advances for future development. The cumulativeness of absorptive capacity and its effect on the formation could also bring it to an extreme case of path dependence in which once a firm ceases investing in its absorptive capacity in a quickly moving field, it may never assimilate and exploit new information in that field, regardless of the value of that information. This condition is defined "lockout". Learning should be continuous to avoid the risk of transforming the core capabilities in core rigidities.

Verganti (2001) proposes that innovation may be seen as the result of a process of generation and integration of knowledge. Three types of knowledge are essential for developing a superior capability to innovate, understand, anticipate and influence the emergence of new product meanings: knowledge about user needs, knowledge about technological opportunities, and knowledge about product languages. Verganti in introducing the book of Borija de Mozota (2008) affirms that design can be considered like a vital and central resource from management. Imagination is a rare resource, and designers could be a powerful source of imagination and knowledge able to interpret the signs of society that could lead to sustain a competitive advantage.

In the intermediate position between open and closed innovation, Von Hippel (1988) identifies four external sources of useful knowledge: 1- suppliers and customers, 2- university, government and private laboratories 3- competitors 4- other nations, defining the lead user concept. The Lead User Method is a market

research tool that could bring breakthrough products, created by identifying leading trends in the to-be-developed product's associated marketplaces. Lead users are people or organizations that are striving to solve a particularly demanding version of the stated problem. The lead users are also questioned to determine whether they have knowledge of individuals or organizations that are considered to be "outside the market" and have even more extreme portable lighting needs than the policemen or home inspectors. By learning from both the lead users and the outside-the-market users, companies could identify new methods or approaches towards creating innovative products.

Fosfuri (2006) discusses in his article the licensing of technology. It requires a trade-off: "licensing payments net of transaction costs (revenue effect) must be balanced against the lower price/cost margin and/or reduced market share implied by increased competition (profit dissipation effect) from the licensee". The trade-off is not easy to be stabilized because of the competitive presence of multiple technology holders. The presence of multiple technology holders, which compete in the market for technology, changes such a trade-off and triggers more aggressive licensing behavior. So, the most important characteristics that determine a firm's rate of technology are the licensors' market share in the product market and the degree of technology-specific product differentiation.

Gans et al (2001) confirm within their research the role of the intermediate markets to alter the incentives for innovation, and also the conditions that allow the entry of new technologies from a new firm into an industry.

Gambardella in his book and articles describes the market for technology. Because of the fragmentation of the product market, the probability of licensing, despite the problems linked to the IP rights and the transaction costs. The transaction costs become less critical and strict, market for technology can overcome three market failures: R&D duplications, externalities in potentially public R&D outcomes, deviations from marginal cost pricing in the downstream product markets. Moreover, since the markets of potential users are becoming more and more sizable, suppliers are encouraged to produce more general technologies that range over a broader number of industries. Some new problems are arising due to the markets for technology: they induce deviation from marginal cost pricing in the sale of the technology, and they generate externalities associated with

complementary R&D and other investments made by the independent buyers and suppliers that operate in them.

In the last years Chesbrough, publishing books and articles about a new managerial approach toward innovation, has promoted a new term: Open Innovation, which is opposed to the closed model. Companies could not afford anymore to be closed to the external knowledge. The closed model has been dismissed and its validity has been questioned by the increased mobility of skilled and trained experts, wider availability of knowledge from different sources, the emergence of venture capital, the reduction of the market time, the shortening of many products' and services' life cycle and the ongoing globalization which embitters competition. Open innovation is defined as "the use of purposive inflows and outflows of knowledge to accelerate internal innovation, and to expand the markets for external use of innovation, respectively" (Chesbrough, Vanhaverbeke and West, 2006: p. 1).

Huston and Sakkab (2006), Senior Vice President of R&D in Procter and Gamble home care division, describe the way in which P&G's R&D department has moved from being an internal research and development to a Connect and Develop C&D rather than R&D organization. This decision did not change the internal department. Indeed, the 9000 scientists continued to work and do research, but the company also created more than 20 different global communities of practice (suppliers, universities, entrepreneurs, and institutes). C&D also shares risk and interdependence, through licensing and collaborating where it makes sense. Moreover, the approach to inventions changed: if after three years research result is not utilized they are available to other firms, including direct competitors.

Laursen and Salter (2006) have studied the English manufacturing firms and the aim of their study is to link the search strategy of innovative ideas to the firm's innovative performance. Moreover, they study how firms organize searches for new ideas that have commercial potential in the new models of innovation, adopting open search strategies that involve the use of external actors to help them to achieve and sustain innovation. Using a large-scale sample of industrial firms, this paper links search strategy to innovative performance. The considerations that have been provided are: first, there may be too many ideas for the firm to manage

and choose between; second, many innovative ideas may come at the wrong time and in the wrong place to be fully exploited; third, since there are so many ideas, few of these ideas are taken seriously or given the required level of attention or effort to bring them into implementation.

Cooke (2001) describes, in his paper, the OI from a cluster perspective, affirming that OI happens in clusters of firms, where the company has little influence and control on it. Small firms are able to satisfy their needs through inter-firm networking and regional policies. Inside a network knowledge spillover is quite frequent in the technology research. Being part of a network, as in leading centers where there is a consistent amount of money, stimulates further open science communication, cross-fertilization through knowledge spillovers and further new firm formation. The author identifies the conditions for favoring innovative clusters where an open innovation among the firms could arise. He distinguishes among infrastructural level (autonomous tax spending, regional private finance, policy influence on infrastructure, regional university-industry strategy), super-structural level (co-operative culture, interactive learning, associative consensus, harmonious labor relation worker mentoring, externalization, interactive innovation, networking).

In the following chart the different strategies of involving outside authors and the different levels of involvement of outside authors, from one side the close innovation model and on the opposite side the open innovation model.

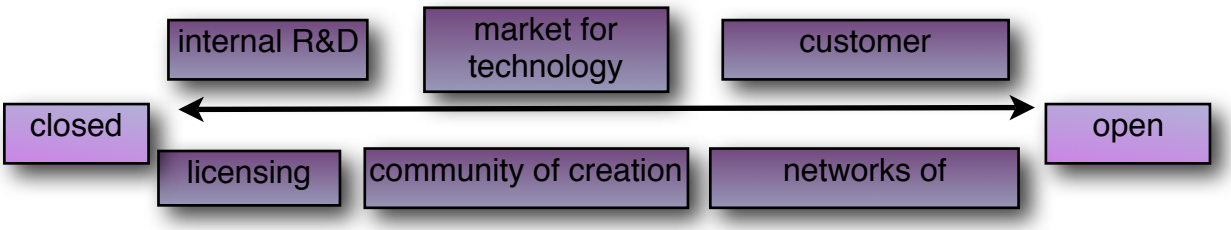


Figure 1 Adaptation from Verona and Prandelli (2006)

In the followed table, the most important characteristics discussed in the articles used for the literature review are confronted in an open and closed innovation context.

The review of the theory discloses that OI is a quite young subject. It is mainly based on case studies and it is quite difficult to provide general guidelines valid for many industries. The characteristics can be summarized:

✦ environment:

- It stresses the importance of sharing information;
- The marketplace is transparent

✦ people and rewards

- Proudly developed somewhere else (P&G motto);
- Project teams are not afraid to introduce an idea developed externally and are rewarded for the success of the project.

✦ culture

- The central idea behind open innovation is that in a world of widely distributed knowledge, companies cannot afford to rely entirely on their own research (Chesbrough et al 2006);
- Focus on learning instead of results;
- Willingness to take projects on board, avoiding the not invented here syndrome;
- Fuzzy open creative culture that avoids linear process;
- Ability to think outside the box;
- New thinking and opportunities.

✦ network

- Networked: Not all the smartest people work for the company. The company needs to work also with professionals and other companies in the network;

•External R&D can create important value and the internal R&D should be able to claim part of the value;

•Internal R&D is not an entry barrier in many industries;

•Contributions of external partners;

•Use of knowledge brokers, third parties who connect, recombine and transfer knowledge to companies to facilitate innovation.

✦ SME, entrepreneurship, inventors

•Trust and collaboration;

•The actors involved are: research universities, start-up and established firms, government agencies, nonprofit research institutes, leading research hospitals, venture capitalists, law firms, talent scouts, advertisers, consultant, financiers, privates, and not-for-profit agencies, business angels, venture capitalists, banks, governments, public (stock) markets, spin off and spin out.

✦ IP management

•The company is profiting from the others' use of IP, and buys IPs from external markets.

✦ ideas in the organizations

•Not centralized

✦ scouting for technology

•Assess partners, outside the company, asking them to contribute with their ideas, mixing with internal ideas connecting in this way different typologies of knowledge. This is a less expensive way to approach market: ability to leverage R&D developed by other firms;

•Searching for new boundaries and concepts

3. The Virtual World

Business has only two functions: marketing and innovation
Milan Kundera

In this third chapter the Internet possibilities for innovation and the potentialities of social networks and online communities are explained. The chapter is aimed at understanding how this tool can be useful for the OI.

The Internet has the advantage of having almost immediate feedbacks and real time interfaces that allows companies, communities, customers and another actors to be involved and informed immediately, and providing the possibilities for instantaneous feedbacks, creating cooperative relationships between two or more organizations, based on mutual exchange of rights and regulated by mechanisms through which information flows and mutual adjustments take place.

The Internet can allow firms to fill the structural holes between individual customers, communities and firms, and increase the richness of information, not being constraint by the trade off between reach and richness. The virtual world allows overcoming the problems related to the physical constraints, such as physical proximity, dedicated channels, size of the community, and speed of the respond cycle (that on the net, if built properly, is very fast). The Internet allows to cover all the aspects of the information richness: bandwidth (amount of information), degree of information that can be customized, and the level of interactivity (Verona, Prandelli, & Sawhney, 2006). Firms have to deal also with the persistence of the relationships with the communities: they have to understand if they are able to develop an ongoing engagement instead of an episodic interaction (Verona, Prandelli and Sawhney, 2006). Moreover, in comparison with the

physical world, the Internet has the potential to create influential indirect ties, allowing firms to access to the partners' partners' knowledge (Verona, Prandelli, Sawhney, 2006) by entering in partners' database, recombining it disparate ways.

The Internet permits an open and almost cost-free exchange of information between actors in any market (Evans & Wurster, 1999). The information is acquired through the observation, monitoring and tracking of the customer behavior. Moreover, customers may be asked to take actively part to surveys and pools or online focus groups to get their specific feedback (Verona et al.). Another advantage of the web is the iterative prototyping, rapid experimentation, and ongoing customer involvement to acquire customer knowledge and to better adapt new products to customer needs (Bhattacharya, Krishnan, & Mahajan, 1998). Hence, the web is a very interesting and inexpensive tool to develop new ideas and realize new products, it could be used successfully in all the phases of new product development. According to the literature, in the idea generation moment, firms can benefit from the external community input through questionnaires, feedback sessions and surveys, suggestion boxes (where users can leave their comments), complaint areas, ideas from virtual communities and blogs. In this phase it is essential to well define the mechanisms of regulation of new ideas and the IP behind that, creating social and financial mechanisms to increase participation and assure the right reward (financial remuneration and peer recognition).

In the idea selection stage, the hard task is to balance creativity with economic feasibility. The most useful tools on line are the concept testing and the online focus groups, through the virtual technology that allow firms to develop, test, evaluate and compare the different products.

During the product design phase, the priority is to transform the concept into a product, taking into consideration the aesthetic and functional features of design. There are some tools that can utilize effectively the competences and knowledge of customers, allowing them to modify the products, or suggesting their ideal products, becoming co-designers and co-developers in the process. The users can contribute, through digital

tools, to the development and prototyping moments (von Hippel and Katz, 2002). In some cases, companies utilize the innomediaries to complement the external channels of customer interactions, which can help companies to overcome the gaps in knowledge about customers that impede innovation, aggregation and dissemination of customer generated knowledge (Sawhney, E. and Verona, 2003), bridging the structural holes in the market.

Based on the previous analysis, it is possible to summarize tools that support exploration activities and tools that support exploitation possibilities (Verona, Prandelli, Sawhney, 2006).

	Exploration (ideation and concept)	**Exploitation (product design and testing) Deep/ high richness**
deep/ high richness	Suggestion box, advisory panels, virtual communities, web-based idea, markets information pump	Toolkits for users' innovation, Open source mechanisms
broad/ high reach	Online survey, Market intelligence services, Web-based conjoint analysis, Listening in techniques	Mass customization of the product Web-based prototyping Virtual product testing Virtual market testing

Verona et al, 2006

3.1.1 Infomediaries

Digital networks allow a large number of players to systematically share ideas and create distributed learning systems (Sproull & Kiesler, 1991). As a consequence, a number of intermediaries, called information intermediaries or infomediaries (Hagel & Rayport, 1997) have emerged to facilitate knowledge exchange in digital environments, mediating between customers who make the buying decisions and the companies that want to reach them (Bakos, 1997; Kannan, Chang, & Whinston, 1998), by making it easier for customers to obtain information about sellers and by allowing

sellers to reach customers. One of the first infomediaries online is the advertising company called AllAdvantage. These virtual brokers increase the efficiency of exchanges in commerce (Hagel & Singer, 1999; Sarkar, Butler, & Steinfeld, 1998).

The peculiar characteristics of the Internet are allowing firms to involve internal and external users in their new product development activities (Verona, Prandelli, Sawhney, 2006). According to recent studies (Verona et al. 2006), external sources of ideas play a very important role in the development of new ideas (from 45% to 90% in some retail companies). This confirms a trend that has been constant in recent years: companies are interconnected with many actors, trying to build a consistent path to market. Companies do not need to invent the best knowledge to win, but they become successful by creating the best employment of internal and external know-how in a well-timed way. The information and communication technologies are considered a winning tool to make this process faster, sustainable and feasible. Information and knowledge can be considered more distributed and more specialized in the learning process and geography is not crucial anymore: the same piece of knowledge can be leveraged more extensively: the absence of geographical barriers and the opportunities for connectivity across industries enhance the possibilities for knowledge exploitation (Upton and McAfee, 1996).

