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THE AMBIDEXTROUS APPROACH TO THE
OPEN INNOVATION MANAGEMENT:
EMPIRICAL ANALYSIS OF FOUR
ITALIAN INNOVATING FIRMS

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ABSTRACT AND INTRODUCTION

ABSTRACT

This dissertation examines the organizational choices underlying the management of the innovation process. The traditional approach to Research and Development has been mostly inwardly focused. Firms performed all the activities of such process within their borders in order to gain all the benefits. This paradigm is usually referred to as Closed Innovation.

In the last years, radical changes in the knowledge landscape made information much more accessible, causing the traditional approach to be outdated. For this reason, a new paradigm is born which considers Innovation an open process that leverages the opportunities offered by the external knowledge environment. This paradigm is called Open Innovation.

In real applications firms actually perform both Open and Closed research activities and it is necessary to correctly manage the whole process in order to face the contrasting features of both approaches. The purpose of this dissertation is to analyze the theory of Organizational Ambidexterity, which explains how a firm can successfully manage Radical and Incremental innovation processes, in order to provide a framework for a new paradigm called Open-Ambidexterity. This paradigm explains how a company can perform both Open and Closed Innovation. The theoretical analysis is supported by an empirical survey on four Italian innovating firms.

ESTRATTO IN LINGUA ITALIANA

Il processo innovativo è un'attività fondamentale per la sopravvivenza e il successo della maggior parte delle imprese moderne. *Innovazione* è lo sviluppo di una nuova idea in grado di portare miglioramenti nei prodotti e servizi erogati, oppure nelle modalità con cui questi vengono realizzati. Una corretta gestione del processo di Ricerca e Sviluppo consente da un lato di ridurre i costi operativi, grazie a processi più efficienti; dall'altro di incrementare le entrate, grazie al possesso di prodotti e servizi con caratteristiche superiori a quelli dei concorrenti. Pertanto, specialmente in un contesto di grande evoluzione tecnologica, innovare diventa una necessità improrogabile, pena il fallimento dell'impresa.

Occorre tuttavia evidenziare come il processo innovativo, sebbene necessario, sia un'attività estremamente rischiosa, a causa della quantità elevata di risorse coinvolte e della sostanziale incertezza sul risultato finale. Questo aspetto rende fondamentale una corretta gestione, mirata al perseguimento degli obiettivi congiuntamente al contenimento dei rischi.

L'approccio tradizionale utilizzato dalle imprese per la maggior parte del ventesimo secolo si è basato sulla concezione di un processo innovativo completamente interno all'impresa. La ragione di questa scelta è la volontà di appropriarsi di tutti i benefici derivanti dalle nuove tecnologie e soluzioni realizzate, minimizzando la diffusione esterna di conoscenza. Coerentemente con questa concezione, la soluzione organizzativa tipicamente adottata consisteva in un dipartimento interno di Ricerca e Sviluppo fortemente verticalizzato e in grado di eseguire tutte le attività, dalla ricerca di base allo sviluppo prodotti. A causa di questo approccio chiuso all'ambiente esterno, il paradigma innovativo che ne consegue viene definito *Closed Innovation*.

Tale soluzione privilegiava fortemente le imprese di maggiori dimensioni che, potendo disporre di un maggior numero di risorse, erano in grado di ottenere risultati migliori in tempo inferiore. Questo meccanismo innescava un circolo vizioso, infatti le imprese più abili nel processo innovativo potevano incrementare il proprio vantaggio competitivo ed utilizzare i guadagni per potenziare ulteriormente il proprio dipartimento di ricerca. Si è pertanto potuto assistere alla nascita di grandi centri di ricerca come i *Bell Laboratories*.

A partire dalla fine della seconda Guerra Mondiale si è verificato un radicale cambiamento nel panorama innovativo mondiale che ha comportato la crisi del paradigma innovativo tradizionale. Il boom economico e il miglioramento delle condizioni di vita hanno incrementato il livello di istruzione e con esso la disponibilità di personale altamente specializzato. Inoltre l'accresciuta mobilità dei lavoratori ha messo in crisi i tentativi di evitare la diffusione esterna della conoscenza, infatti i ricercatori portavano con sé le competenze e le conoscenze acquisite nei precedenti impieghi. Contemporaneamente il velocizzarsi del progresso tecnologico ha facilitato lo scambio di informazioni e l'elevata specializzazione di ciascun campo di ricerca ha reso impraticabile una logica di completa verticalizzazione. Infine si è assistito all'ingresso di nuovi attori nel panorama innovativo, generalmente costituiti da università e piccole imprese innovative, supportate dal mercato del *Venture Capital*.

Risulta evidente come in un contesto così ricco di conoscenza specializzata, un approccio chiuso risulta obsoleto e dannoso. Si corre infatti il rischio di investire molte risorse nello sviluppo di conoscenze già abbondantemente presenti all'esterno, o di ignorare l'introduzione di nuove tecnologie e soluzioni di grande impatto.

Negli ultimi decenni del ventesimo secolo si assiste pertanto alla nascita di un nuovo paradigma innovativo denominato *Open Innovation* il quale, a differenza del paradigma classico, si fonda sull'apertura dell'impresa all'ambiente esterno. Tale apertura è generalmente possibile su due fronti; per quanto riguarda le attività di ricerca consiste nell'utilizzo interno di idee provenienti dall'esterno dell'impresa; per quanto riguarda le attività di sviluppo prodotti consiste invece nell'utilizzo esterno delle idee sviluppate internamente.

Gli attori esterni coinvolti nella collaborazione possono essere di natura istituzionale, come università e centri di ricerca, oppure di natura aziendale, tipicamente fornitori, clienti e in alcuni casi perfino competitors. Non è infrequente il caso di un'impresa che collabori con un fornitore, sfruttando le competenze specifiche, per lo sviluppo di un nuovo prodotto; altrettanto possibile è l'utilizzo esterno di idee che non possono venire sfruttate commercialmente sui prodotti e servizi interni, ad esempio tramite la cessione del brevetto in cambio del pagamento di *royalties*.

A differenza del paradigma tradizionale, risulta chiaro come l'*Open Innovation* si basi su una concezione estremamente aperta del processo innovativo. Lo scambio di informazioni con l'ambiente esterno diventa pertanto una delle attività principali del processo, al fine di individuare la scelta delle attività di ricerca da svolgere e dei migliori *business model* per sfruttarle.

Sebbene *Open* e *Closed Innovation* costituiscano approcci radicalmente differenti per quanto riguarda le soluzioni organizzative implementate, occorre evidenziare come nelle applicazioni reali i due paradigmi siano complementari. Escludendo alcuni rari casi di imprese completamente chiuse al mondo esterno, la maggior parte delle aziende si trova a gestire parte delle attività di ricerca in maniera aperta e altre in maniera chiusa. Una situazione plausibile è che l'impresa sia incentivata alla

collaborazione per tutte quelle attività ritenute *non-core*, e ad internalizzare tutte le attività fortemente legate alle *core competences*, in grado di generare un reale vantaggio competitivo. Si può notare pertanto come l'approccio *Closed* altro non sia se non un caso particolare del più generico approccio *Open*, in cui l'impresa decide di non esternalizzare alcuna attività.

L'implementazione di entrambe le soluzioni presenta tuttavia numerose problematiche legate alla sostanziale differenza di necessità e requisiti. Se da un lato infatti l'approccio *Closed* prevede una totale chiusura all'ambiente esterno, l'approccio *Open* si fonda sullo scambio di informazioni; inoltre le soluzioni organizzative adottate possono differire notevolmente. Si possono pertanto verificare problemi riguardanti la decisione di quali attività esternalizzare e quali internalizzare; oppure relativi alla scelta della natura delle informazioni da condividere e dei sistemi di gestione della conoscenza.