3.1.2 Knowledge brokers

Knowledge brokers are third parties who connect, recombine and transfer knowledge to companies to facilitate innovation (Hargadon and Sutton, 2000). They serve as intermediaries, or brokers, between otherwise disconnected pools of ideas (Hargadon and Sutton, 2000). The knowledge brokering cycle consists of network access, knowledge absorption, integration and implementation. These entities (organizations and individuals) facilitate the sharing and diffusion of knowledge between knowledge sources and knowledge needs, working in intermediate markets, where ideas and technologies are developed by sellers and sold to buyers who re-sell them to consumers. They possess technical knowledge and

relational knowledge, better defined as knowledge about knowledge, allowing them to know what others know, while providing the managerial and physical tools to access that knowledge (Sousa, 2006). Knowledge brokers can connect with a broader base of customers than the firm's own customers, in context that are very different from their and in domains that extended beyond the firm's immediate product and service offerings. Therefore, they help individual firms to overcome their biases and listen to more diverse and unusual voices, accessing customer knowledge that could be not only individual and social, explicit and tacit. This kind of mediators help firms to widespread their vision about core customer knowledge. Knowledge brokering is based on the Collaborative Product Innovation theory. This theory can be understood as a collaborative relationship between firms and external partners, established with the purpose to sustain the development and/or the commercialization of an innovative product or product line (Costa & Sarkar, 2008). Collaborative relationships are defined as cross-boundary information-exchange linkages that are characterized by high levels of relational and structural embeddedness (high levels of interaction, integration, transparency, mindfulness and synergy, as well as highly similar actionable knowledge bases), and in which each party contributes actively and significantly to the common goal (Rindfleisch and Moorman, 2001).

The best knowledge brokers systematically use old idea to create new products or services, spotting old ideas that can be used in new places, new ways, new combinations and new contexts (Hargadon and Sutton, 2000). According to Hargadon and Sutton, 2000, the knowledge brokering cycle has four phases. The first one, called "Capturing Good Ideas," consists in bringing promising ideas to span multiple markets, industries, geographical locations, to keep seeing proven technologies, products, business practices, and business models and to recognize that old ideas are their main source of new ideas. The second one is "Keeping Ideas Alive," through the creation of organizational memories. This step is crucial because ideas cannot be used if they are forgotten, information should be available in the organization at the right time despite the problems that may hinder the

widespread of ideas, geographic distance, political squabbles, internal competition, and bad incentive systems. Spreading information about who knows what is a powerful way to keep ideas alive. The third phase is called "Imagining New Uses for Old Ideas." The last phase is "Putting Promising Concepts to the Test". A good idea needs to be tested and, if successful, integrated into the rest of the company's portfolio: quickly turning an imaginative idea into a real and testable service, product, process, or business model. The testing should be quick and early in the process, to recognize mistakes and make improvements. Brokers' attitude toward ideas is usually "easy come, easy go" (Hargadon and Sutton, 2000). Ideas that do not solve the problem should be abandoned and the failure should be considered a learning experience. Within the context of Open Innovation, the core capability of knowledge brokers is defined as the ability to understand innovation problems. The VKB are virtual manifestations of the knowledge brokers, with the aim to connect, recombine and transfer knowledge to companies to facilitate innovation (Hargadon and Sutton, 2000) in the virtual environment. They translate the acquired knowledge into a structured project thanks to the necessary capabilities, skills and knowledge to solve the problem network access, knowledge absorption, knowledge integration and knowledge implementation (Verona, Prandelli, Sawhney, 2006).

In the virtual world, such brokers are more diverse, the scope of their activities is broader, and their potential impact on the innovation process can be greater (Verona, Prandelli, Sawhney, 2006). VKB also help firms to overcome perceptions of bias that firms may face in soliciting customer inputs for innovation (such as direct involvement in surveys, pools and online focus groups to get specific feedbacks). This enables the systematic information access and augments the awareness about available knowledge, making its internalization, recombination and implementation easier. VKB can convert themselves into marketplaces of ideas, where users and customers can solicit new applications, and voluntarily collaborate to identify the requires applications. In virtual environments, VKBs can benefit from a reversed process, creating a public repository of their

knowledge and promoting contests to stimulate users to find the best applications for their ideas. The business model of a VKB has to achieve two aims: to create a business able to have a worthy value chain; and to generate value for the business. Intermediate markets by their definition imply that the owner of IP is not selling a product or a service in a final product market (Chesbrough, 2003). The Internet offers new cheap and easy capabilities to absorb the customer knowledge and to allow them to engage actively in the firm's activity.

In the following table, the most well- known VKB are described:

Intermediary	Function	Role
Innocentive	Virtual market place that puts in contact agents and technology transfers	On line portal that links problems seekers with problem solvers
Nine sigma	Agent	Put in contact a partner who is looking for a technical solution with the scientists in his network, with the goal to work with the clients to rapidly develop OI to leverage the global innovation community for new knowledge, capabilities and breakthrough innovation.
Innovation Exchange	Innovation intermediary (match organizations seeking innovative products)	It is a community of individuals and midsize businesses, which fosters products, services, processes, business model
Big idea group	Agent/co-developer	Innovation intermediary (match organizations seeking innovative products)
Shanghai silicon Ip Exchange	Broker	The aim is to meet the IP needs and managing IP law.
Ocean Tomo	Merchant bank	Specializes in IP transactions

3.1.3 Online Communities

Sundam (2007) defines community as composed of two attributes: first, it is a web of affect encumbering relationships that encompasses a group of individuals, rather than simply a chain of one-on-one relationships. A

community requires a measure of commitment to a set of shared values, mores, meanings and historical identity to create a shared culture. The ties framed in the communities on line are based on trust. The term community of practice was originated by Lave and Wenger (1991) to indicate a community that sustains participation in an activity system about which participants share insights concerning what they are doing and what that means in their lives and for their communities. Lave and Wenger are stating that the community of practice does not imply co-presence of identifiable group or socially observable boundaries. The most important thing for a community is to develop the joint knowledge and practice and socialization of newcomers into the norms and practices of the community of practice: a shared repertoire. The greater anonymity and the diminution of the importance of physical appearance give a greater control over the time and space of interactions. People tend to meet and cluster together if they have support, face similar mental, physical, traumatic problems: since they are dealing with similar situations, they tend to be more empathic and show more understanding. As a consequence, research shows that in online support groups there is relatively little suspicion, and interactions are characterized by a low level of negative emotional remarks and high level of emphatic communication. This could satisfy the basic need to belong, which can be especially relevant for people who are lonely or isolated in their offline environment because they feel unique. The sensation is increased also by the possibility of having anonymous interactions, engendering strong feelings of groupings or cohesion. The sense of community, safety and privacy helps to share opinions and decrease the sense of loneliness, especially when they have the sensation that their identity is not accepted by society. Frable (1993) argues that people who suffer from diseases and physical problems can have the feeling that their social environment acts with uncertainty or awkwardly when they are present, which can ultimately lead to feelings of isolation and social exclusion. In online interaction people can feel liberated from this burden, because of the anonymity of interaction, the weak ties in online forums. It is easier to reveal hidden parts of the personality, and the context increases

the chance of meeting others that understand the own situation (Frable, 1993).

In online communities, frequently spontaneous forms of communication are monitored and considered as the result of a process of self-segmentation, which ensures a high degree of involvement (Hagel and Armstrong, 1997). The virtual communities contribute to reinforce the customer's willingness to buy, because they are giving additional information about the product and can increase the perception and the presence in the customer's mind. Moreover, they can also provide personal assistance during the product's selection process. This process could be facilitated by virtual comparison programs, which help users to visualize in 3D the product. During this process the customers can also improve the product features through suggestions and clarifications. In their analysis, distinguished tools that can be used for explorative or exploitative reasons.

Fans forum are composed or created by fans, who are loyal and devoted persons. Enthusiastic about the product, they are willing to engage proactively to participate on line, providing variegated inputs for exploring new solutions and ideas. In these forum (Verona, Prandelli, Sawhney, 2006) managers could take part, sometimes clearly identifying themselves, sometimes staying incognito (depends on the sensitivity of the audience and on the privacy concerns), with the aim of expanding the peripheral vision beyond their own customers, and reaching them directly, without the intermediation of a third party. The management of the R&D activities is intended to include new creative potential partners, exploring new ideas risen from the interconnection of different actors, through specific and ad hoc mechanisms of customer engagement, sharing experiences, continuous feedbacks on specific solutions, shared standards of communication and idiosyncrasy of skills (Verona, Prandelli, Sawhney, 2006). In this process of innovation, the idea behind is the joint IP: knowledge is socially constructed, and can be enhanced through the involvement in the communities. The communities of practice have been traditionally considered mechanisms to catalyze situated (Lave and Wenger, 1991) and distributed (Sproull and Kiesler, 1990) organizations, in some cases serving

as an alternative to teams (Wenger and Snyder, 2000). They focus on new knowledge creation, beyond the boundaries of the firm, emphasizing the contributions of a shared project (Upton and McAfee, 1996), building a common context of experience through the socialization and development of new contexts. A set of rules of participation has to be specified (Verona, Prandelli, Sawhney 2006). The virtual communities allow the aggregation of users who have unbiased competences, (Sawhney and Prandelli, 2000) and thus able to come out with disruptive ideas. In these communities, it is necessary a mechanism of coordination to avoid confusion and misleading contributions (Sawhney and Prandelli, 2000). It is essential to define a form of governance of the architecture, an access modality and some standards around which the community is organized. In many communities, the presence of a sponsor is required to facilitate the interaction and to guarantee the organization of the community (Verona, Prandelli, Sawhney 2006). To generate many attractive ideas, the community should be as much wide as possible: intranet communities, users, suppliers, and other stakeholders are encouraged to share experiences, to build a common background and to give their contribution in the idea generation. The online communities are particularly important in a contest of multinational companies: they can overcome problems related to the physical and geographical boundaries and distances, reaching low cost connections between firms belonging to the same network (Upton and McAfee, 1996). Virtual communities create relational ties, a well defined identity, socially generated experiences, shared knowledge, and they represent a new way of dividing cognitive work among numerous subjects who share the same language, easily transfer best practices, and solve internal problems more rapidly (Wenger and Snyder, 2000) despite the absence of a space-time proximity. The company can have a different attitude that can range from being only superficially or temporally interested in consumer activity to having very strong ties with the consumer activity.

Virtual communities can cover important functions. They are aggregating demand on a global scale, supporting the transaction processes and the test of the product concepts, reversing the problem of

segmentation: the consumers select themselves defining the firm's offering. The process of target audience identification is easier, increasing the effectiveness of the market research. The flow of communication between consumers is increased (Verona, Prandelli, Sawhney, 2006). This has a double face: it can increase the word of mouth and user loyalty, but at the same time it could also widespread bad opinions and complaints, that could affect the image that potential clients have about the enterprise (Chatterrjee, 2001) if not properly managed. The sense of community is created because of the deep involvement the users have about the products, the problem solving and the interests related to the discussion and sharing opinions in the field: there is positive relationship between the user's experience level in using the specific products of the firm and the firm and the frequency of posting messages to the community, answering and communicating between users (Buss, Strauss, 2009). More the users are experienced, the more are likely to solve problems and answer to questions (Chesbrough, 2003), the setting of the online community encourages peer users to innovate. The innovative users are individuals who create and reveal value in the field context, and can become a strategic and inimitable resource, lead mostly by intrinsic motivation, in constant evolution.
These communities are characterized by weak ties, they are a good mean to supply, distribute and discuss technical advice that will be unavailable or costly to acquire and communicate.

Researches in behavioral economics (Frey, 1997; Frey and Oberholzer-Gee 1997; Kreps 1997; Bénabou and Tirole 2003) and social physiology (Deci 1975; Deci and Ryan 1985) take into consideration interest in the intrinsic motivation of taking part in dedicated communities and social networks of expertise. Empirical research supports this argument and shows that there is often a "hidden cost of rewards" (Lepper and Greene 1978): in the words of Deci (1975) extrinsic rewards "corrupt" voluntary efforts. In the virtual world, only hobbyists are able to preserve intrinsic motivation to participate in these innovation activities (Jeppesen, 2005). Professionals will be "corrupted" by extrinsic rewards and will therefore not feel attracted to participate voluntarily in community-based

activities, as hobbyists do (Jeppesen, 2005). They are instead motivated by reputation gains through signaling (Glazer and Konrad 1999).
Lerner and Tirole (2002) explain the motivations of open source software programmers. In their view, open source software programmers' innovative efforts and free revealing may be found in "peer recognition", a reputation-based reward enhancing a provider's position in the job market. Many times, lead users have an important role in the online communities, and their presence should explain why firms should be more involved and being present in these developing new products. Recent researches (Jeppesen, 2005) highlight that lead users appreciate when their innovators are integrated into the firm and their innovative ideas are realized. Lead users have a strong motivation in participating in the product development because they don't have anything to loose by sharing innovations. The sharing of innovation is a key condition for firm-established user communities to succeed (Jeppesen, 2005). A simple way to allocate firm-recognition in return for users innovation is to openly acknowledge their contributions in the most visible way (Jeppesen, 2005). In the community, one of the fundamental aspects for being successful is the development of the joint knowledge and shared repertoire. On the web there is a sensation of perceived similarity, in combination with the easiness of access to a large number of individuals that online communication affords, and contribute to provide a sense of universality and communality in online support communities that is not likely to be found offline (Riegelsberger, Sasse, McCarthy, 2007)

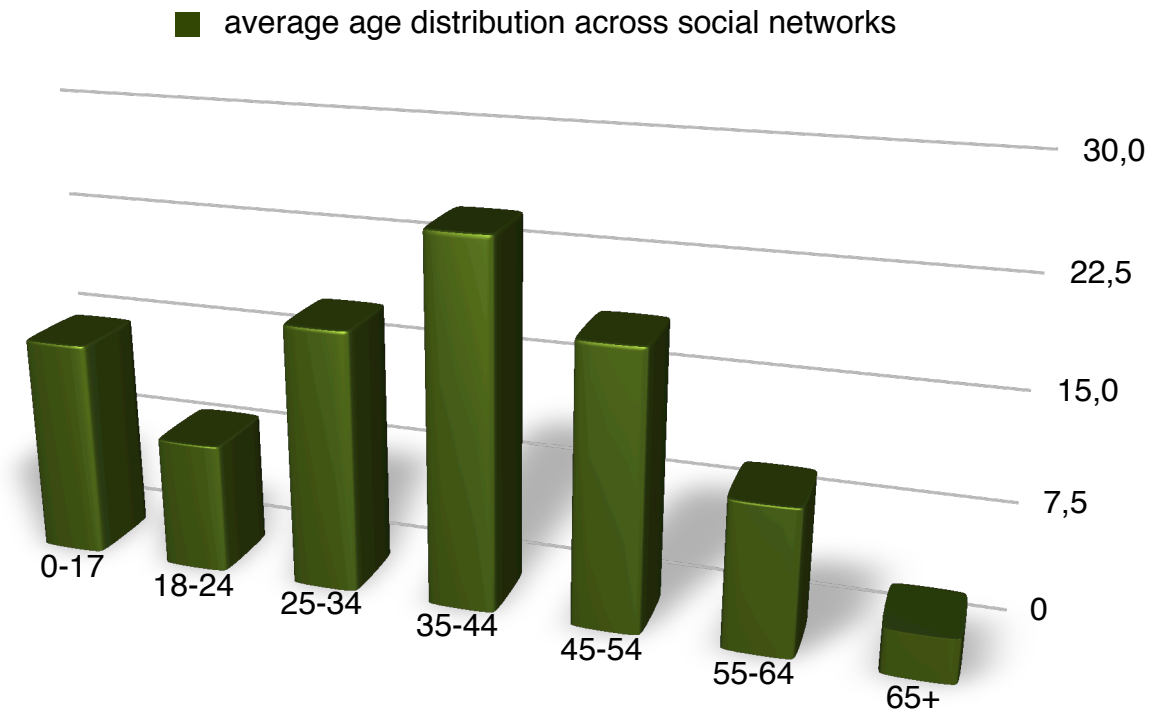
3.1.4 Social Network

The web has become one of the most powerful tools for information sharing, and there is a wide umbrella of websites, even if the most popular are surely YouTube, Facebook and Twitter. A social network site is defined as a web based service that allow individuals to: 1) construct a public or semi-public profile within a bounded system, 2) articulate a list of other users with whom they share a connection, and 3) view and traverse their list of connections and those made by others within the system (Buss and Strauss, 2009). Social networks are used to create new relations and meet new people (it is an easy and cheap

opportunity to meet new people in a cheap way), socializing (sharing experiences, reporting activities, small talk and commenting in each others' guest books, social support, looking for information about events, publications, net experiences).

Social networks are influencing many aspects of the person's daily activities. The consumer spends more time on social media than ever before (Nielsen Online 2009). Companies are trying to interfere with the social networks and on online communities by creating corporate blogs in Facebook, Twitter, Youtube etc. "People with access to relevant information are today questioning every form of communicative authority" (Andersen 2004, p. 21). Friedman (2006) perceives Google as one of the primary smoothers: for the first time people have access to a wide amount of information about disparate topics, ranging from education to searching for information, blogging, chatting, involving the customer creatively, provoking deep changes of knowledge and skills. In the social networks, users can create personal webpages. What is relevant is the speed at which knowledge and skills and the nature of jobs appear and are renewed since the Internet and social networks has become integrant part in the private and working life, involving learning, transmitting skills, and producing knowledge (Castells and Haraway, 2007). Social networks also supports intellectual technologies that amplify, externalize and modify a number of human cognitive functions: memory (database, hyper documents, binary files), imagination (simulation), perception (digital sensors, telepresence, virtual reality), and reasoning (AI, modeling complex phenomena). "The emergence of a cyberspace does not at all mean that the whole is initially accessible, but rather the whole is finally out of reach" (Castells and Haraway, 2007). In social networks,"web pages express the ideas, desires, knowledge, and offers of transaction of persons and groups" (Castells and Haraway, 2007, pg 142) and it is present a sort of social and collective intelligence: through the blogs, comments and interaction it is possible to note a collective memory, based on imagination, experience, and exchange of knowledge. The sharing of knowledge and skills facilitate the ability to communicate with individuals, agents, and increase the likelihood to meet similar persons, with similar interests. Social networks enable a new level of community navigations. Members have a profile, a home page with the link to other home pages displaying their preferences, groups, and forums in which they are involved. The connections are kept by links (explicit relations) and forums (people's interest) and are not depending on people's context.

A research conducted by the Economist (February, 2010) showed that the social networks are used to create job connections and are used for many scopes beside the friends' interaction. Nielsen confirms that Facebook is the web's number- one sink, with a trend that is increasing: In June 2009, Nielsen estimated that the average U.S. user spent 4 hours and 39 minutes per month (9.3 minutes per day) on Facebook. In August, it increased to five hours and 46 minutes (11.5 minutes per day). In January, it was more than 7 hours. Globally, time on site for Facebook was nearly six hours per month on the site.
The age distribution is another factor to take into consideration. The following chart describes the distribution among the population.



The age group 35-44 is the most active in the social groups, followed by the generation in its twenties. This could have a remarkable impact on firms that are willing to use the net for their purposes.

In this chapter I have analyzed the role of the web in the innovation process. The online communities and social networks are individuals who interact

to achieve common goals. Users are freely revealing innovations or suggesting implementation of the existing products (Jeppensen, 2006) for the firm, new alternative uses, or adjustments. The innovation coming out from the user community context is the result of voluntary and uncompensated activities where some users innovate and thereafter (most often) freely reveal their innovation (Chesbrough, 2006), pushed by intrinsic motivations. One of the main advantages of the online communities is that suggestions and observations come from the straightforward observation and their use from the hobbyist users. They are motivated by the recognition from peers and the achievement of the status of innovative users. The literature suggests that innovators are likely to have lead user attributes that differentiate them from the remaining users in the population (Chesbrough, 2006). These observations fit well with the notion of lead users who are defined as users of a given product or service type who combine two characteristics: a) they expect innovation related benefits from a solution and are thereby motivated to innovate; B) they experience the need for a given innovation earlier than the majority of the target market (von Hippel 1986). This means that innovative users frequently achieve the status of lead users. The common goal is to share innovations for free: hobbyists are not in competition among each others. If users were professional, they would not have the same propensity to reveal and share, because secrecy would be often a precondition (Jeppersen, 2005). This is consistent with Morrison et al (2000) study of information sharing among lead users (Chesbrough, 2003): they do not have anything to lose by sharing and revealing if innovations are in common place, and this would not happen if the users were professionals. Innovative users feel proud when the firm acknowledges their work openly in the community and perceive this recognition as an additional benefit of creating an innovation (Chesbrough, 2003). Customers and product users, by voluntarily revealing valuable information, contribute to the innovation process in many ways: as problem-finders, problem solvers, co-developers, suppliers and testers. These activities complement the firm's product development platform and thus create additional value for the firms. Users are quite independent and autonomous and from this autonomy interesting ideas could be originated. The benefits of having on line users communities can be summarized in three key points. First, online communities are relevant for obtaining sticky

information about the immediate, relevant and not communicated needs of users for their future products. The firm thereby receives qualified market information in the fuzzy front end of product development (Ottum & Moore 1997) as well as an opportunity to perform search procedures in a heterogeneous pools of information generated by product users, which allows the firm to carry out opportunity-spotting and recognition (O'Connor & Rice 2001). Indeed, they are likely to answers to many of the technical and operational questions posted. Second, there is availability of information: gaining quick and low cost access to information from users to try, and test the products. Third, the product can live a second life or can be moved through the curve of life cycle curve easier and faster.

4.1 Novo Nordisk

If you want to build a ship, don't drum up people together to collect wood and don't assign them tasks and work, but rather teach them to long for the endless immensity of the sea"

Antoine de Saint-Exupery

Novo Nordisk has a history dating back 80 years. It began in the early 1920s when August Krog, a Nobel prize professor at Copenhagen University, decided to produce insulin, which had just been discovered in Canada. His legacy of making a positive difference in people's life, by defeating diabetes, is still the core vision of the company.

Novo Nordisk is a worldwide leader healthcare company in diabetes care, possessing the broadest diabetes product portfolio in the industry, including the most advanced products within the area of insulin delivery systems, haemostasis management, growth hormone therapy and hormone replacement therapy. The company has its headquarters in Denmark, and it is present in more than 179 countries. Its business is driven by the Triple Bottom Line: a commitment to economic success, environmental soundness, and social responsibility to employees and customers. This practice is also a strategy to retain employees and increase their motivation and commitment inside the organization.

For more than ten years, Novo has achieved impressive financial results compared to the pharmaceutical industry. Indeed, it has achieved double digit sales growth. By August 2009, Novo Nordisk was the global market leader in diabetes care with 51% of the total insulin market and 45% of modern insulin market (measured in volumes). Diabetes care account for 73% of Novo's sales. The company has experienced significant growth in recent years, with total sales increasing by 11% from January to June 2009, and increasing the workforce (now approximately 27,900 employees) in the period 2000-2008 by 119%, and has the scope to employ by 2018 43,000 workers. Currently, of the total workforce, 17% work in R&D, 30% in

production, 34% sales and marketing and 19% in administration. In the next table, the strategic focus and products are presented. In the first six months of 2009, Novo increased operating profit by 39%. Net profit increased by 22% to DKK 5,690 million. Raised outlook for underlying operating profit growth for the full year. The gross margin increased to 79.9% compared with 77.1% in the same period of 2008, coherent with the company's vision: we will be the world's leading diabetes care company.

4.1.1 Industry

Novo Nordisk, to compete in the pharmaceutical field, has to deal with big challenges. The benchmarking competitiveness report released by the European Commission highlighted that R&D investment in Europe grew by 3.3 times between 1990 and 2007, the corresponding increase in the U.S. was 5.2 times. According to the 2000 competitiveness report, "North America has become the main locus of innovation in pharmaceuticals, to which European companies turn to get knowledge". The report notes that the concentration of research and innovation in the U.S. is "worrying because Europe risks to be relegated into the fringe of the industry, surviving and even thriving through imitation, generics, marketing, but giving up a large share of the value added and becoming dependent on the USA for the development of new products." Estimates refer that time to bring a new drug to the market will be over 12 years, with a cost of around $1.5bn. For 10,000 molecules with potential, around 250 make it to pre-clinical trials, 10 to full-scale trials and 1 may succeed.

Companies in the pharmaceutical fields are facing these challenges with many different strategies, like spinning off and setting up new businesses as entrepreneurial satellites of established players, various forms of corporate entrepreneurship and venturing but also developing new capabilities for competing in such environments, balancing exploration with exploitation. The difficult task is not only coming up with a new product, untapped market niche or business model, but also repeating the conditions that have brought them there. A quite typical behavior for pharma firms is, once they have found a successful compound, to turn conservative, fossilizing in the improvement of

the innovation, renouncing in the quest for new breakthrough products. The pharmaceutical world is growing in complexity. To face this complexity, Novo has opted for different strategies. First, it is constantly increasing the line extensions of the portfolio of drugs and delivery devices. Second, it invests the 17% of turnover in areas that have close links with the core competencies. Novo has also opted for a strategy of exploration, by experimenting and receiving fast adaptive feedback to emerging situations, engaging a wide variety of stakeholders.

4.2 Innovation In The Device Area

The analysis of innovation has been delimited to the device R&D unit.
The following chart describes the organization of the R&D device area.

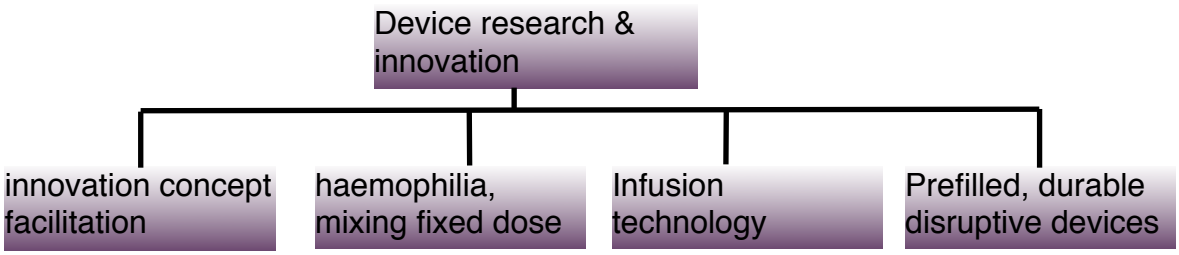


Figure 5 R&D device departments

The department in which I concentrated my attention is the Innovation and Concept Facilitation department, in the Device Research and Innovation Area. It has to provide ideas and concepts for the other units of the R&D area, through constant interaction and communication. The Innovation and Concept Facilitation department is a comprehensive toolbox for concept development. It has the aim to increase the number and the quality of concepts developed, give inspiration to other areas through an open discussion and provide the colleagues help on an open discussion basis. It has to provide ideas both for the next generation device and for the line extension, which requires a more focused product development. It is under the responsibility of the Device Research and Innovation (DRI, with 3 employees and part of the vice president area)

department, that has to ensure innovation of the next generations of diabetes and hemophilia devices, looking for sustainable and radical innovation projects candidate. The creation of this area has been though to ensure superior leadership in order to not loose terrain comparing the competitors: Novo Nordisk recognized that, with the device area under the insulin department, it was not able to provide innovative devices. Medical devices are extremely important to support the sales of insulin, because in the recent years insulin has been on par and competition is done on the combined sales of drug and medical devices. The current development practice is influenced by the mind- set staged in 1985 with the creation of NovoPen. The decision to systematically approach an open innovation strategy, in March 2009, was due to the recognition that the department needed to settle some rules and practices because before there were no rules about how to approach external actors, so solutions and actions would have emerged along the way.

4.2.1 The xxxx Project

The xxxx project is an explorative project within the insulin area, to create an innovative product candidate to sustain future Novo insulin injection leadership, with the aim to satisfy some of the end users' necessities. The scope of the project is to develop a safe, reliable, cheap and disposable injection device.