Lo scopo del presente lavoro è di elaborare un *framework* teorico in grado di spiegare come sia possibile l'esecuzione contemporanea di attività *Open* e *Closed*, e quali siano le leve organizzative e gestionali sulle quali agire per una corretta gestione del processo innovativo.

Per far questo viene analizzato in dettaglio un paradigma denominato *Organizational Ambidexterity*. Si tratta di una teoria concernente l'analisi dell'attività innovativa, volta a dimostrare come sia possibile per un'impresa gestire l'esecuzione contemporanea di attività di ricerca potenzialmente contrastanti. L'applicazione tipica di questa teoria fa riferimento alla realizzazione di ricerca di tipo incrementale e radicale, o alternativamente di ricerca di tipo *explorative* ed *exploitative*, e le conclusioni riportano come, con le opportune scelte organizzative e gestionali sia possibile gestire le conflittualità e raggiungere gli obiettivi prefissati.

La letteratura presenta due differenti soluzioni organizzative per l'implementazione dell'*Ambidexterity*. La prima, definita Strutturale, prevede un approccio *top-down*, in cui i ruoli dei ricercatori sono rigidamente definiti ed il management è responsabile di ogni decisione sulle attività di ricerca da intraprendere; la seconda, definita Contestuale, prevede un approccio *bottom-up*, in cui le scelte relative alla ricerca sono affidate alla libertà decisionale dei singoli ricercatori ed il management svolge essenzialmente funzioni di supporto e coordinamento.

L'*Ambidexterity* è tipicamente applicata ad un contesto innovativo di tipo *Closed* e solo in rare eccezioni la letteratura specialistica considera l'effetto di fonti esterne di conoscenza; mentre la possibilità di esternalizzare lo sfruttamento delle idee non viene mai menzionata. L'analisi compiuta nel presente lavoro si è pertanto focalizzata sull'estensione del paradigma al fine di considerare tutte le caratteristiche di un approccio innovativo di tipo *Open*, per la formulazione di una teoria più generale denominata *Open-Ambidexterity*.

Per questo scopo sono stati inizialmente analizzati i requisiti base di applicabilità delle due teorie al fine di verificarne la sostanziale coincidenza. Sono stati identificati quattro gruppi di requisiti:

- **Requisiti strategici:** riguardano la necessità di intento strategico e allineamento strategico, affinché le attività di Ricerca e Sviluppo siano concordi con gli obiettivi aziendali. Considerano inoltre la necessità di una vision condivisa e di un'elevata flessibilità per adattarsi ai cambiamenti nell'ambiente esterno.
 - **Requisiti della struttura organizzativa:** riguardano l'importanza della soluzione organizzativa adottata, tenendo presente che essa può essere estremamente differente nel caso di approcci Strutturali o Contestuali.
-

Evidenziano inoltre la necessità di un sistema di incentivi volti a garantire intento e allineamento strategico.

- **Requisiti del management:** riguardano l'importanza del ruolo dei managers per quel che concerne il coordinamento delle attività di Ricerca e Sviluppo, la gestione delle conflittualità e la diffusione della cultura aziendale. Devono tener presente delle differenze dovute all'approccio Strutturale o Contestuale.
- **Requisiti delle risorse umane:** riguardano i ruoli assegnati ai ricercatori, le competenze necessarie e il grado di autonomia decisionale ad essi affidato.

In seguito all'analisi dei requisiti sono state rilevate tutte le leve organizzative e gestionali di importanza essenziale nella gestione del processo innovativo, e per ciascuna di esse è stata effettuata un'analisi dettagliata. Successivamente queste leve sono state organizzate in un *framework* che considera quattro diversi elementi:

- **Strategia:** rappresenta il *background* sul quale le altre leve devono essere gestite, ogni attività innovativa deve infatti essere allineata con le esigenze strategiche dell'azienda
 - **Struttura organizzativa e ruoli:** rappresenta la soluzione organizzativa adottata sia dal punto di vista interno, che di connessioni con l'ambiente esterno. Considera inoltre i ruoli e l'autonomia decisionale assegnati a management e risorse umane.
 - **Sistema di gestione della conoscenza:** definisce le modalità fisiche con le quali l'informazione e gli scambi di informazione, interni ed esterni, vengono gestiti. Riguarda inoltre la presenza di unità aziendali specificamente dedicate alla gestione della protezione della proprietà intellettuale.
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- ***Sistema di misurazione delle performances e di incentivo***: rappresenta le procedure adottate per misurare le performances dei progetti di innovazione di tipo Open, considerando fattori interni ed esterni, valutando le prestazioni degli attori esterni all'azienda e infine selezionando le modalità di incentivazione.

Il *framework* elaborato è stato in seguito utilizzato per l'analisi di quattro casi di studio relativi alle modalità di gestione del processo innovativo adottate da quattro imprese Italiane operanti nel settore dell'elettronica e delle comunicazioni. L'analisi empirica è stata effettuata intervistando i responsabili dei rispettivi dipartimenti di Ricerca e Sviluppo. Tale intervista ha avuto il compito di individuare le soluzioni organizzative implementate per la gestione delle leve organizzative considerate nel framework, e giustificarle in base alle specifiche esigenze di ogni singola azienda.

I risultati dell'analisi mostrano che tutte le aziende, appartenenti al settore delle aziende di media dimensione, sono prevalentemente focalizzate sulle attività di sviluppo, ed effettuano ricerca di base limitatamente alle aree in cui possiedono forti competenze specifiche. Questo significa che tutte le imprese intervistate mostrano un elevato grado di apertura verso l'ambiente esterno. Questa scelta strategica può essere giustificata dalle dimensioni che, in un contesto nel quale l'innovazione tecnologica è estremamente avanzata, non consentono la completa internalizzazione delle attività di ricerca di base.

I partner tipicamente utilizzati sono costituiti da enti istituzionali, grandi imprese multinazionali oppure piccole imprese altamente specializzate.

Per quel che riguarda la struttura organizzativa adottata si è rilevata una sostanziale coincidenza nelle soluzioni scelte. Ogni impresa ha un unico dipartimento di Ricerca e Sviluppo, che si occupa di gestire l'innovazione interna ed esterna.

In questo contesto il responsabile del dipartimento assume un ruolo fondamentale di connessione con il vertice aziendale.

Le modalità seguite per la gestione dei progetti di innovazione sono tipicamente burocraticizzate e nella maggior parte dei casi prevedono la redazione di un *Business Plan* e la conseguente approvazione in fase di *budgeting*. Questo aspetto si mostra in sostanziale contrasto con le necessità di flessibilità e di adattabilità precedentemente evidenziate.

Per quanto riguarda la gestione delle informazioni si è notato come, al fine di garantire la maggior riservatezza possibile, le conoscenze scambiate siano le minime indispensabili per l'esecuzione delle attività concordate. Poichè tuttavia molte informazioni potenzialmente riservate vengono diffuse, l'approccio tipico prevede la firma di un accordo di riservatezza.

Per quanto riguarda la gestione dei brevetti si è notato come il loro utilizzo sia direttamente collegato all'ammontare di ricerca di base effettuata. Inoltre occorre evidenziare che l'utilizzo del brevetto ai fini di protezione della proprietà intellettuale non è l'unico riscontrato, altre ragioni possono infatti essere individuati nella possibilità di ottenere *royalties* dovute allo sfruttamento e all'impatto positivo in termini di reputazioni aziendali.