As the first stage of the project, Novo's engineers tried to develop internally (through brainstorming, consulting colleagues, searching for patents and doing web and literature studies), contacting the Teknologisk Partnerskab, the Teknologist Institut consultants, and asking the collaboration of some Danish companies and consultants. After having had unsuccessful results from all these partners, the team decided to go for OI. Since it was the first project developed intentionally with an OI perspective, the team started to look for documents and articles from Harvard Business Review. Then, the project manager contacted Lars Bo Jeppesen, professor at CBS and Jill Panetta, former CTO and founder of InnoCentive Inc. The project manager decided to hire her as consultant, because of her wide involvement in the OI network. The team first contacted InnoCentive, looking for a broadcasting project. But they decided to not go on with this collaboration because they lately discovered Eli Lilly founded this intermediary

and was working with it to develop a new insulin pen. Then, Novo approached YouEncore, founded in 2005, which works with a narrow casting model. But this time YouEncore refused to work with Novo because it was already collaborating with Eli Lilly and was afraid of having some troubles due to competition issues. So, Novo asked Science24Seven, a company established in 2008, with a strong network in Russia and India, to try to solve their problem. The OI project was initiated on October 2008. This intermediary facilitated an on-line expert workshop, acted as link between the expert group and Novo (which remained anonymous), and handled expert contracts, payments and confidentiality. The main problems arose in this last area. Since it was a newly established company, Novo spent a consistent amount of time only in negotiating the fees and to have, at the end of the project, the names of the seven skilled experts chosen for the workshop. The team was put together based on their expert fields (polymer chemistry, material science, micro electronics), with almost 200 years of combined experience. Novo described the ideal sequence and the features of the product. Jill Panetta, who also ran the workshops and compiled the final report, vetted the team. The expert workshops ran for two and half weeks, and finalization of the report took one week. The experts suggested five approaches and two of them were particularly promising. Finally Novo's team decided that the concept could be produced. After having passed the initial difficulties of not having the names of the experts, the team was able to enter in contact with the members. The scientists understood the use of the concept and put Novo in contact with a manufacturing company able to produce this particular device. Now, the challenge that Novo is facing is to find alternative uses for this product, in different areas, to out license the device to enable the manufacturing company to produce it in a profitable way.
The overall experience was considered successful because the expert group possessed knowledge and competences that lay outside Device R&D area of expertise, coming up with a solution.

4.3 Internet Tools

Novo would like to change the way in which employees are using the social media to communicate and interact with others employees. The aim of Novo is to

improve continuous innovation with the involvement of all the stakeholders. These means of communication have been introduced to enhance the dialogue, humanize the organization, facilitate the knowledge sharing and improve collaboration. Novo, since has understood the importance of these devices as source of information, education, news, interactions, has decided to start to train employees in their use, to make them aware of the possibilities of the on line communication, especially in a multinational company. Novo is present in 80 countries all around the world, so the social media can play an important role in enhancing the corporate culture and at the same time emphasizing the local units; it could be used to increase the on-time communication, the accessibility to competences and expertise in other countries, and find and share relevant knowledge. The aim is to support a new level of innovative diversity within the organization and across disciplines, borders, cultures, and departments, creating new spaces for innovation. But this diversity can also result in new forms of organization as boundaries continue to blur between internal stakeholders such as employees and semi-internal stakeholders such as partners, suppliers, and freelancers.

4.3.1 Innovation Portal

In the innovation portal there are three sections: help me now!, coach me! and challenge me! Help me now is a way to get help from experts and colleagues if the person has a question to pose or a problem that he is not able to find a solution for. It is internal to the device research unit, but it is not known by many. It is an on line brainstorm panel and helps to solve real innovation problems posed by colleagues. This is though as a way to increase the personal innovation experience and be part of Device research unit more innovatively.

Coach me! helps to discover useful process tools and get inspired from cases and articles to enhance the innovation thinking and practice. Novo is also organizing courses and training about the concepts of creativity and innovation. The objectives of these courses are to understand why innovation is important, how to foster creativity, demonstrating and experiencing the difference phases in the innovation process (search, selection, implementation). The Internet platforms are thought to have a positive impact both on the content and on the process

dimension of knowledge and expertise, that have a relevant impact on the product development.

4.3.2 Care System

It is a call center used by patients (64%), pharmacists (18%), physicians (12%) and others (6%). The reasons why these people are calling are for referrals, basic information, training, product problems, literature request and medical inquires. The care system is also on line, with a suggestion box where anyone can leave his comment. The R&D department is benefiting from suggestions received by customers for the product development. Marketing participates quite actively in the R&D process, because it has the responsibility to describe the market and the needs, and lately it is using the suggestions it is receiving. The marketing department, at the beginning, was skeptical with these tools, because it had the perception that designers could interfere with their tasks. The care system is used frequently by designers of Innovation and Concept facilitation because it provides them a database where the ideas, suggestions and improvements are being collected and classified, used as source of inspiration for additional devices' features. The Internet database is a powerful and cost effective tool, because it is able to connect many stakeholders all around the world, blunting the barriers of physical distance.

4.3.3. Interactive Website

Novo has perceived the necessity to be in the new media's dimension. In fall 2009 some initiative has been launched and will be present on the net. Internally, a site for idea generation (Idea Storm) and an internal user- generated encyclopedia (Novopedia) has just been started. Externally, a blog at novonordisk.com/career, targeting graduates, has just started to be operative. These are frameworks for knowledge sharing and considered a new and valuable way to communicate. These ideas have been suggested by competitors, which are already in the virtual world. This is certainly a good opportunity for dialoguing with the stakeholders, both internally and externally. The top management is aware of the potentialities of new social media, and the device research and innovation is looking forward for using them systematically as complementary tools to increase idea generation, but at the

same time the department recognizes the difficulties that it will have to face, especially because Novo is not used to these kind of tools.

4.3.4 Idea Storm

This project will develop a generic idea development and sharing platform - a web application that allows users to add ideas, best practices and experiences, rate them and comment on them in the Globeshare. In the long term perspective, the generic idea sharing platform will be available for use for employees throughout the organization so that any given project manager can invite colleagues to contribute with ideas to a specific theme and easily use the input and dialogue in his or her daily work. In an organization with a focus on innovation there is seldom a lack of ideas. But this is often difficult to share and develop these ideas into innovative projects. The idea sharing platform will enable the discussion and development of ideas arising within Novo, and encourage and support an innovative culture, and allow for wider stakeholder buy in for ideas as they are developed jointly across the company. The climate idea storm will seek to exemplify these benefits by gathering ideas on ways to reduce our climate impact and communicate the organization's position and ambition related to climate challenges in an engaging and involving way.

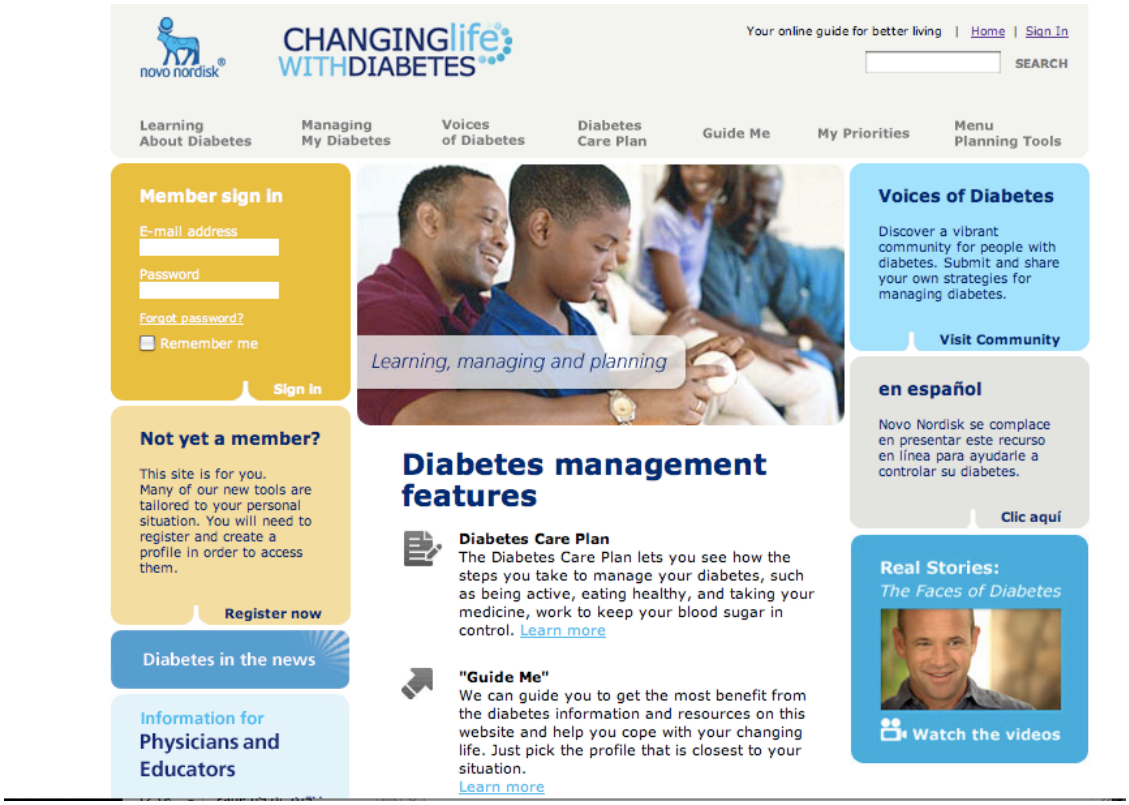
4.3.5 Novopedia

This project will develop an internal wiki tool as a collection of web pages designed to enable anyone who accesses it to contribute or modify its content directly. The ambition is to create Novopedia, focused on collecting and explaining things, very similar to Wikipedia, but for only internal use.

4.3.6 Changingdiabetesnow.com

Changinediabetesnow.com: could support stakeholder dialogues before, during, and after the physical event. This could include a democratic outreach by involving a broader set of stakeholders such as grassroots, social entrepreneurs, and social

media opinion leaders who are willing to experiment with new concepts and models for change. Development of such a website requires a deeper understanding of these stakeholders' interests and motivates for participation. The website has just been launched, but it is quite challenging because it requires a deep understanding of the stakeholders' interest and motive the participants.



4.3.4 Graphic Interface

A student, for his master thesis project, constructed on the website a section where users could construct their own pen. The features were the one proposed by Novo. Users basically reshaped their own pen, without contributing with anything new. But the section has been closed down because it was considered too expensive (especially the outcomes to be produce). There was also the suggestion to create a dedicated on-line place where anyone could post ideas. This has not being realized yet because the company was not able to answer to some questions related to the IPs: what happens if a user provided an idea similar to some non patented idea the company would have been working on? Could the company be sued?

4.5 External Websites

In this section I analyze briefly some of the Internet websites. The Internet is an important aspect of social interaction, and it has become more integrated with everyday life, and it could be considered a mean to exchange online support, especially in situations in which the face-to- face dialogue is difficult.

4.5.1 tudiabetes.org

Tudiabetes.org is a website with almost 15.000 users, created at the end of 2006 by Manny Hernandez. His aim was to create a community of support where the members could help and encourage each others, creating a network of people with diabetes, beyond making friends and socializing. The community also promotes positive and proactive actions to stay healthy while living with diabetes, and heartens the exchange of information and storytelling about diabetes. Anyone who would like to have any information concerning diabetes can have access in the community, and find the help of other members. Indeed, the main aim of this website is to have a reciprocal help, educating each other, and share the steps they take every day to stay healthy while living with this serious condition. One of the

members wrote about the community: “It's like 'MySpace' on insulin..." In TuDiabetes.com, it is possible to write write blog posts, exchange ideas in discussion forums, share photos and videos that are considered useful and informative, or reflect on the daily difficulties that users of this web site would like to share.

4.5.2 Eli Lilly

Eli Lilly has developed many programs online to increase the quality of patient care and to help to manage care and public payer organizations though educational outreach. Among the others, the online programs are related to foster innovation through spin off as InnoCentive, now independent, sourcing innovation, connecting with employees, connecting to patients, nurturing differences as supplier diversity program, patient eduction, heros in the fights, inspired by diabetes, fribromylogia initiatives, journey awards (a program that recognizes diabetes patients who have successfully managed their disease with the help of insulin), solutions for wellness.

e.Lilly is the online branch of Eli Lilly. It has developed the web site to manage properly the interactions with customers with the aim of supporting R&D activities (including the generation of new drugs and the creation of new partner solutions), exploring new ideas and strategies for growth with its creative partners, establishing dialogue among patients, doctors and employees. The company, to explore new opportunities and test solutions, invite patients suffering from diseases to participate in ad hoc forums, seeking to increase the effectiveness of health care through sophisticated, innovative technology to the needs of communities concerned with securing basic health care.

The company invites suppliers and people suffering from the disease to take part in collaborative forums. More specifically, the Supplier Diversity Pharmaceutical Forum is a collaborative group of supplier diversity professionals from 15 of the larger pharmaceutical companies that dedicate resources to create a greater opportunity for diverse businesses to serve the pharmaceutical industry. The forum is a network for its members where it is possible openly share diverse supplier information, benchmark for best practices and work cooperatively on joint events. The group meets formally on a quarterly basis, but interacts and shares best practices among members on an ongoing basis, and to engage the patients

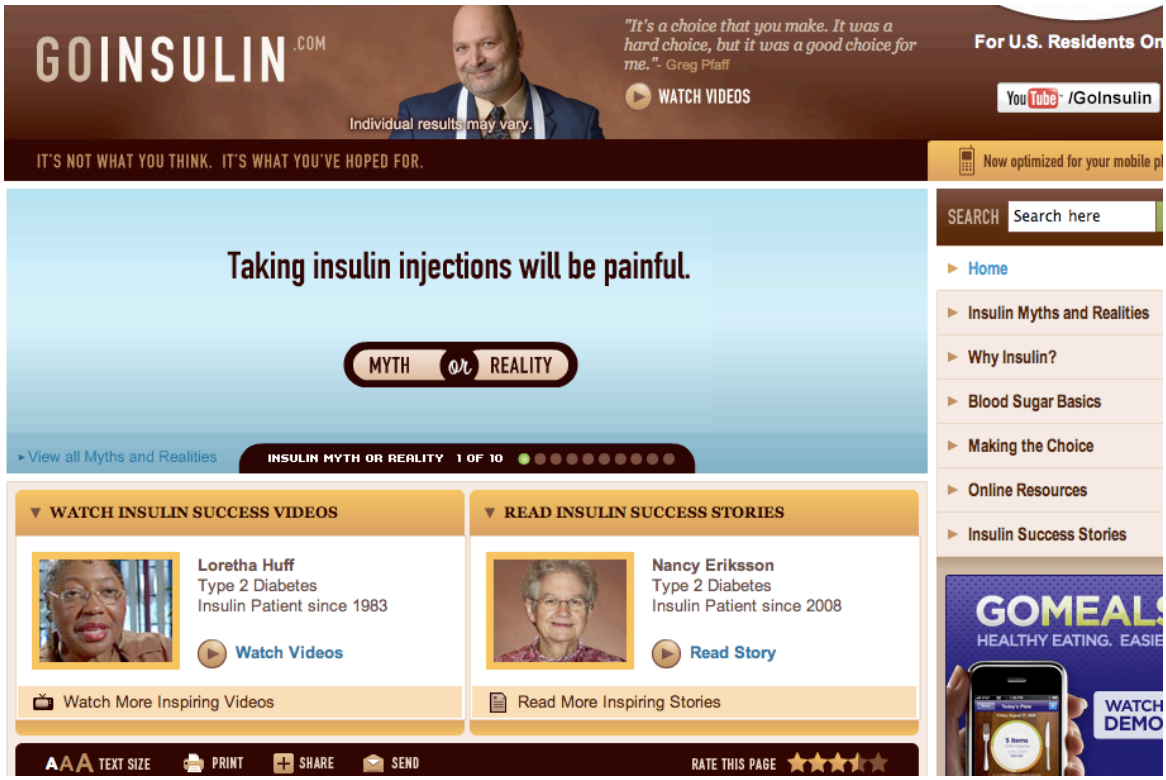
affected by the same pathologies to share experience of learning how to deal and cope with a specific health condition.

Inspired by Diabetes is a global campaign asking people with diabetes, as well as their families, friends, and health care professionals, to express how diabetes has had an impact on their lives - and share those stories with others around the world. At the heart of Inspired by Diabetes is the Creative Expression Competition, which seeks expressions of the challenges and triumphs of the diabetes journey through art, essay, poetry, and photography. Inspired by Diabetes is a collaboration between global champions Eli Lilly and Company and the International Diabetes Federation's Unite for Diabetes initiative.

Lilly aims at educating patients on a broader basis, through the corporate web site and other related sites, such as Women's Health. Patients are encouraged to share their opinions and doubts, and at the same time, they are empowered in the choice of the medical treatment. In this way, the company is able to have feedbacks about products, product concepts and collecting data through on line polls and surveys. Doctors are occupied in advisory programs, which have the aim of supporting continuous feedback in specific pathologies, to predict the trends and the evolutions in the market and in the diseases. Since the company wants to find new solutions to problems, it invites patients to socialize and share their experiences and advices, and the company can use these interactions for taking

ideas for new products and idea generations. It created also dedicated websites, divided into the main illness, where patients involved in the therapy receive customized information and Eli Lilly can get information through polls and surveys from people with the disease and people who care about them.

4.5.3 goinsuline



Senofi- Aventis has launched in YouTube goinsuline, to reach patients, and consumers. The Sanofi channel is part of its integrated GoInsulin campaign, an unbranded health education program designed to give people more information about diabetes and serve as a launching pad to the Sanofi homepage. It features a wide range of patient videos and links to off-sites, online videos that separates the myths about insulin from reality. The channel has no branded material, but the name of the company is clearly visible below the top banner. The senior manager of the company, Crowe, stated: "We wanted to share patient video stories about their success in managing their diabetes by working with their physician, as well as key tactics of the GoInsulin campaign that have demonstrated the most appeal and impact to the patient[1]. " The website is though to

[1] http://pharmexec.findpharma.com/pharmexec/Marketing/Sanofi-Aventis-and-AZ-Launch-YouTube-Sites/ArticleStandard/Article/detail/582363

challenge the barriers, the misperceptions and difficulties about the use of insulin, and help people with type 2 to make better decisions for managing their conditions. Many patients feel they have failed something if they have to take insulin, and they perceive this step as something that could interfere with their daily routine. The goinsuline website has been created to help people to explode the fake beliefs and myths about diabetes and make the best decisions about treatment for them. In this web site there are videos that are balancing the information, risks and real life experiences. In the web site there are dedicated sections where it is possible to read about the signs and the symptoms of the illness, find and work with a doctor, create a support partner relationship.

5.1 Comprehensive Analysis

In the this chapter, projects are evaluated on the base of the OI theory individuated in the literature review.

5.1.1 Environment

The environment is very closed and the competition very high. There is a supporting staff, called the competitive intelligence monitors, which analyses and communicates competitors' information. The main scope is the analysis of competitors' activities that have an impact on Novo's R&D portfolio. The goals are to provide the best possible data driven assessment of the competitive landscape to challenge and optimize Novo strategies on R&D project, R&D portfolio and on corporate levels.

5.1.2 People And Reward

The rewards are linked to the success of the project. Frequently, ideas are stopped at milestone A (where it is decided the feasibility of the concept): this is a department that has to develop ideas for the device R&D area, so an abundance of ideas is a need. For each project that is in milestone C, four projects should be in milestone A: 75% of ideas are left on the shelf. From milestone A to Milestone C, the project identified is proven feasible, and has to pass to other milestones to be more reliable. Many ideas are not developed not because they are bad ideas, but because the time is not right or in that moment there is a better proposal. Failures are not a punishment as long as the worker demonstrates that he has learnt from the mistake. The metric used to decree that the project is successful or not is if it has a good development option. Successful concepts are the exploitation of the latent values. Concept is defined as the description of a potential future product using technology and design to fulfill unmet needs in alignment with Novo vision and business.
Every February there is the meeting with the evaluation of the concluded year's performances and the settlement of the goals for the next year. If a person has outperformed, he/she obtains as reward an extra bonus (from 0% to 8% of

yearly salary), while if the team has reached an important milestone, there is a department celebration. People are evaluated according to two drivers, the business driver (how well a concept could do or do in the market), and behavioral driver (how they individually and collectively led, behave, play their role, spend their time).

5.1.3 Culture

Team members introduce ideas from outside, but they are quite reluctant if it comes from a person or entity that has the same level of knowledge, while they are willing to accept, but are very careful (only after having signed the confidentiality and disclosure agreement), if the idea comes from the expertise of an area in which they are not competent. The department is focused on learning instead of results. After the closing of a project, the teams are encouraged to share the results and what they have discovered, through reports, discussion forums, opinions and experienced problems.

On different occasions teams are experiencing the "not invented here syndrome", because they believe themselves to be in a company that hires the best people in the field. The management is working on transforming the "not-invented- here" syndrome in "proudly- developed elsewhere", following P&G example. The department is not willing to out-license the patents, and resulting in protective attitude towards the external exploitation of knowledge.

Novo considers itself innovative in relation to R&D, but when it comes to commercialize ideas, it is always a faster follower, being very risk adverse. Commercialization of a product happens when the company sees a threat from the competition, frequently waiting and studying what the others are doing, and based on this, deciding which competitive move to make because it would not like to introduce a too innovative product that would not be accepted by the users, but could give inspiration to their competitors.

The system is very slow also due to the stage gate system and the requirements it has to meet. The stage gate system frequently freezes ideas and focuses more on "doing better" instead of "doing different". But, since the department of Innovation and concept facilitation focuses in the early phases, risk taking, debate, creativity, lateral thinking, idea support and ability to think outside the

box are propelled. In this department there is a very relaxed atmosphere, people frequently joke and play because they see their workplace as easygoing, fun and relaxed. The persons totally trust the other employees inside the same department, but not from other departments, because they are scared they could steal their ideas.

5.1.4 Networks, SME, Inventors And Entrepreneurs And Building Relationships

The department members have the perception to be among the best designers and engineers in the industry and for this reason they are reluctant to network with outside actors who have similar competencies. Consultants are used in two different ways: as partners to be involved in the team, and from which to learn, or as competencies' outsourcing. When consultants are inserted in the team, they are treated like team members, and the hope is to absorb their knowledge by working closely with them. In the second case, the company receives only the already developed concepts and does not learn anything new. They are starting to see the suppliers as partners, not as vendors: the department said what it needed, without giving the partner a set of requirements, and it delivered the required product only to Novo. The OI approach with this entity has been possible by leveraging the known supplier taking the relationship to another level considering the previous experience. But it believes that it is necessary to develop a sort of guideline to decide in which part of the process and with which modality it is desirable to involve them. They are willing to use knowledge brokers, but they are not willing to receive ideas from inventors and entrepreneurs because they do not know how to deal with the IPs issues. Indeed, there could be the possibility that one of these actors would submit an idea that is under development, but not already patented, so they could claim a portion of the value generated from a future sale. The entities involved frequently are research universities, start-ups, government and non profit agencies, leading research hospitals, research institutes, and talent scouts. As well as being connected into the network, it is important to be an investor and consider them as long-term agreements of companies that endeavor to build a competitive advantage compared to the

companies who are not part of the network, through access of reliable information and knowledge. When Novo approves the conjoint projects, it always has full control of the decisions. Novo also exercises a strong control over the academic researchers who write their project inside the company: it checks and approves what is written in the project, controlling that they will not publish information that could damage the company, even if they could increase the value of the research. In the extended reach and capability for new technologies and ideas, these experiences have benefited the firm because they contributed to change the mental mind- set and approach to collaboration with external environment.

5.1.5 IPs Management

IPs are considered a tool to sustain innovation. They generate rents that are reinvested in the company and create a positive loop of innovation. IPs are an extremely valuable strategic resource: the new products are supposed to give a competitive edge on the markets, and need strong protection because of the consistent investment that there is behind.

IPs are highly controlled by the company. Patents are perceived as a barrier to entry and in the industry they are a source of revenues and profits. An unsolved question for the department is related to the modality of acquisition of external knowledge (when, how much and how information should be received). Some of the patents that are not used anymore are made available in the market, with the not exclusivity clause. This means that every one can use the patent for make a new product, but no one (especially competitors) could appropriate and making an exclusive use. There is the diffuse fear that competitors could benefit from ideas that are not used but that could turn out to be profitable in the future. Some attempts to outsource internal competencies have been realized. The company has sold the pens to other companies that are producing medicines outside the diabetes and hemophilia area (as Avonex, which is focused on the treatment of multiple sclerosis). The company tried, unsuccessfully, to sell the patents related to the glucose monitoring, area dismissed. According the manager of the department, other industries and businesses would not be rejected a priori, but would be considered only if a

secure strategy within IPs management would be proposed. This is not only a problem related to the difficulty of managing the patents in a safe way, but also because the company believes that if an idea has not being transformed into a commercial product in that moment, does not means that it is a bad idea, but there are ideas that have been considered better than it or the times are not right for it. They want to avoid the possibility to favor a competitor in any way. The department is concerned about how many information should receive, how many confidential information should be disclosed and how. A task force is working on this problem and by the end of the last year (December 2009) it was expected to provide some tools to look outside the boundaries of the company.

5.1.6 Ideas In The Organization

The ideas are mostly bottom up: the DIB (device innovation board) defines a five years strategy, the needs and the requirements for each department. The head of each department provides guidelines and relevant areas to explore, and then the teams present ideas and the board decides which one should be developed considering the overall product portfolio. Interestingly, along with the open innovation strategy, the role of the innovation and concept facilitation portal has broadened and not only focused on external ideas. Indeed, the innovative forums, seminars, and other activities aimed at increasing internal innovation have become more frequent. But this open to innovation- based culture is still in an embryonic stage: in the company there is a diffused not invented here syndrome, also internally: if some of the other departments propose an idea or a concept, it is hardily taken seriously into consideration. Moreover, during the inter-department meetings, not all information is shared: there is the perception that colleagues could steal ideas for making a good concept in their department.

5.1.7 Scouting For Technology

Scouting is done internally and, if it does not produce anything, teams start to look outside the department and eventually outside the company. The department uses two approaches. The first one is looking inside the

organization, involving other departments and creating mixed teams. The second one is to monitor the external environment by hiring consultants in their projects. This could be considered a path toward OI, a managed transaction for more innovative and systematic approaches. An essential part of the scouting process is the establishment of the external networks. The aim is to find innovative concepts and partners at the early stages of the development process. For this reason, none of the projects involve start-ups, because they usually sell the product when it is finished. All the projects have been in- out projects, in the sense that Novo was looking for a solution. The other way round, when companies, users, researchers are looking to institutions to develop it, is not an option already used by Novo.

5.1.8 Users

End users are very important, and the R&D teams have to be careful, because they are developing products for people who are experiencing a difficult situation. The method mostly used to understand their needs is the participatory and empathic design: team members observe and analyze users' behavior to understand their hidden necessities and try to put themselves in users' shoes

5.1.9 R&D

In the innovation and concept facilitation department, all the members are working on projects related to early R&D: this means that they are developing new ideas and solutions at the early stages of the process, and then they pass the concept to the other departments (infusion technology and needles, pre-filled, durable and disruptive devices, hemophilia, mixing and fixed dose devices). It has to act as knowledge broker, promoting knowledge diffusion and new opportunities. It has to identify, understand, select and connect the available knowledge, integrate internal and external knowledge to form more complex combinations to develop the ability to generate additional revenues and profits from selling research outputs.

5.1.10 Knowledge

The employees are complaining that apposite absorptive capacity tools are not developed. The main critic is in the number of external consultants involved in the projects. There is not a specific methodology to store what has been learned during the project: when the project is closed and the consultant leaves the company, it is hard to say what the department has learned. The main feeling is to be in hostage of the external people, losing the full control of the project. The employees ask for less consultants and more knowledge building or sharing inside the firm. Moreover, external consultants are not under a strict behavior control: sometimes they are misbehaving, taking advantage of their position and they do not care about personal relationships breaking possible future collaborations among different departments. There is also a problem related to future team building: if a new project with similar characteristics is developed, it is difficult to re-build it because the external consultants could not be available, not benefiting, in this way, of economy of experience.

In the company there are two ways of using external consultants and external collaboration. The first one is simply outsource the project or the part of the project for which they would have the consultancy, and then they receive the finished product, without learning anything. The second way is to employ an external consultant who has the competence necessaries for that position and define the job. Teams are constantly encouraged to think about organic growth on a daily basis and are constantly encouraged to lookout for opportunities and to create inspirational visions. Managers periodically re- examine their capabilities, process, metrics, organizational structures, and deployment of resources.

Innovation portal is a tool with high potential knowledge sharing portal, but not fully exploited.

The follow table is a map, which shows the most important sources perceived by employees from which they capture and absorb useful knowledge.