L'analisi del sistema di misurazione delle performances mostra risultati coerenti con l'approccio di gestione del processo innovativo adottato. Poichè infatti le specifiche del progetto vengono stabilite in anticipo, le principali valutazioni *ex-post* vengono effettuate verificando il rispetto dei tempi e dei costi pianificati. Non viene implementato alcun tipo di meccanismo di misura appositamente studiato per le caratteristiche dei progetti Open. Anche la valutazione degli attori esterni è essenzialmente effettuata con le stesse metodologie utilizzate per la valutazione dei

fornitori. Non viene registrata infine la necessità di incentivi specifici mirati alla corretta esecuzione della collaborazione esterna, poichè i dipartimenti di Ricerca e Sviluppo si mostrano generalmente capaci di valutare in autonomia le scelte più coerenti con gli obiettivi aziendali.

SECTION 1 - THEORETICAL ANALYSIS

1. THE INNOVATING FIRM

Part 1 - What is Innovation

Innovation is one of the most important issues of the modern capitalized economy, and most firms invest a high level of money and resources in managing the innovation process.

Innovation can be defined as a new idea, the outcome of a process of research. As long as this idea is perceived as new by the individuals involved ¹, it can be defined as *innovative*, even though the same idea may result obsolete to other individuals. In addition a logic of usefulness is connected with the definition of *innovation*, so a new idea that is not considered useful is not called *innovation* but mistake.²

Since 1980 there has been a substantial agreement in academic discussion concerning the definition of innovation³, which is considered technological change, the development and implementation of new ideas, either applied to products/services or to the production process.⁴

For what concerns products and services, innovation may be considered the introduction of new technologies and functionalities that result in added value either for the firm or the final user. In the production process, on the other hand, innovation means the adoption of new solutions that can improve product quality while reducing production costs.

¹ Zaltman, Duncan, Holbek - 1973

² Van de Ven - 1986

³ Roberts - 1998

⁴ Roper, Du, Love - 2008

Part 2 - Importance of Innovation

It is widely acknowledged that innovation is essential for both the survival and the success of any firm.^{5 6}

This statement is more relevant in the modern 21st century competitive environment.⁷

A firm needs innovation to get more customers and to improve their fidelity through the development of innovative products and services, with new features and better reliability.

But, as said before, innovation is also the way to improve the production process in order to reduce the costs without affecting the quality, and thus incrementing the operating margin.

Even though the relationship between innovation and survival is not completely clear, it is possible to say that in long term a company that does not innovate is condemned to death. This process could be fast or slow, depending on the environment in which the firm operates, but is usually unavoidable.⁸

Any company needs to innovate and yet most innovation fails. Researchers state that the rate of failure is between 50% and 80% of the innovation processes.⁹

Innovation is in fact a hazardous activity, both for the amount of resources needed and for the high uncertainty of the results. So if a firm invests a lot of money and resources in an innovation project whose results will prove later to be useless for the business, there is a high chance of failure for the firm itself.

⁵ Koellinger - 2008

⁶ Xu, Houssin, Caillaud - 2010

⁷ Chesbrough - 2003

⁸ Dalglish, Newton - 2001

⁹ O'Sullivan - 2002

This means that, even though innovation is essential; a correct management of it becomes much more essential.¹⁰

A badly managed innovation could lead to a sudden death of the company, where a total lack of it usually leads to a slow death.

In addition to all this it is necessary to consider the trends in the competitive environment that have taken place from the last half of the 20th century.

The innovation process has shown a fast expansion, with a higher number of innovators and a consequently of discoveries. There are always more research fields and each of them is investigated deeply.

For this reason there has been a growth of the effort needed to keep up with the innovating environment. This means a higher number of resources required to innovate with success, and thus more relevance of risk connected with innovation.¹¹

Usually innovation has been considered a way to build up barriers to competitive entry, due to the large amount of resources needed to come up with new discoveries and technologies but also to the cumulative effect of knowledge.

Bigger firms usually could build better R&D departments which could help them gain competitive advantage, increase their margin and thus utterly improve their innovation. This created a leader-follower environment where the bigger firms usually were leaders of the market, and the smaller ones had no choice but to copy their improvement and have lower incomes.

However at the present time things have changed. Although the importance of innovating is still a fact, the ways to do so have become more articulated, and the traditional innovation paradigm is no longer valid.

¹⁰ Van de Ven - 1986

¹¹ Chesbrough - 2003

Some firms have great success without making any kind of internal R&D, and on the contrary it is possible that highly innovative firms face the difficulties connected to finding a way to earn money from the output of their R&D process. Most of these last ones find themselves in great financial issues, and eventually fail, due to the high amount of resources invested without any useful result.

Part 3 - Structural organization of Innovation

It has been said that a correct management of innovation is needed in order to improve the results of research and to reduce the connected risks.

For this reason it is useful to take a closer look at the innovation process in order to analyze the ways it is carried on.

It's possible to divide it in two different segments, with important differences from each other, which will be called "*Research*" and "*Development*".^{12 13}

Research: is the process through which a firm invests money and resources in order to obtain new knowledge and discover new technologies.

This segment can be furthermore analyzed to make a classification of different types of research:

- Radical vs. incremental innovation: refers to how much the new discovered technology is different from what was already known.¹⁴ Radical innovation is made by changing radically the way of doing things, and inserting new features which didn't existed before. On the other hand incremental innovation is obtained through small changes in the technology that is already available.

¹² Chesbrough - 2003

¹³ Reinganum - 1989

¹⁴ De Visser, De Weerd-Nederhof, Faems, Song, Van Looy, Visscher - 2010

- Exploitative vs. explorative innovation: refers to the fields of research. Exploitation is done by researching fields that have already been studied, and generating improvement within those fields. Exploration is done by scouting for new fields of research in order to find new ideas.¹⁵

Both these axes of analysis classify innovation considering its intensity. Usually incremental, exploitative innovation is easier to obtain and requires less resources, while radical, explorative innovation is much more expensive and implies a higher risk.

It is also necessary to state that knowledge can be obtained not only through research: as it will be discussed later, alternative ways are becoming very popular, such as licensing, joint ventures, academic research.

Development: is the process meant to find the best business model to be used in order to gain the maximal value from the discoveries that has been found in the research process. For example through the development of new products or services that exploit the new technology discovered in the research process; or through the incorporation of that technology into existing products in order to improve them.

Obviously this process must necessarily take place after the research activity has been completed. However as it will be explained later, a strong connection between the two steps is needed, in order to avoid investing too many resources in finding technologies that bring no economical advantage to the firm.

In the modern context, development is also responsible for finding a way to use the discoveries outside the firm, if there is no useful business model to be fulfilled

¹⁵ O'Reilly III, Tushman - 2007

inside. This can happen through licensing, spinoff and similar activities that will be explained in the following chapters.¹⁶

This classification of the innovation process in “*research*” and “*development*” will be used in this entire dissertation in order to better understand the differences between the traditional innovation paradigm and the new paradigm.

¹⁶ Chesbrough - 2007

2. TRADITIONAL INNOVATION PARADIGM

Part 1 - Closed Innovation

If a company has leadership on a certain market, the only way it has to maintain it, is through the introduction of innovative products and services. The same can be said for a firm that has no leadership and wants to get it, but even for a non-leader company that simply wants to survive. In all these scenarios, the way of doing this is mastering the innovation process and gaining competitive advantage.

Until 20th century, research has been focused inward the firms. As a matter of facts there was no external source of knowledge, because public research was constrained to military and generic science discoveries and wasn't able to provide a commercial application of any of these.¹⁷

For this reason companies had to start performing commercial innovation inside their borders. Great investments were done to explore the whole innovation chain, from generic research to product development, and so the discoveries remained within the boundaries of the firms. It is necessary to say that at this stage the complexity of the research process was low, and a company was able to be self-sufficient.