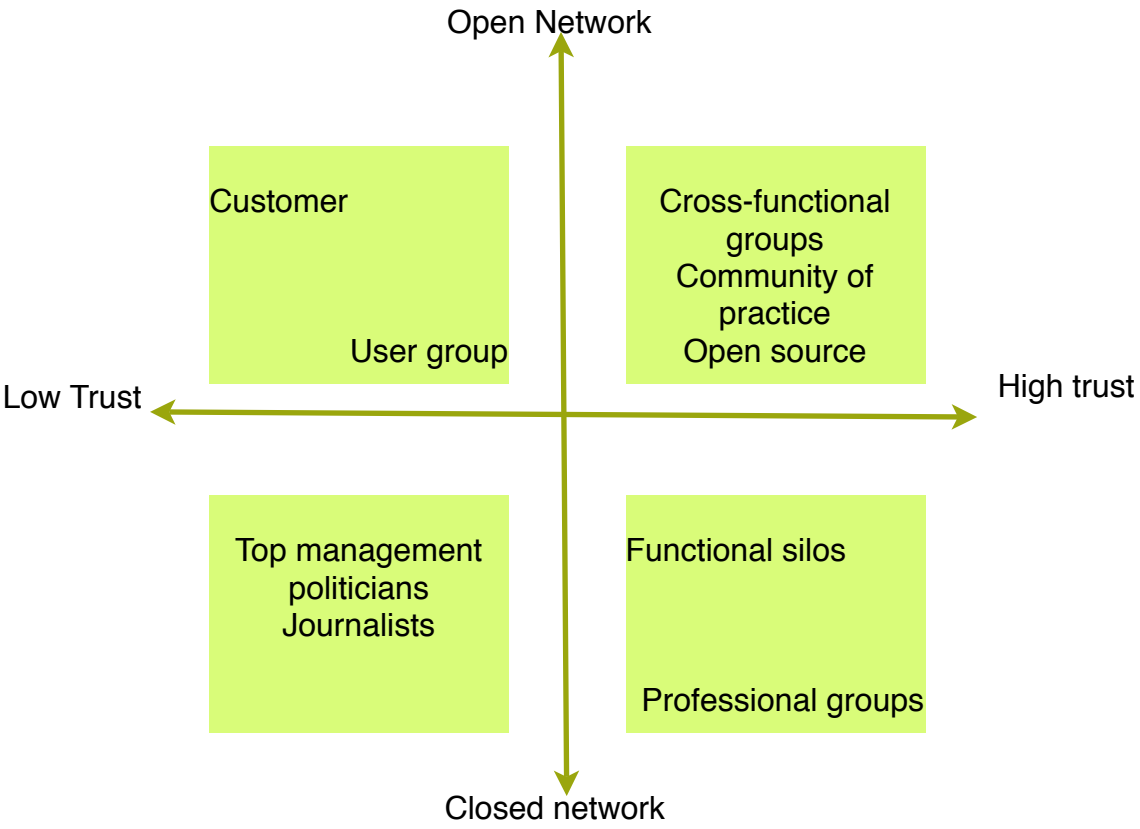


Figure: Sources of knowledge

5.1.11 Metrics For Evaluating Finished Projects

Device is not a product, but an instrument to support the sales of the drugs. The most important metrics are the complaint rate, and the cost of production and manufacturing. No specific metrics are provided for evaluating the innovation level of the device.

5.1.12 Business Model

The business model does not change. The department does not reconsider the value proposition, the value chain and value network to meet the other company's expectation. The business model has been always the same, compatible with the pharmaceutical industry, where product introduction is slow, highly regulated and with strong IPs protection: due to long life cycle, it needs to be highly protected. The innovation, in the medical device, is not about finding something completely new. It is auspicial in the drug area, but in the medical device area is fundamental

the way in which the technology is used and implemented. The aim is to make the medical device a standard adopted by the majority of people affected by diabetes. However, its attitude is always risk- adverse: once it realizes the product, it carefully studies what the others are doing before introducing it in the market.

5.1.11 Internet

The company is not clearly exploiting all the possibilities and potentialities of the web. It is focusing only on internal portals, that anyway are not well known by the employees in the company, and the the external web site are supported mainly by non profit organizations, so it is having only a passive role in them. It is not having and active role, and it is not using some of the potentialities the net is offering to increase the benefits from the implementation of the OI strategy. However, the use of the web is related to the desire to have a more open dialogue and interaction outside the company and the web can therefore be considered a part of the special applications that make innovation more open.

6.1 Discussion

This study examined which is the level of openness of the medical device department in Novo Nordisk. In March 2009, the strategy "open innovation" has been clearly settled, after the successful realization of the project in narrowcasting. For that project, the project manager recognized that the in-house engineers and designers were lacking of ideas and the gap in technology and competencies portfolio had to be filled. The department also recognized that, while the need to fill up strategic specific technology and expertise gaps persisted, it had to stretch the active search to seek innovation, deciding if using or not the promising concept coming from outside, how and who to involve. The participants agreed in advance in mutually defining the goals, avoiding in this way a free riding behavior, combining and absorbing complementary and idiosyncratic resources. The OI has been seen as a quick mean of accessing already existing knowledge and technology, without developing it in- house. The experiences related to the involvement of external partners have been nourishing some positive effects in the enterprise: from a technological point of view, the solutions provided are relevant and decisive in the development of a product or a component for which the department and the company did not have the necessary expertise. This turned out to be cost and time saving, because training the engineers and experimenting in house would have required many months and an enormous amount of resources. The involvement of external partners, was possible, according to the project managers, because both parties had mutual interest, trust, open communication, and both sides were aware of the opportunities, timing, people and skills they have. Due to the business model based on long product life cycle and deeply rooted in the management of IPs, the features of the collaboration are highly regulated. Knowledge about diabetes and medical devices is complex and the expertise is dispersed. Collaboration is seen as an effective way to network both tacit and explicit knowledge, to fill the missing pieces of knowledge, to be embedded in a community, and participating in seminars. It is possible to affirm that internal capability and external

collaborations have been complementary. It could be said that Novo is applying, for some projects, the "market for technology" (Arora et al, 2001) strategy, because it understands that it needs to acquire externally the competencies and resources that it does not have internally, making internal and external technology not mutually exclusive. But is not doing the reverse (except in one occasion when it licensed the pen to a pharmaceutical firm specialized in multiple sclerosis disease), lacking of a new competitive perspective in identifying potential licensees and potential markets. It has not considered the possibility to contact specialized intermediaries in the management of IPs able to export them to other industries, avoiding the cannibalization of revenues and the potential threats from competitors, increasing in this way the value created by smart management of patents, enlarging profit margins, expanding market shares because their medical device could become a standard in other pharmaceutical fields. Thus, since Novo recognizes and strongly protect the value of its IPs, it is clearly more in an intermediate position between closed and OI.

The project was developed independently, following its own route and the pathway was not reproduced in other projects, even if similarities exist. There are no general guidelines to be followed. This is because the company considered the search for ideas outside the company as the last attempt, if it was not possible to find a solution in house to complement the internal technological portfolio. Not opening too much fulfills the need to have the situation under control.

The characteristics of OI highlight the difficulty to implement this strategy in Novo. First, it is not sure it would change the policies concerning IPs and licensing. Second, the acquisition of external technology is used for marginal projects, and an OI approach is the external technology exploitation that involves the core business. Third, according to Chesbrough (2003), in an OI environment organizational boundaries are porous and firms strongly interact with their environment, involving multiple internal and external technologies and commercialization channels (Christensen et al. 2005; Laursen and Salter, 2006): it is evident that Novo is far from applying multiple sources, both internally and externally. It has systematically started

in 2008- 2009 to plan and develop many projects aimed to connect different actors, but the results are neither significant nor satisfactory. This implies that the medical device department is positioned in an intermediate position: the department is afraid to lose control of its ideas, but external and internal relationships are strongly desired, because the combination of these two relationships function as an enabler of inter-firm learning and permit to increase the competences.

The online environment offers the possibility to improve its position, to have stimulations and suggestions. In the communities, people with diabetes share experiences, in an easier way: it is a place where persons with similar problems can meet, share thoughts, and receive support and suggestions. They think to be better understood by who is living in the same conditions. It is an ecosystem where people create and nurture relationships on similar experiences and content, offering the opportunity to interact and engage with each others. Each network is characterized by a very peculiar context. Some of them, satisfy the need to create relationships and connect with some people, to look for and receive information, to entertain, and to re-shape or better define a personal identity. The contact with other people increases the sense of belonging and the sense of shared social identity.

6.2 CONCLUSIONS

The thesis aims at enhancing the managerial understanding of OI, providing an empirical analysis of this theory. My objective was to verify how OI is implemented in a company that affirms to use this strategy. I am aware that the results of the research are the outcomes of a single case study; therefore it is hard to affirm that the findings are generalizable to all firms producing medical device products, or pharmaceutical products.

Novo has a history of collaboration with external partners, but OI has become stated as strategy in the department in March 2009, after the positive experience with the project in narrowcasting. This project was a successful implementation of the OI strategy, with the involvement of a specialized intermediary that produced the required product. Academia collaboration is the network that has provided the major results and achievements, increasing the level of knowledge that allows the realization of many

innovative concepts and products, thanks to the access and retention of competences, information and IP. Being part of the network limits investments and decreases the risk, and also provides the possibility to test at low cost the concepts and features, providing an extensive data base for future researches. The department recognizes that the expertise group possesses knowledge lying outside of the device R&D competence's area. I perceived that the decision of using the OI strategy has been a reaction to Eli Lilly's launch, in 2007, of the first electronic pen, considered easier and more convenient to use.

Innovation has been driving the medical device area since 1985, when NovoPen was introduced. Organizationally, innovation has become, recently, a cross functional activity: the marketing department is involved in idea generation with the medical device department to develop a more systematic investigation of current and potential customers. Gallegher & West (2006) define OI as methodical encouragement and exploration of different internal and external sources of innovation, consciously integrating that exploration with firms' capabilities and resources, and proudly exploring opportunities through multiple channels. Considering this definition and the OI characteristics discussed in the literature review, the department is not implementing OI in all its aspects. It could be possible to affirm that it is applying the OI because it recognizes the possibility to search for ideas outside the department. The problem is to understand if this search is coherent with the theory of OI, because the simple statement does not imply its application: if it is not done correctly, it could be a simple outsourcing.

Chesbrough (2006) affirms: "in order to innovate effectively, you must innovate your business model, the way you create value, and capture a portion of that value yourself". The department director and the project managers interviewed assert that they do not intend to change the business model, considered winning and competitive. The changes of the business model imply a different management of IPs. OI means that "companies should make much greater use of external ideas and technologies in their own business, while letting their unused ideas be used by other companies"(Chesbrough, 2006), because innovation opportunities are widely distributed. These options have not been contemplated, since there has been only one attempt to out license a product internally developed and the patents related to the glucose monitor when Novo decided to dismiss this area. Another limit enlightened in the analysis is that the department does not consider the intermediate markets ("markets in which an upstream supplier licenses its know how and actual IP to downstream developers and producer" Chesbrough (2006)) as a source for

out licensing or selling to other industries. Novo considers intermediate markets extremely inefficient because information required is hard and very costly to obtain, the potential value difficult to predict and calculate, so innovations are left on the shelf. Another problem related to the use of intermediate market is the definition of span of time after which the ideas could be sold: the department is afraid to sell a patent that could turn out to be a winning idea in a decade. For these reasons it is not willing to create a secondary market for innovation.

The way in which the department is managing IP is still in a close innovation perspective: it is still pursuing extensive internal programs of research and development to create new medical devices. When a new promising idea is identified, one or more patents are deposited. A selected number of these ideas would be chosen to pass milestone A and only few (25% of all ideas) reach the market. The other ideas are left on the shelf. This is clearly a closed IP management: "There is only one way to access the IP (from within your own firm) and only one way to deploy it (through your own firm) and only one way to exploit it (through your own products selling to the market). In this model the majority of IP never gets used" (Chesbrough, 2006). The internal way of management of IP is defensive, ensuring the possibility to use the technology in this area without the risk of having litigations, not considering the IP as an asset to be exploited nor a candidate for acquisition from outside. Novo is not connecting the management of IP to its underlying technology life cycle: it is using the same level of protection for products in the market, products that have not being produced yet, and products that are declining or already dismissed from the production. Recognizing the high costs of internal development of technologies that could be available externally, it looks in other Novo's departments, and eventually outside the company, to save time and money in the development process. This recalls another principle stated by Chesbrough (2006): "In a more distributed environment, where organizations of every size have potentially valuable technologies, firms should do well to make extensive use of external technologies", and a way to make it happens is the use of IP intermediaries that can help to allocate IPs through purchase or sale. OI also requires the construction and the support of a rich internal innovation network, connected to a diverse external innovation community. This is not done, probably because the department is suffering from the not- invented- here syndrome, inducing internal employees to refuse ideas developed outside their own department. It is an expectable syndrome because large and successful firms develop even a greater inertia.

Considering external partners, the customers are not used as a source of ideas and suppliers are seen as companies to take as additional functions to develop what Novo is not able to develop internally, paying a lot of attention to avoid the possibility that the supplier would benefit competitors. In relation to the external network, Novo is particularly active and embedded in the cultivation of ongoing relationships with academia, not profit organizations, and firms participating in the networks, considered a fruitful source of external possibilities. Through knowledge sharing, it would have possible to exchange information, and allow the company to come out with new products. The department succeeded in applying a model of narrowcasting involving an external actor, but did not succeed in the broadcasting model because it was afraid that the intermediaries, which were collaborating with its main competitors on similar projects, could disclose important information or propose similar solutions. The main constraints in the application of an OI strategy in Novo are the general mind-set to consider the external sources of innovation as a factor to utilize, and the refusal to change in the use and management of IP. Moreover, it wants to use OI only as a tool to increase the medical device pipelines, omitting all the other facets: OI affirms that firms would achieve a greater return on their investment if they are willing to loose control over IP (Chesbrough 2003, 2006), and they require a broad range of knowledge sources, for firms' innovation activities (including customers, rivals, academics, firms, unrelated industries) and exploit the internal IP.

There are many reasons that bring forth the choice of using an OI strategy. Firms would like to focus on core activities and look outside for what they are not able to realize internally. It is a stimulus to improve the product development, integrating with technologies, bringing expertise in the firms that could enhance the internal knowledge and counterbalancing the lack of skills. OI also ensures the optimal use of talents, qualities, ideas of current employees, obtaining a double effect: enhancing the innovation rate and the motivation and commitment of people asked to contribute actively. Opening to external partners increase the diversity and enhance the successful rate of problem solving, but it is important to decide consistent governance rules: OI is not self-organizing. Every platform has to be carefully structured to protect IP and specifying decision rights in advance; it needs clear rules and transparent organization for setting goals and resolving conflicts among members. Leadership must maintain a cohesive view to minimize the risk of refusing the project supported by a community. This could enable firms to buy and sell IPs to fill their gaps and support the use of external technologies within the firm's business.