Of course, all the benefits coming from the research remained inside the company. This created a virtuous circle, because the innovators could provide better products and services to the market and thus gain a leadership position, which usually lead to increased income and gain. This way the firm became bigger and stronger, and had more resources to be dedicated to the innovation process, making results easier to obtain.

Economy of scale was also connected with this event, because the bigger a R&D department is, the better it works because of the cumulative nature of knowledge.

¹⁷ Chesbrough - 2003

TRADITIONAL INNOVATION PARADIGM

This means that a firm with a bigger R&D department is able to better exploit its results in order to produce more knowledge at a lower cost.¹⁸

Such departments were able to obtain significant discoveries with little resources required minimizing the impact of risk.

As a consequence of this inward directed approach, it was possible to assist to the birth of a number of important R&D centers, which became specialized in their own field of research and usually were responsible for most of the innovation.¹⁹ A clear example of this fact can be seen in Bell Laboratories in the United States.

The traditional innovation paradigm has recently been named the “*Closed Innovation Paradigm*”²⁰, in order to underline its tendency to keep every part of the process internal to the firm. Of course this definition is just a result of the birth of the new open model which will be discussed later.

To further analyze how this paradigm works it is necessary to introduce a typical funnel chart.²¹

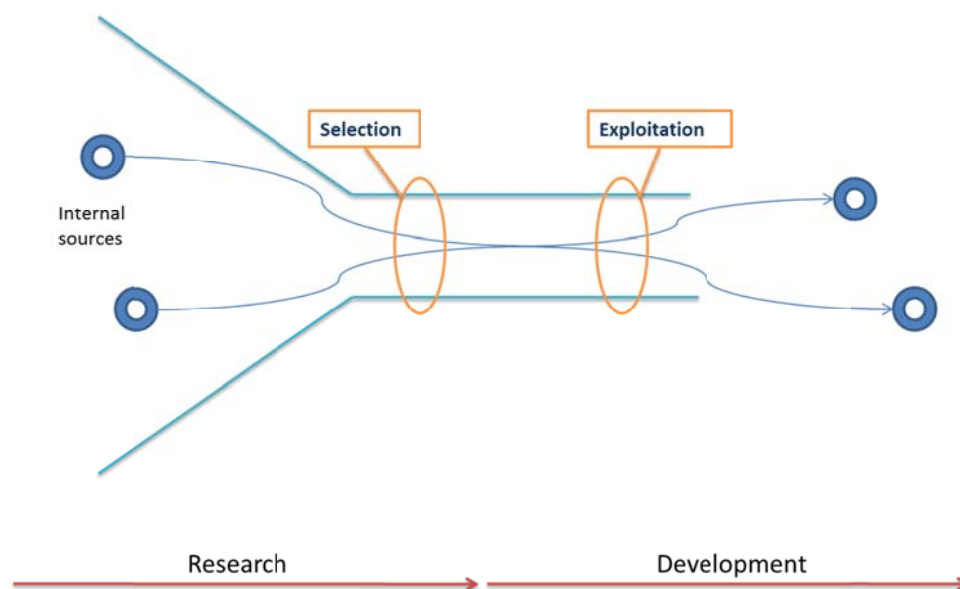


Figure 1. Closed Innovation funnel

¹⁸ Schumpeter - 1942

¹⁹ Rosenbloom, Spencer - 1996

²⁰⁻²¹ Chesbrough - 2003

The chart shows the traditional way of innovating. On the left it is possible to see the Research part, and on the right the Development part.

The lines which build the funnel represent the boundaries of the firm. Ideas are generated within those boundaries, then they are selected in order to find which of these are worth to be sent to the development. The funnel works like a filter, selecting useful innovations and finding the best business model to take advantage of them.^{22 23}

It is clear that all the improvements come from within the firm, so there is neither space for external ideas, nor for any kind of external utilization of internally generated ideas. Therefore the number of innovations which complete the whole process is usually a small fraction of the total of the research processes. Even assuming that all these will later prove to be successful, it is evident how they must generate a consistent economical advantage in order to support all the unselected ideas. In fact, as said before, innovation is an unpredictable activity, so most of ideas which complete the whole process are likely to be unsuccessful.

The closed approach has become part of the innovation culture and has been adopted even when significant changes in the context made it inadequate. This can be referred to as the *“Not Invented Here”* and *“Not Used Here”* syndrome which underline this tendency of managers to consider innovation only from an internal perspective.

In such an environment, it is clear that firms have to perform a strong vertical integration in order to control every aspect of the innovation process. The more important an issue is the more complex the innovation chain is.

²² Chesbrough - 2003

²³ Reingaum - 1989

Part 2 - A change in the knowledge landscape: factors of erosion of the Closed Innovation paradigm

From the second half of the 20th century on, there has been a constant change in the knowledge environment. The economic growth, consequent to the end of World War II, led to a rapid improvement in life conditions in the developed countries, and together with this there has been a great development of the educational system. This is the main cause of the sudden acceleration in the innovation process and the building of a fertile environment for innovative knowledge. More discoveries have been made in the last half of the 20th century than in all previous human history.

However, most of the firms have found big issues in facing these changes.^{24 25} A wider range of knowledge came with such a growth rate that it has slowly become impossible for a company to perform everything within the borders of his own R&D department. Resources required to master the entire innovation chain slowly became too high, and this generated a trend of de-verticalization.

Meanwhile, due to the increase of the level of education, there has been a strong growth of academic research with two direct consequences: first, a higher number of highly specialized researchers were available to the industries to be used in the innovation process; and second, the output of academic research ceased to be economically useless and started to be competitive.²⁶

There was no more lack of highly trained people; moreover mobility of R&D workers increased dramatically. This caused the end of the closed approach to innovation,

²⁴ Gaule - 2006

²⁵ Chesbrough - 2003

²⁶ Mansfield - 1990

because workers could easily be hired by a different company, taking their knowledge and their skills with them. Even though most of the firms tried to prevent the escape of knowledge through mechanism of Intellectual Protection, such as patents, spillovers have consequently become unavoidable.

In addition to all this, it is possible to observe the entrance of small, but influent competitors in the innovation game. Most of these came directly from start-ups born from academic ideas (i.e. Google). Others were spin-offs from the main R&D centers of bigger firms (i.e. Intel and Xerox Parc). These competitors were usually small but had the ability to face the bigger innovation centers of market leaders, and the role of venture capitalism further increased this tendency.²⁷

Globally speaking, innovation has become a much more competitive process, with a shorter time to market, so that kind innovation must be carried on fast, and without mistakes, for the survival of the firm.²⁸

All of this caused the failure of the Closed Innovation paradigm, although in some business segments with low development degree it is still a valid model. The internal approach to R&D is no longer the best one possible. As a matter of fact most of the greatest innovators in the world use different approaches.

This inadequacy can be seen also internally. Indeed finding the correct business model to take advantage of a new discovery is a difficult activity, and causes tensions between the Research and the Development sections of the process.

On one hand there is a strong risk of spending too many resources in pursuing the wrong idea. (i.e. Polaroid), on the other hand there is risk of disconnection between the two stages, which causes the ideas found in the research process not to be used because it is impossible to find a good business model to utilize them inside the firm.

²⁷ Carpenter, Petersen - 2002

²⁸ Gaule - 2006

This event which is called "*Ideas on the Shelf*" creates de-motivation in researchers who feel that their work is not considered and increases the risk of them starting their own spin-off, in order to pursue their ideas.

In conclusion, all these reasons gradually caused the birth of a new innovation approach, which is commonly called "*Open Innovation Paradigm*".²⁹

3. OPEN INNOVATION

Part 1 - Introducing the new paradigm

Open Innovation concerns a new logic regarding both sources and use of ideas. In contrast with the traditional approach, sources can be internal or external to the firm, as well as potentially be used internally or externally.³⁰

There are many more ways than before to perform innovation, and usually most of them are better than the internal path used in closed innovation. This way the traditional approach becomes obsolete.