The department is not either looking at what is happening in the web, it is not aware of the potentialities of the online communities, which are proving social support, both not for profit independent associations or based on competitors programs' websites.

The Social support consists of a whole range of ways in which people can tacitly or explicitly help one another to improve the quality of their lives, and is found to be beneficial for reducing stress, and feelings of solitude and isolation. Online social support groups can take many forms, ranging from a list of email addresses used to send messages to all members on the list, to electronic newsletters that contains information about specific topic and to web-based discussion forums. In these usenet or web- based discussion forums, members can post and comment public messages. So, the discussions have the form of threads that consist of reactions to previous postings, and members are free to start a new thread whenever they feel the need to do so. One of the advantages of the forums is that they offer the possibility to search through the list for a specific topic of interest. On these forums, active participation is not required and people can visit the forums without contributing to the discussion. There are different kinds of web forums: the ones not moderated at all, the ones with administrators monitoring and acting when inappropriate or irrelevant messages are posted. The forums are considered easy and accessible places where people give and receive support and help (instrumental, informational or emotional, Sundar, 2007) and where people can interact and share experiences or look for information. Social support is elucidated as "communication between recipients and providers that reduces uncertainty about the situation, the self, the other or the relationship and function to enhance a perception of personal control in one's life experience"(Sundar, 2007). Thus, "it can help people to manage and cope with uncertainty and thereby contribute to the well-being of (group of) individuals" (Sundar, 2007). Informational support concerns "the exchange of practical information such as tips on new types of mediation, relevant addresses of institutes, knowledge about medical or psychological treatments, legal issues, but also stories of first hand or second hand experience by members". The primary scope of this support is to expand one's knowledge base (Reeves 2000), providing people with more control over the situation and reducing uncertainty about the self. Emotional support is about confiding emotions, thoughts and looking for

compassion, commitment, empathic understanding, and responding to these feelings in an appropriate manner is what makes emotional support possible (Levenson and Ruef 1992). This support is characterized by the confrontation and encouragement of interactions that can enhance the self-esteem of the persons, especially in situations of chronicle diseases, where people are conscious of their situation and they feel they cannot change it, especially when they are disclosing personal information linked to traumatic experience. Researches has demonstrated that social support can decrease the stress, depression, increase self esteem, internal control, and contribute to help people to cope with the peculiar situation. This could increase the sense of stability in one's life: it is not said that the social support can have a direct effect on the well being of the person, but it can contribute to reduce the stress. The weak ties are an advantage in these cases: the extended network can provide more support and wider information. Indeed, according to Granovetter (1973), weak tie relationships can increase the variety of the community and, thus, open new sources of knowledge and information. The weak ties should allow people to gain support without the embarrassment of the need to explain their condition to people they might know. Sharing the feelings with a low risk perceived, may help the patient to feel better. The low risk perception and the benefits of sharing on line is also fundamental in the innovation sharing communities, and it could be an explanation why innovative users are likely to share. Since users and bloggers in this settings are not in competition with other users and do not have anything to lose by sharing and free revealing if innovation are commonplace. Sharing of innovation is a key condition for firm-hosted user communities to succeed. If users were professional, they would not have the same propensity to reveal and share, because secrecy would often be a pre-condition for reaping the benefits of innovation. The users in these communities are active part to share experiences, emotions, meet other persons, get connected, and find solutions to common problems. This is the main reason users are joining the communities hosted by a specific firm. They could contribute to idea development in many roles: problem- finding, idea conceptualizing, co-development, supplying and testing. These activities complements the firm's product development platform and thus create additional value for the firms. Firms can benefit from monitoring the online communities for different reasons:

obtaining sticky information about immediate needs of users, gaining quickly and low cost access to information related to test the products and feedbacks about it, encapsulate product innovations, improvements in the product development process.

From the analysis of the literature review, and the empirical analysis, it is possible to affirm that OI is a theory that requires changing the mind set, the business approach and the way to look at the external environment. The analysis of the projects in Novo reveals that it could not be applied suddenly, without any preparation and top managerial support. First, it is necessary to train the R&D to have a not problematic transition; this is a challenging task especially for very specialized R&D staff. To avoid losses in R&D efficiency, a very strong effort to enhance the level of human resources through recruiting, incentives and reward is required. Moreover, there is the possibility to incur in higher coordination and transaction, administrative, legal and bureaucratic costs (due to inexperience) than if all the activities were internalized. Sometimes the overall benefits of OI get lost in the management overhead and when similar problems arise, management prefers to retreat. To avoid this solution, firms need templates and discipline, or even an "innomediation" partner (Verona and Prandelli, 2002) able to advice them in the initial phases. Frequently firms approach OI without any mechanism apt to define success in advance, criteria for testing it, nor guidelines for avoiding unnecessary duplication and repetition of activities. The organizational culture is a barrier to overcome: it is important to balance work inside and outside the company, to solve communication problems due to the diversity of actors because of their different fields, industries and jobs, and to align different partners. Attitude toward property rights and ownership of developed innovations has to be clearly defined and modified to exploit all the potentialities of OI. But in large and successful firms, with a culture of strong protection, it seems a task very difficult to be achieved without and appropriate training of the internal staffs as solution finders and not only as problem solvers.

Furthermore, there is the risk that companies claim to apply the OI theory but instead they are working on just an alternative sourcing with the same old costs, inefficiencies and narrow- minded approach. Other problems arise when partners do not meet the expectations and the deadlines, concepts are not well structured, customer requirements are misjudged, employees lack of labor flexibility necessary to reach the goals of the

projects, they resist to changes, or they are not committed to the projects because they perceive that the top management does not support what they are doing or consider that a very marginal activity. Considering the involvement of external partners, firms should develop policies and motivating factors (both monetary and not monetary) able to provide the right incentives to attract participants. It should be important to evidence the learning possibility, the opportunity to be recognized of their work from their peer community and the chance to interact on topics not naturally in their daily field of operation but for which they have interest and sometime very pertinent view. A great limit is that firms affirm they have achieved diversity using OI, because they use novel ideas coming from outside and from new actors, but there is the possibility they have found new partners with the old filters of qualification: in this way the external partner becomes an extension of the firm and it is not more different than doing the work internally, because it will likely yield the same results. Another problem is risk sharing. In order to reduce corporate risk through OI, new business models and new approaches to partnering are required. To remove the cost of failure, firms have to understand the asymmetry of risk. This demands the appreciation and the management of non-cash utilities.

In the chapter related to the Internet, the potentialities for innovation through the web are explained. On the web, it is possible to distinguish mainly two typologies of actors: on one hand, the innomediaries and the VKB, which are hired by firms, and social networks and online communities on the other one, which are independent but could contribute to the innovative process. The Internet is a flexible tool for collaborative meaning and content creation, for the identification, exchange and comment of information. There is a shift in the focus of problem solving: from individual, it becomes collaborative, by building distributed knowledge, enabling participants learning, providing structures for learning, transforming organizations into learning communities. It provides also new ways for communicating and sharing ideas and experiences. The persons using the personalized institutional websites or social networks feel empowered, autonomous and they have the feeling they are learning just-in-time, lowering the formal barriers. Novo is missing these opportunities that have, instead, been developing by some of its direct competitors.

The major limitations of my research are that the findings presented are the result of a single case study and they are intuitive and could be subjected to quantitative validations.

Chesbrough (2006) in his book states: "Companies that don't innovate die. This is

not new. In the current environment, however, to innovate effectively, you increasingly must innovate openly". However, based on the results of this research, I argue that both managers and researchers have to consider carefully the limits to OI. For this reason, it is necessary to do further investigation on this topic, before making strong managerial advice.

7. Managerial implications and further researches

The OI theory is described as a new winning formula: it is not essential anymore to hire the best and the brightest persons in the industry to discover the best and greatest number of ideas to get to the market first, but to access as soon as possible what it is new, either from inside the company's own research laboratory or from the knowledge created in someone else laboratory (Chesbrough, 2006).

From a managerial perspective, it could be interesting to explore how Novo could create a flexible IP management, since it is its major constraint to overcome. One suggestion, could be taken from the Creative Commons. In 2002, in the artistic and computer environment, it has been developeing a new form of management and protection of the IP: the Creative Commons licenses. This is a more flexible copyright model, which replaced the "all right reserved" with "some rights reserved". Creative Commons could be considered a successful innovation because they provide institutional, practical and legal support for individuals who wish to experiment and communicate with culture more freely. For further researches there is the need to develop studies in many more departments, industries and firms of different sizes, measuring firms' openness, create a performance measurement system able to indicate the effectiveness, and the level of inter- firm learning, because the mere financial metrics are not a good measure of performance in an innovative environment. A good starting point should be to make an internal analysis and review of the firm's competences and intangible assets, especially the patents left not utilized. Further researches could investigate if it is possible to apply in the medical device industry such flexible way of managing the IPs, trying to understand how it is possible to take advantage from the management of some rights on the device and grant to other firms, to fully exploit the potentialities of the innovation.

Furthermore, the management of Novo should question which is the optimal number of collaborative ties it could develop, balancing the locus of innovation process with the extent of collaboration. Considering this last managerial issue, a further research could be addressed at understanding how actually the process of innovation takes place and how the Internet could take a steady place in the

interactions between firms and environment. In this scenario, the hierarchical model of coordination is no longer sufficient. It should rather applied a coordination mechanism. The Open Source movement (Henkel, 2006), and the community of users (Sawhney and Prandelli, 2000), are examples of this kind of mechanism. If the locus of innovation is external, there is a need for coordination, which should be better specified in the processes, barriers, capabilities, teamwork, and in the role of leadership (especially because the relationships and interactions will be more virtual than physical, optimizing trust, motivation and performance). The leaders should, hence, define a new teamwork approach, specifying what are the most important capabilities that should be present in an OI approach comparing to the closed one. Thus, there is the necessity to develop a further research in understanding ho companies can work practically to develop their capabilities.

Novo should also recognize the existence of self-organized patients communities, and include them in the development of its communication program. It should consider these platforms as a means for patients to outreach the companies, allowing the engagement in patients' needs to achieve a level of innovation through patients involvement and feedbacks in product development. Novo should meet the following objectives:

- Enhance stakeholder dialogue
- Facilitate knowledge sharing: knowledge within NN should become social, allowing continuos feedbacks on processes, opening discussions and different interpretations
- Improve collaboration: adopting social media will make it easier for Novo employees to develop and drive projects across the main disciplines, boarders, distances, cultures, hierarchies, and department
- Spur innovation and continuos improvement: by creating an online space for sharing and validating ideas, both internally among employees and externally with stakeholders, the company could gain valuable ideas and insights to increase innovation, product development and stakeholder relations.

Appendix 1: What Is Diabetes

Diabetes is actually two fundamentally different diseases that share a similar set of symptoms: type 1 patients produce no insulin, the hormone necessary for cells to utilise glucose, while type 2 patients cannot efficiently use the insulin their bodies produce. Type I, also known as juvenile diabetes, usually begins during childhood or puberty. Type 2, known as adult-onset diabetes, manifests later in life (usually after the age of 40) and usually is associated with- and possible caused by- obesity. Digestive processes convert most food into glucose (a simple sugar) and then pass that glucose into the blood as the body's main source of energy. Body cells are able to burn or metabolize glucose, however, only when there is insulin present, acting as a sort of catalyst for burning the glucose. Because they either cannot produce insulin in the pancreas (type1) or use the insulin they produce (type2), those with diabetes can have high concentrations of unmetabolised glucose in their bloodstream.

Patients need to inject the precise amount of insulin required to metabolize the glucose produced by the digestive system. if they inject too little, the resultant high blood sugar levels cause a slow deterioration of the body, particularly the eyes and kidneys. Low blood sugar levels caused by a blood overdose of insulin can rapidly precipitate unconsciousness and, potentially, death.

Many type 2 patients can treat their conditions with oral medications that either causes their pancreas to produce more insulin or enhance the sensitivity of their body tissues to the insulin they naturally produce. Some type II and type I. however, must take daily injections of insulin to survive. Insulin cannot be taken orally because it is a protein and would be broken down by the digestive system.

All type 1 patients can treat conditions with oral medications that either causes their pancreases to produce more insulin or enhance sensitivity of their body tissues to the insulin their aren't symptomatic. The illness remains undiagnosed until it is discovered during a routine physical exam or in the course of the treatment for some other diseases.

Appendix 2: Questions

Questions

1. Could you describe your project?
2. Why do you consider it a project developed in open innovation?
3. Which were you sources to integrate knowledge?
4. Which were the major barriers? And the challenges?
5. Have you been for licensing the technology? If you would be contacted, what would you reply?
6. Who is managing the IP in the project?
7. Is it a breakthrough product in your market?
8. Which is the market segment?
9. Which is the cost structure?
10. Which was the approach for knowledge? In/out? Out/in?
11. Which was the vision to sustain the project?
12. Which is the mission (objectives, scopes that you wanted to achieve)
13. Which were the opportunities you were looking for?
14. Could you define the scope of Open Innovation?
15. Which are the market models that you wish to pursuit?
16. Do you have established a model from a legal point of view?
17. Are you increasing the competences for in house competences?
18. Do you think the culture inside should be changed in order to have a open innovation strategy?

Appendix 3: Milestones

The usual time and milestones cycle is:

1. Strategic planning process (SPP)
    a. (boards/committees meetings): January, February, March, April
    b. portfolio review: May
    c. project review: June
    d. local resource allocation: July, August
2. Anchor budget: September, October, November, December
3. Product business plan (PBP)

    a. clinical development plan (CDP) and considerations
    b. regulatory affairs (RA) plan considerations
4. First milestone
5. Product business plan update
    a. CDV outline
    b. RA outline
6. Second milestone
7. PBP update
    a. CDP exploratory
    b. RA plan exploratory
8. Third milestone
9. PBP update
    a. CDP confirmatory
    b. RA plan confirmatory
10. Forth milestone
11. PBP update after M4

Appendix 4: Products realized in the device department.