It is possible to upgrade the funnel diagram used before to work in the new context.

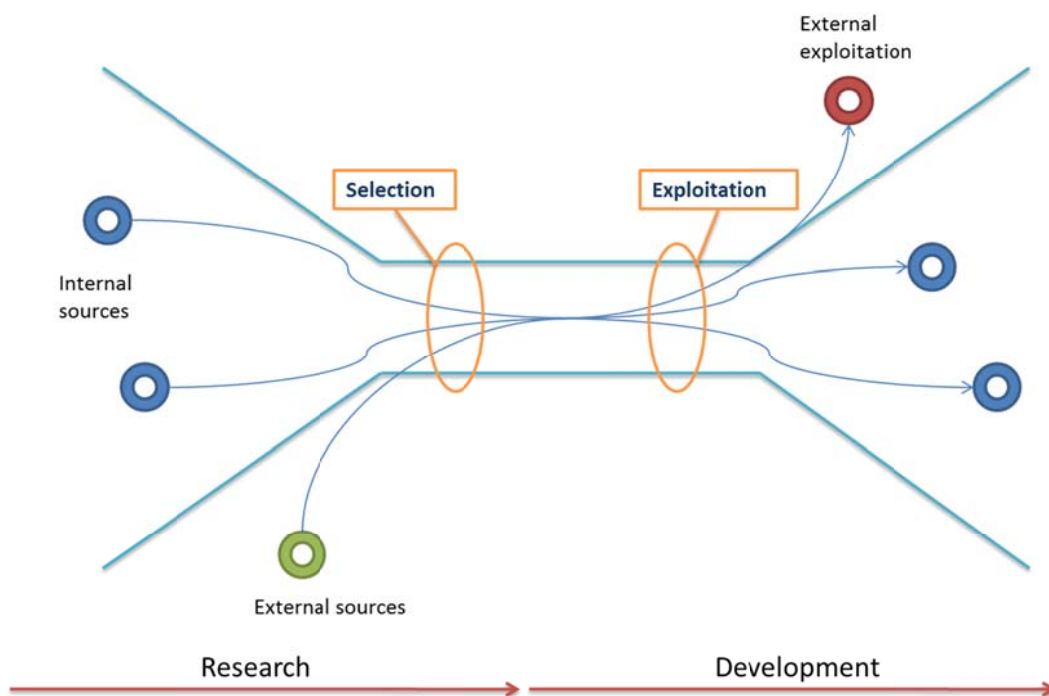


Figure 2. Open Innovation funnel

The division in “*Research*” and “*Development*” remains valid. However it’s possible to see that ideas can come from outside the firm, and at the same time internal ideas can be exploited outside as well.

³⁰ Chesbrough - 2003

Concerning the left part of the diagram it is possible to say that there is both more availability and accessibility to knowledge. This last one is provided by the great development of communication technologies that has taken place in the last century. Internet has become a powerful way to spread knowledge worldwide, improving the innovation process by avoiding duplication of resources.³¹

For what concerns availability of knowledge, it should be noted that internal research is no longer the only source available.³²

First of all the role of academic research has become more active, providing not just general research but applying discoveries to business problems. This means the entrance of highly specialized players in the field of technological research which are able to provide a critical source of innovative knowledge. In addition the number of universities has widely increased making such knowledge more affordable to industries.³³

A consequence of this can be seen in the birth of highly innovative districts, such as Silicon Valley in California, where universities feed local firms with fresh ideas and highly trained personal.

Of course, one of the main sources of knowledge for a firm, which has open to the external environment, is represented by other firms.

Suppliers and customers are the first subjects to be interested in sharing ideas with the company. Each of these actors plays a role in what can be seen as the *"Innovation Chain"*, which goes from basic research to the final product and service development.³⁴

³¹ Gassman - 2006

³² Von Hippel - 1988

³³ Gaule - 2006

³⁴ Chesbrough - 2003

Making a parallelism with the supply chain management it is possible to see that the path is leading to a relationship which enables the open paradigm.³⁵

At first most companies were vertically integrated and controlled every step of the production process, from raw materials to product delivery and post-sale services.

Later, together with a trend of de-verticalization and specialization, supply has become highly competitive, and with a market approach. A great number of suppliers were available to the firm, and the choice was usually made by economical evaluation. Contracts were usually short term, so new arrangements could be done each time with the most convenient player.

The actual behavior of most firms is to remain de-verticalized, but to entertain a close relationship with a limited number of suppliers. This is mainly due to the increased complexity of the process, and to the higher necessity of elevated quality standards. In addition it is not unusual that the two actors want to collaborate in product development. Both of them have strong competencies in different parts of the same research field, so collaboration becomes a way to improve the innovation process.

It is clear that this kind of relationship with suppliers, and consequently also with client firms, involves not just the supply activity but also the innovation activity, making in fact research and development an open process.³⁶

Nevertheless it is not unusual that even competitive firms make partnership of any kind, to execute a cooperative research. So, while these companies remain competitors in the product market, they become allied for what concerns innovation.

³⁵ Hagedoorn - 1993

³⁶ Mac Duffie, Helper - 2005

The relationship can take different forms, from strong connections just like joint ventures, merge and acquisition or partnering; to weaker form of openness, like the use of competitor's technologies under the payment of a license fee.

Last but not least one of the most important sources of ideas that is beginning to be used is represented by the end users.^{37 38 39}

Selected groups of experienced customers can be used to try out new products for beta-testing or even to directly cooperate with the R&D department, not just as beta testers but really to help introduce new features and push innovation towards the market needs.

It is obvious that in such a complex environment, knowledge monopolies no longer serve.⁴⁰ Indeed a closed approach works well in an environment where there is lack of knowledge outside the firm, but in a context where there is so much to use outside the company, it would be unwise not to open up the process.

For these reasons the new paradigm takes the name of "*Open Innovation*", in contrast to the closed approach seen before.

Of course this involves a series of deep changes in the structural organization of the Research and Development process.⁴¹

First of all there is an enlargement of the competencies needed by the researchers.⁴²

³⁷ Olson, Bakke - 2001

³⁸ Lilien, Morrison, Searls, Sonnack, Von Hippel - 2002

³⁹ Bonner, Walker - 2004

⁴⁰ Chesbrough - 2006

⁴¹ Fredberg, Elmquist, Ollila - 2008

⁴² Gaule - 2006

They should not only be able to perform their own research, but also to scout the external environment in search of useful ideas. Indeed their role becomes essential, because only they have the necessary knowledge needed to fully understand the potential of external innovation.

Usually a new role is defined for researchers who perform this activity, which is called "*scouting*", meaning that they scout external sources of knowledge in search of good ideas.

Another way of opening the left side of the funnel is the introduction of external experts in the research process. Usually these are specialists, belonging to the academic world, well trained in the specific research field which the firm needs to be supported.⁴³

Of course radical changes are visible also in the right side of the funnel, which concerns development. In this activity the role of researchers and managers becomes the one of business analyst. It is important to find the best business model for each idea, be it an internal or external path to market.^{44 45}

The first step is of course selecting ideas which should be kept inside the firm. This could be due to many reasons, which could be economic, if the new discovery provides higher gain if used fully internally, but also strategic, for example when the reason for keeping it inside is connected with avoiding to spread core competencies, or creating barriers to competitive entry which helps to hold a monopolistic position.

However internal usage of an idea is not always a good choice. Sometimes if a company is stuck in developing an internal innovation and using it inside its own boundaries, it could face great difficulties.

⁴³ Chesbrough - 2003

⁴⁴ Chesbrough - 2006

⁴⁵ Chesborugh - 2006b

One of the clearest examples of this event is the case of Polaroid. The company possessed an important technology in the analogical photography field and, in order to exploit its core competencies, it tried to develop a similar technology for the home movie film. However this proved to be a bad evaluation of the external environment and the firm failed to notice the importance of new emerging digital technologies that fully surpassed any kind of analogical approach. Failure became unavoidable, and in October 2001 the corporation filed for Chapter 11 bankruptcy protection.

Sometimes ideas cannot be developed inside the firm, because there is too much risk. Nevertheless the company does not want to externalize the innovation and spread core knowledge outside. In this case a solution often used is the creation of a spin-off, which becomes a separate firm, born with the specific purpose of developing the new technology. This spin-off can be internalized in the main company if the process is completed successfully, or dismissed without affecting it if the process fails.⁴⁶

The last chance, for internally born ideas which cannot be used internally, is to complete externalization instead of keeping them on the shelf. There are a lot of ways of doing this, for example they can be sold, or just given in usage under the payment of a license fee.

Part 2 - The requisites of an Open Innovating Firm

Open innovation takes place in a complex and unpredictable context, with various sources of ideas and various paths to market. A firm operating in such conditions

⁴⁶ Chesbrough - 2003

must necessarily to open its innovation process to take full advantage of the many possibilities they offer; otherwise it is condemned to failure.

However opening up the innovation process is not as simple as it may seem, especially for big, older companies that have led the Closed Innovation era. It requires deep changes both in the way R&D is performed and in the managerial attitude towards relationship with the external environment.⁴⁷

It is possible to analyze some of the requisites a company should have in order to perform Open Innovation in a successful way.

Of course the first level of analysis involves strategic intent in the firm conduction. This means that R&D should be aligned with the corporate strategy⁴⁸, and oriented in creating the maximum value for shareholders and stakeholders. So, for what concerns innovation, it is necessary that all ideas that are developed in the internal research department, or selected from the outside, are worth being used.⁴⁹ The lowest amount of money and resources should be invested in research if it is neither going to carry any good to the company, nor to internalize ideas from outside when it does not lead to any competitive advantage. At the same time it's necessary that the business model selected for each idea is the one which fits best the creation of strategic value and competitive advantage, avoiding falling in the "*Not Invented Here*" or "*Not Sold Here*" syndrome.⁵⁰

Of course, as long as the process of finding the best way to use a technology is carried on in the Development section, it is easy to understand that a strong connection between the two structures is indispensable, but this is not easily performed. As will be explained later, there is a high chance of conflict between

⁴⁷⁴⁹ Chesbrough - 2003

⁴⁸ Gaule - 2006

⁵⁰ Chesbrough - 2007

Research and Development, and it is full responsibility of the Senior Management to find a way to avoid it.⁵¹

Strategic alignment means that every action is directed towards value creation. It's important for the company to fully understand how that value is created. As said before, in an open context, the firm plays just a small role in the innovation chain. For this reason it has to find the best strategy, defining precisely what role is to be played and what value is to be taken from.

These values are not always diffused inside the company, so it is always to the managers to help subunits to work in a strategic direction. Usually those units have their own personal goals which can be discording with the strategic ones, and this is of course a source of conflict. The best way to make all levels work coherently is to spread strategy through the firm. Units that are well aware of the global goals are more likely to act in the correct way and avoid contrasts. Communication is the way management can promote strategy at any level.⁵²

In addition to all this, another strategic requirement connected with the nature of the new environment, is flexibility. Context changes quickly and so the firm must adapt its behavior to face those changes at best. This means that ideas that worked well in the past may no longer be attractive, just as it is with the Closed Innovation paradigm, so the firm should consider the possibility of dismissing them to try out new ones. At the same time, also the business model that suits best each idea may change during time, so it is important that the company is quick to adapt to every change in the context to gain the maximum value.^{53 54}

⁵¹ Chesbrough - 2003

^{52 54} Gaule - 2006

⁵³ Christensen - 2006

At a second level of analysis it is necessary to consider how an Open organization should behave for what concerns organizational structure. Open Innovation is indeed different from the traditional paradigm, so it is important that the company adopts the organization that best fits strategic decisions.

Most of the time the simple possession of distinctive technologies is not enough to provide competitive advantage.⁵⁵ Without the correct organizational structure the firm is not able to capture the benefits coming from performing innovation. This becomes even more important in an Open context, because it is necessary that every part of the company works with a strong interconnection, with the other parts and with the outer world. A strong organizational structure is needed to connect every component of the system and build a strong value chain.⁵⁶

Further developing the analysis it is possible to recognize two main types of organizational structures that can be found in an Open Innovating firm. Inbound organizational mechanisms refer to the structures and rules implemented in order to expand the capacity of channelling external knowledge inside the firm with the purpose of improving performances. Outbound organizational mechanisms refer instead to the capacity of creating connections with the external actors in order to take advantage of technological opportunities.⁵⁷

Nevertheless simple interconnection is not enough. As it has been pointed out before, one of the biggest problems that must be faced is the high incidence of conflicts between functions. Indeed a lot can be done to prevent this by spreading vision and strategy through the firm, to make people fully understand what is best

⁵⁵ Christensen - 2006

⁵⁶ Chesbrough - 2003

⁵⁷ Chiaroni, Chiesa, Frattini - 2008

for the whole firm; usually there is a need for another type of incentive.⁵⁸

As it is stated in most of the research regarding change management, introducing radical changes in the behaviour of people is never easy. They have their own priorities and usually see the change as a menace to their freedom. If the solution could be the change of mentality obtained through the diffusion of a new vision and the creation of new values, this is indeed a slow and complicated process. Most firms simply do not have enough time to wait for this to take place, because the new context evolves so fast that the shift towards an open model must be as quick as possible.

For this reason it is necessary to use incentives rewarding units and people that perform their best in the attempt of building an Open Organization. These incentives must push for collaboration between units inside the firm, to prevent conflicts such as those between Research and Development, but also must push for collaboration outside the firm, with clients, suppliers and competitors, in order to defeat any kind of *“Not Invented Here”* or *“Not Sold Here”* idea.⁵⁹

The logic behind all this is that every part is going to work for the good of the entire company, and not for its own good, if the incentives are based on the global firm's performances.

Of course from a managerial point of view this is in contrast with the principle that suggests to evaluate each person using only what can be directly influenced, so a balance between these two aspects is to be found out by the management.⁶⁰

⁵⁸ Gassman - 2006

⁵⁹ Chesbrough - 2003

⁶⁰ Azzone - 2006

Nevertheless it has been explained in the previous part, the role of management is essential for the correct implementation of Open Innovation. This importance does not just refer to the capacity of settling and avoiding contrasts between actors of the process, even though this is one of its main roles.⁶¹

Management is responsible for selecting the best positioning of the company within the value chain. Which portion of the value has to be taken and act so to fulfil strategic goals should be decided by leveraging on to internal as well as external resources. This is not just a spot activity, positioning has to be done every time there is a change, inside the firm or in the outside environment.⁶²

Once positioning is done, the management is in charge of finding the best business model for each developed idea, as well as selecting internal and external ideas. So it is clear how managers are directly involved in the right part of the innovation process. Of course, as long as they are not specialists, they need to surround themselves with the appropriate people that can help them understand every aspect of the technology and make the best choice.