NovoPen

In the 1980s, Novo management, after having achieved the highly purified mono component insulin, believed that insulin development could be accomplished no further, so, in order to have a leading position within the diabetes treatment, it should turn its attention to the everyday life of diabetics. Fryland, one of the marketing directors, contacted a project manager to propose his idea: making a device that looked like a fountain pen, easy to use, holding a week's supply of insulin and able to administer units of insulin at the touch of the button. Fryland had taken inspiration from an article describing an English girl with diabetes who each morning filled a disposable syringe with enough insulin to last the day, allowing her to administer the dose without refilling it during the day. She asked an English company to develop a

dosing tool that could contain the filled syringe and deliver the pre-measured doses. She had always felt that it was indiscreet to administer these doses of insulin from a vial disposable syringe. So, the company designers started to develop the idea based on her intuition.

Novo Concept

The first project signing the path toward Open innovation is Novo Concept project. In 1996, Mayo Clinic and Novo Nordisk entered in a strategic alliance within the field of evidence-based medicine with a focus on diabetes. The Mayo Clinic of the United States is one of the most reputable and innovative clinics in the world.

The partnership was aimed to improve the management of diabetes and give easier access to best practice management guidelines. The cornerstone of the partnership was clinical projects with focus on the jointly developed Diabetes Electronic Management System (DEMS) and clinical outcomes studies. The DEMS would help to establish of a continued medical education and training program of health care professionals in the diagnosis and treatment of diabetes.

To make a real difference to the patients' life both actors have to look beyond the products to optimize efforts in all areas of the healthcare system, with the objective of jointly developing tools to better organize and monitor the health care delivered. The partnerships with the Mayo Clinic, the Steno Diabetes Center and other prominent institutions allow for comparisons of health outcomes and treatment strategies/ intensities.

The project captured data to have a better understanding of people and their relationships with doctors. In order to achieve this goal, Novo Nordisk shifted the perspective usually used in the projects. The company focused on something that could be important for doctors rather than for the company. The positive feeling associated with this focus would have permitted Novo Nordisk to be remembered as a good partner, generating business in a long term perspective and indirectly. From an economic perspective, Novo Nordisk is interested in developing a system to help people in managing diabetes, because it could increase sales.

NovoNet is the tool that has been developed to capture and analyse data. Novo Nordisk generated a report and benchmarked each clinic. In the data insertion process, the clinics remained anonymous (except for Novo Nordisk). At the end, each company received a personalized report and an indication of how it was positioned

considering the other clinics, stimulating a critical analysis considering the results in comparison to the overall situation of other clinics. The strategy to open to the external was decided when Novo realized not to have the necessary competences in patient management to build the database. Thus, Novo directly involved the doctors of Mayo Clinic and WHO (World Healthcare Organization) to understand which the necessities were. Every organization involved in the project recognized that Information technology was the way of the future. The clinics decided to take part in the project because they need data and to learn how to manage information. The standard used was the Diabcare's standard. Novo Nordisk had created a win-win situation. The presence of Mayo brand guaranteed the correctness and unbiased data. Novo, by building the database, presenting and installing it for free in different clinics and hospitals, hoped to be recognized as a preferred partner to gain entrance and expand its market. Novo had a great return on image. Indeed, the network opened the doors to the company's sale traders, so they could talk about the system and then promote its insulin and medical devices. The doctors had a positive return because they learned how to manage data. They were also allowed to publish data in magazines, increasing their reputation and influence in the scientific world. WHO wanted to improve care and, showing positive achievements, obtain the budget for the following year. Mayo clinic decided to share knowledge because it wanted for free the best system to manage the diabetes patients and it wanted to be recognized by the scientific community: in the system there is its brand.

These non-profit projects are recognized by stakeholders as a good example of a socially responsible company contributing to organize and develop health strategies and systems. These practices helped the company to be closer to the different actors, creating a presence and positioning itself in health care structures, providing many inputs for supporting healthcare professionals. This was also a good way for learning about new approaches to care, and it well represent a significant 'hidden R&D' investment, in a long term perspective.

NovoLet

NovoLet is an interesting project that directly involved designers in the product realization since the earlier stages of the process, without considering this involvement as simple outsourcing. NovoLet is a disposable pen where the insulin cartridge is part of the pen and cannot be removed. Novo Nordisk approached in a totally new way

design. It asked the designer Steve Mc Guggan in 1989 for a device with a simple mechanism in order to be very cost- effective to produce. The utilized approach was different because Novo did not require to create, as it usually did, a packaging around something the engineers had already constructed, but asked to design an entirely new product. Novo Nordisk wanted something useful and with some design included. After the unexpected success of the first pen, the whole company's culture evolved around good design for employees and users. According to Rasmus Højring, Corporate project vice president, design for the devices has always been a strategic tool at Novo Nordisk. First of all, it is used to distance the company from the competitors, developing material products whose starting point is the user's need. Design is what makes a decisive difference compared to competitors; it's a business advantage to be ahead providing superior service and products. The patients and users get a better and higher quality product. It has to look good, function well and give people a sense of quality, so users have faith in the product. It has to make the employees proud of making a good product. The Novo's insulin pen is one of the most used insulin pens in the world. The turnover has increased by 70% because of design. The packaging gives a greater value, offering people a better solution to their problem. The designer has to consider he is dealing with a product that is going to save people's lives and if it is a bad product, it can also cause death. The concept of medical device changed: it has to be reliable, functional and easy to use.

The overall project lasted for 3 years. NovoLet looks extremely small and injection can be done by pressing the sides in at the top. The two flat surfaces of the cap, once turned, are used to dial in the number of doses the user needs.

Innovo

The alliance between Novo Noridisk and LifeScan was aimed to develop and market a new family of devices that were expected to improve daily diabetes management for many insulin users. By jointly marketing the two companies, both could benefit from each other's strengths in providing people with diabetes and health professionals with simple and accessible solutions to their diabetes management needs. As a result of this agreement, people could link the use of therapeutics and glucose monitors, educational material, therapeutic guidelines, and compliance programs.

Novo Nordisk and LifeScan recognized that total diabetes management was extremely important in order to reduce the high costs for people with diabetes,

providers and payers, and to maintain a strong competitive position. The aim of this alliance was to develop an application of optimal treatment guidelines, which included the availability and correct use of drugs and blood glucose monitoring systems, quality of care will increase and costs decrease.

An integrated approach in diabetes care with insulin and self-monitoring of blood glucose (SMBG) was important to the successful outcome of diabetes management. Research published in recent years has shown that the debilitating effects of diabetes can be reduced by as much as 60% through compliance with intensive insulin therapy and self-monitoring of blood glucose.

One of the products realized in collaboration with LifeScan is "Innovo". This medical device, once in the market, achieved great attention from the end users, but both Novo and LifeScan decided to dismiss the production for business reasons (high costs of realization).

Innovo is short and compact, making easy to carry in the user's pocket, and ideal for quick and discreet injections. It is an insulin pen and glucose meter with a display, which is quite large and clear, easy to read the dose of insulin dialed and delivered. The glucose monitoring provides the added value, because it is able to check blood glucose testing in a fast, easy and less painful way. Both companies agreed to try to realize this product because their core business was not involved. In Novo Nordisk the main business is the insulin and in LifeScan the production of strips. The innovation involved the creation of a new business model for the realization of Innovo. It was the first time that Novo Nordisk faced the possibility to realize jointly with another company a new medical device. It was necessary, thus, to redefine the markets, the sales, and users. For the realization of this product, the two companies worked together, each of them bringing their own expertise and experiences. The combined team became a sort of separate company, working in a protected environment, with an independent budget. Combining the different mind-sets was extremely difficult. Novo has a low risk approach to the product development: it takes a long time, usually five years, to make a new pen, because the medical device market is product driven. The business model of LifeScan is coherent with a consumer market: usually, the company comes out with many new incremental products every year, and a breakthrough product every three years. So, it was a challenge to manage these different approaches to time to market and product definition. The project manager affirms that the

experiment was successful, because there was a high level of trust inside both companies, which allowed the creation of a cooperative environment with joint IP rights and ownership.

Integrated Glucose Monitoring: Novotrack And PDA

This project aimed at realizing a sort of PDA to allow patients to upload information about glucose through the glucose meter and writing manually, in the PDA, a sort of diary with their health's status, eating diet, exercise, and other comments. This project has been developed (but not launched in the market) in collaboration with Microsoft and Mayo Clinic. This could be considered a collaborative innovation project because companies agreed to put in the project their experiences and competences to develop the product on a common basis. Novo perceived the necessity to create a system able to monitor blood and glucose. Mayo wanted to have a good system to collect data and Microsoft recognized the potentiality of the healthcare business for a software developer and of the Internet. For this reason, it agreed to give the software for free. One of the complementary tools for the device is the interactive website NovoTrack for patients and diabetes educators that is still operating. After the registration at the NovoTrack site, users answer few questions to receive a personalized educational course. The website also provides tools to assist patients and their health provider for managing the disorder, including blood glucose targets as well as cholesterol, weight, and blood pressure monitoring aids. Through a personal scorecard, participants can keep track of lab and blood glucose test results, physical examination findings and doctor appointments. The goal with NovoTrack is to help people with diabetes to understand the importance of managing the condition and to help them achieve their treatment goals. The Education area contains information on nutrition, exercise, complications, medication and other topics regarding diabetes and living with it. Newsletters feature the latest news from Novo Nordisk. Topics discussed include medic aid and diabetes, recipes, reports on new types of treatments and much more. For Tools, the user can use the Blood Glucose Diary to keep track of blood glucose levels and identify any trends that may indicate a need for change in diabetes care regimen. He/she may configure the target blood glucose levels for mealtimes, two hours after meals and at bedtime. The tools section contains many other features, one of which is the Menu Planner. It helps to plan personalized seven-day menus. It also gives the information to substitute one food for another while still meeting calorie and

carbohydrate goals. Another feature in the Tools area is MediReminder, which helps users to follow the prescribed treatment plan by reminding them when it is time to refill the medication. Based on information that end user supplies, it sends an e-mail reminder when it is time to refill one or all of the medications. The users control the reminder frequency and customize the medication information.

The aim is to give patients insight to help them to make decisions. NovoTrack lets patients keep a record of diabetes goals, A1C tests, kidney tests, cholesterol, weight, foot, eye health and more. The software and all the applications are given to patients for free after registration to use the personalized features of NovoTrack and the Blood Glucose Diary.

Also doctors have a manifested interest in having such a tool able to record data in order to take a decision about the therapy. They need to understand why the glucose is not as good as it could be. Without these data, they are only guessing. Data also allow passing over a problem linked to the reliability of patients, because they frequently tend to not tell the truth about their behavior because they are afraid of the doctors' judgment. From Novo's perspective, this project helps to increase knowledge of diabetes and glucose. The website is still working, but medical devices have never been produced.

Many actors could have taken advantage from this product. Novo could have tracked to have information about the patients' habits to develop better products, doctors could have created an ad hoc therapy according to the hard data recorded. It failed to be realized because the glucose meter was not able to upload data in the PDA, and lacking these data the PDA lost its main goal: end users would not write data manually about the glucose level.

InnoLet

Considering the early supplier involvement, InnoLet coupling ring is the result of this type of collaboration. Novo Nordisk had problems is realizing the internal ring. After having unsuccessfully tried, Novo opted to involve actively a supplier. The involved supplier is Ticona, an international manufacturer of engineering polymers, working in the industry of technological sectors, such as automotive, electrical, electronics, communication technology, industrial applications, machine and plant construction and appliances. InnoLet is a unique dozer specifically developed for people with diabetes who face difficulties in insulin injection due to poor eyesight and

reduced manual dexterity (usually due to different joint related conditions). Innolet, with its large, easily readable dial and ergonomic design helps people to manage insulin self-injection. It is prefilled with 300 units of insulin and it is disposable, it is still the only dozer of its kind available. Novo was looking for a multifunctional component with special requirements.

Ticona's application development team chose the material for the heart of the insulin pen. A grade of Hostaform (a special material) was selected because it is highly rigid (without glass fiber reinforcement) and precise, not weak under stress and has good thermal stability. It is also biocompatible, exhibits high purity, and has consistent product characteristics. The piston rods were extensively tested in the course of development especially for fracture resistance and resistance to insulin. This helped Novo Nordisk to meet the requirements: the component should make the pen easy to be used by older patients with limited vision and reduced dexterity, precise and reliable. The design used a large display with clearly visible figures so the dose could be easily set. The dose is administered via a large, brightly colored push button.

Oxford Project

OHA is an independent venture with Novo Nordisk as a major founding member whose aim is to deal with chronic diseases differently and in a holistic way. The Oxford project was aimed to ameliorate the level of knowledge about chronic and difficult to communicate diseases with the creation of a campaign for the prevention of unhealthy behaviors (poor diet, poor physical activity and high tobacco consumptions). The Oxford Health Alliance, which is an open network, with agreed sharing of IPs, and disclosure agreement of different competencies and knowledge, enables experts and activists from different backgrounds to collaborate to raise awareness and change behaviors, policies and perspectives at every level of society. Alliance members from all around the world include leading academics, activists and corporate executives, patients' rights advocates, doctors, nurses and others, all of whom share a sense of urgency about the worldwide epidemic of chronic disease. Founding participants included:

- 8 treasury and public health departments from the United States, China, Canada, South Africa, Brazil and the United Kingdom;

• 16 corporations from the pharmaceutical, health care, food and media industries;
• 16 world leading universities focusing on medicine and public health as well as economics, geography and development; and
• 12 leading non-governmental and inter-governmental organizations

The first goal of this network is to raise awareness among influencers and educate on critical decision-makers so that the pressing case for preventative measures can advance. A broad range of participants took part in the first Oxford Vision 2020 summit in December 2003.

Different projects have been developed. The first one is the economic argument for prevention. The goal for this work stream is to deliver a decisive economic case for prevention to present to international and national health care funders and others.

Work in partnership with businesses and other organizations to identify, encourage and disseminate effective and innovative ways to promote chronic disease prevention, that's challenging the business model where the pharmaceuticals industry is deriving its revenues. Novo strongly believes also that prevention can create business opportunities. Considering the amount and the quality of participants, all the companies have an interest in being part of the network, at least for the knowledge acquisition. In this perspective, the concept of emergence becomes central: innovation is going to be the product of a process of co-evolution. Novo decided to be part of the network to look for also the small pieces of innovation coming out, that could contribute in making a bigger innovation.

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