Anyway the role of management is even more subtle, and it is possible to say that a new management paradigm is born alongside the new innovation paradigm. Open Innovation takes place in a complex context with high variance and low predictability. For this reason it becomes essential that managers can guide the process in a way which enables to obtain the maximum value from the opportunities offered by an environment rich of knowledge. At the same time they must face the increased risk connected with performing R&D, minimizing the impact of failures.⁶³

⁶¹ ⁶² Chesbrough - 2003

⁶³ Gassman - 2006

Obviously, it is evident the importance of human resources. In the innovation process, just like in most other processes, people are one of the most influencing factors, because they are the ones actually working in order to produce an output. So it becomes clear how strong is the importance of having a good work force in order to perform innovation the best way possible.⁶⁴

Speaking in general terms it can be said that human resources should have all those characteristics of high competence and strong motivation needed in any kind of job. It is also possible to highlight some features essential for an Open Innovation paradigm.

The first one is the attitude for collaboration that can permit the birth of a collaborative and open environment inside and outside the firm. This aspect is essential, because without collaboration is not possible to exploit the potentialities offered by the channels driving knowledge from outside to inside the firm, and which allow the use of internal or external paths to market.⁶⁵

However this aspect which seems so obvious is typically not owned by traditional R&D workforce. Introducing attitude for collaboration is a slow process, and incurs in all the problems connected with change management. Usually human resources not used to work in a collaborative way, tend to see interaction with other actors of the process as a danger to their own benefits. This is the reason for why this is one, if not the most, critical aspect concerning open innovation.

Solutions to this problem, concerning incentive systems and the role of management in spreading vision and strategy, have been explained before.⁶⁶

⁶⁴ Chesbrough - 2003

⁶⁵ Gaule - 2006

⁶⁶ Gassman - 2006

A second important aspect, right after this one, is the possession of distinctive capacities regarding interaction with the external world. Researchers should be able to analyze external innovation in order to find what fits best the needs of the firm. This could eventually mean the birth of a new role in the R&D process called “scouts”. Scouts are specifically committed to searching for external technologies and introduce them into the company, working close together with developers and normal researchers.⁶⁷

Last but not least the external environment has to be considered an essential requisite for the development of Open Innovation. There must be a series of external actors that are just as open as the considered firm in order to correctly build the innovation chain, be they customers, suppliers, competitors or universities.

The importance of the relationship towards the external world is essential for the success of the open model, and as it will be explained later it is one of the critical points which will be faced in this dissertation.

Part 3 - Different degrees of openness

A firm performing Open Innovation needs to connect with the external environment. Assuming the structure of the innovation process analyzed previously, it is clear that there are different ways of being open.

Every corporation needs to make fundamental choices about the correct positioning within the value chain of innovation. This means choosing for both sides of the innovation funnel, *Research* and *Development*, what part of the process has to be conducted inside and what part has to be externalized.⁶⁸

⁶⁷ Chesbrough - 2003

⁶⁸ Gassman, Henkel - 2006

Different firms can have different approaches and different structural organizations which result in different degrees of openness.⁶⁹

In fact it is a choice between investing in internal research or development versus going outside the firm, very similar to these *make or buy decisions* typical of production management. It is reasonable to assume that every company will decide in agreement with its strategy, trying to maximize the benefits.

Firms will be more than willing to open up in fields not perceived as core competence and can be exploited much more conveniently outside. Of course distinctive knowledge, perceived as fundamental for the possession of a competitive advantage, is more likely to be pursued internally; even if the external environment could provide better results. The same is valid for what concerns the development part, so a firm will probably not diffuse innovations, even if it cannot be successfully exploited internally, when considered so distinctive that sharing them is not acceptable.

The question can become more subtle considering how openness is realized. Speaking of research, utilizing external sources does not mean that no internal investment is required. The development of what can be called *Absorptive Capacity* is necessary in order to leverage the possibilities offered by external knowledge.^{70 71}

The choice regarding the best solution is therefore part of a wider strategic approach intended to define the business model of the firm.⁷²

Of course each one of them must be considered as a manifestation of Open Innovation.

⁶⁹ Dahlander, Gann - 2008

⁷⁰ Cohen, Levintal - 1989

⁷¹ Cohen, Levintal - 1990

⁷² Chesbrough, Rosenbloom - 2002

For what concerns the purposes of this work, the main issue is to assess that it is not possible to speak of Open and Closed firms in a categorical way, or at least that there is no totally open company, because some kind of closeness is necessary for the existence of the firm itself. On the contrary the case of a totally closed firm, similar to the model adopted in the traditional innovation paradigm, is possible but very unlikely to exist.

Generally it will be possible to observe different degrees of openness but with a substantial and essential part of closed innovation.^{73 74}

This closed portion is directly connected with the part of the value the firm wants to capture, and will be dimensioned proportionally to that value.⁷⁵

A more correct definition of Open Innovation can be purposed, in which Open and Closed are not in contrast. As showed below Closed Innovation is just a particular case of the general Open paradigm.

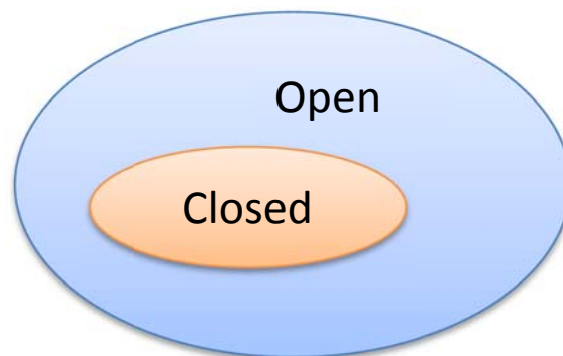


Figure 3. Relationship between Open and Closed Innovation paradigms

This conceptual solution does not however solve the many problems connected with the pursuing of both paradigms. In the following chapters these problems will be carefully evaluated and a theory will be proposed in order to try to find a framework for explaining how a firm can be Open and Closed at the same time.

⁷³ Laursen, Salter - 2006

⁷⁴ Zedwits, Gassman - 2002

⁷⁵ Christensen, Olesen, Kjær - 2005

4. AMBIDEXTERITY

Part 1 - Issues in practicing Open and Closed Innovation together

As explained in the previous chapter, it is very likely that a firm will conduct a portion of its innovations in a Closed way and another portion in an Open way.

The shift towards the new paradigm has indeed been very gradual, so it is reasonable to assume that different degrees of openness could be present in different firms. This means that even if some companies insist on performing totally Closed Innovation, most of them will be adopting a mixed solution, approaching some of the process in the traditional way and some in the new way.

However Closed and Open approaches need radically different attitudes and even organizational solutions. It is clear that the first one considers the possession of exclusive knowledge and technologies as the way to beat competitors, so the main purpose of the firm will be performing internal research that produces real advantage, avoiding any kind of diffusion of information in the external environment.

On the contrary, the open approach means having strong external relationships in order to better leverage the possibilities offered by the external knowledge environment. Of course this means the sharing of internal information, and is potentially in contrast with the purposes of the Closed approach.

As a matter of fact the two paradigms have usually been applied through the use of different structural approaches,⁷⁶ which means different organizations of the R&D department, different roles of researchers and management, different technological solutions and other aspects which will be explained in the following chapters.

⁷⁶ Chesbrough - 2003

It is obvious how these different solutions may result in the arising of conflicts between the different needs and goals of each part. For this reason the main purpose of this work is to determine whether and how it is possible to reach success in performing the two aspects together.

To answer this question, another important subject concerning the innovation process will be used, which is called “*Ambidexterity*”. In general terms this theory concerns the ability to perform effectively two different, and potentially contrasting, activities. For what concerns innovation management the question regards the carrying out of two different kinds of research, usually called explorative and exploitative, even if these have radically different requirements and approaches.⁷⁷

It is clear how this problem is similar to the one concerning Open and Closed innovation. In the following paragraphs it will be explained how Ambidexterity is applicable to an Open Innovating firm, with some corrections and integration to reflect the consequences of an open context. This way it will be possible to say that Closed and Open innovation paradigms can, and should, be performed together.

Part 2 - What is Ambidexterity

A company performing Research and Development, especially if it belongs to a highly innovative segment, needs to perform two different kinds of innovation usually called *Exploration* and *Exploitation*.⁷⁸

Exploration is research made with the purpose of finding new, striking innovation that could radically change the way certain customer needs can be fulfilled, thus enabling the firm to obtain great competitive advantage. Exploring new possibilities means working on previously un-researched fields to find what usually is a radical innovation. Of course, as stated before, there is a difference between the two classifications of innovation: explorative vs. exploitative and radical

^{77 78} O’Reilly III, Tushman - 2008

vs. incremental, however when explorative research is conducted, the results usually represent radical innovation. This kind of activity is meant to get high competitive advantage with the introduction of new products and services, or new features in the existing ones, so innovative that every other competitor should be defeated. However the risk level is very high and, due to the amount of resources invested in the process, consequences of its failure could be severe.⁷⁹

On the other hand exploitative innovation means working on already known fields in order to find further improvements of what has already been discovered. Results of this activity are usually incremental improvements of already existing products and services, so the output, in terms of competitive advantage is far lower than the one connected to explorative innovations. But at the same time process has a lot less risk, and consequences are less severe for the company.⁸⁰

Usually a firm has to perform both types of innovation, because exploitation is necessary to keep products and services up to date with the technological progress, and exploration provides the necessary competitive advantage required to become a market leader. Of course, depending on the peculiar features of the context the process could be shifted more towards exploration or more towards exploitation.⁸¹

Nevertheless simply saying that these activities should be performed together does not make it simple to be done. In fact there are so many differences that without a correct management conflicts are likable to arise and this could prevent innovation from being successful. Exploration has all the features of a long term investment: high level of resources involved, low predictability of results, high risk and most of all, long term goals that are not always aligned with short term profitability goals.

⁷⁹ March - 2001

⁸⁰ Ettlie, Bridges, O'Keefe - 1984

⁸¹ O'Reilly III, Tushman - 2008

In this process the focus is onto dynamic efficiency.⁸²

Exploitation however is more similar to short term investments: fewer resources required, high predictability and lower impact of failure; and most of the time their goal is short term profitability. Focus is on static efficiency. It is not unusual that this kind of innovation is preferred by many firms, because of the traditional approach of management used to preferring short term results, usually identified with net income, over long term performances that are harder to forecast.

Two processes so different from one another seem incompatible, and thus traditional approach to innovation used to perform just one of them a time. R&D has been characterized by continuous improvements with only few local discontinuities, represented by radical technological changes. Also organizational structures usually reflect the overall alignment of the company towards exploration or exploitation.

It has however been widely demonstrated that under certain circumstances, not only co-existence of both aspect is possible, but that the firm actually improves its overall performances. This kind of firm, capable of simultaneously exploring and exploiting is called "*Ambidextrous*".⁸³

⁸² Raisch, Birkinshaw, Probst, Tushman - 2009

⁸³ O'Reilly III, Tushman - 2008

Part 3 - Structural and Contextual Ambidexterity

Ambidexterity concerns finding a balance between *Explorative* and *Exploitative* research.⁸⁴

The application of this paradigm can however be seen in different forms. For this reason, even though the final result is the simultaneous execution of both types of innovation, the actual organizational structure implemented to obtain it may be substantially different.⁸⁵

Usually two main approaches to Ambidexterity are reviewed, respectively called "*Structural*" and "*Contextual*".⁸⁶

The first one refers to a top-down organization of the R&D department, in which decisions on what kind of innovation has to be performed are direct responsibility of research managers if not even influenced by senior managers.

The role of each researcher is typically pre-defined, so there will be a part of the human capital employed in radical and explorative research, and another part employed in incremental and exploitative research. This is done for a purpose of specialization of roles, in order to better exploit the predisposition of each researcher to a certain type of work.⁸⁷

⁸⁴ Cao, Gedajlovic, Zhang - 2009

⁸⁵ Chang, Yang, Chen - 2009

⁸⁶ Birkinshaw, Gibson - 2004

⁸⁷ DeVisser, DeWeerd-Nederhof, Faems, Song, Looy, Visscher - 2009

The second one is a more flexible, bottom-up approach, which usually implies the presence of a single R&D unit, responsible for both kinds of innovation. Researchers are not specialized and are allowed to personally choose the kind of research to perform, according with the general company goals.

The role of management is of support and coordination. This model insists on job enrichment to better exploit the benefits of a flexible attitude towards innovation. Of course in order for it to be successful it is necessary that company vision, strategy and goals are well diffused within the human workforce.

The absence of managerial impositions, if on one side allows better adaptability to the evolution of the contest, on the other side implies the risk of the use of resources in research which don't fit company strategy.⁸⁸

It is necessary to say that these approaches must be seen as complementary, so in real applications there will be a mixture of both, coherent with the specificity of each situation.⁸⁹

The analysis of Open Innovation under an Ambidextrous will obviously have to consider the differences between Structural and Contextual application.

⁸⁸ Chang, Yang, Chen - 2009

⁸⁹ Birkinshaw, Gibson - 2004

Part 4 - Requirements of an ambidextrous organization

Exploration and exploitation require a different set of processes, organizational structure, assets and competences. Most companies simply prefer exploitation because it gives immediate results, when exploration takes a longer time to prove itself valuable. It has to be said that for smaller firms, with very few resources available, it is practically impossible to duplicate structures to perform both; so bigger companies are more likely to be ambidextrous.⁹⁰

However, disregarding any observation on business size, and considering a firm big enough not to have any lack of resources, it is clear that strategic alignment is essential for Ambidexterity.⁹¹ As said before, exploration and exploitation, involve different kind of goals, so a firm focused on short term results will surely not get any benefits from operating long term research.

In addition the process of creation of an ambidextrous organization is itself a long time investment, because it requires a lot of resources and a strong change management plan. A firm trying to get ambidextrous has to be motivated enough to face all the difficulties that may arise.⁹²

In addition performing exploration may not be an attractive activity because of the slowness of the process and the risk of working hard without any useful result. For this problem strategic intent becomes the way of increasing interest, and the creation of this intent is one of the specific roles of management responsible for developing and communicating strategy through the firm.⁹³

⁹⁰ Cao, Gedajlovic, Zhang - 2009

⁹¹ ⁹² O'Reilly III, Tushman - 2008

⁹³ Birkinshaw, Gibson - 2004

Also, flexibility and adaptability play a crucial role in Ambidexterity because the company must be quick at changing the way innovation is performed to better capture opportunities which could arise.⁹⁴

For what concerns organizational structure, as said before, there are two approaches to Ambidexterity which are called Structural and Contextual Ambidexterity. Structural ambidexterity is a top down approach which requires the creation of a rigid structure within which researchers perform either exploration or exploitation basing it on the instructions given by management. On the other hand, Contextual Ambidexterity is a bottom up approach which is not based on any structural organization but leaves to the judgment of the researcher to decide what kind of innovation to perform.

It is obvious how in the first case structural organization is essential for the correct management of innovation,⁹⁵ however structure is very important also in the second case for helping management to face conflicts which may arise between different activities with so different goals.⁹⁶ It is exactly for this reason that the existence of an incentive system that includes material rewards is essential for the correct management of Ambidexterity.^{97 98} Nevertheless organizational structure also plays an important role for what concerns interconnection between the two activities. For instance it is possible to observe that it is needed to protect exploration, which is the most innovative activity performed in the firm, from being cannibalized from the rest of the business.

Like in most of activities, management plays a difficult role in Ambidexterity. First of all it has to possess capabilities of coordination and problem solving, to face any

^{94 95} Birkinshaw, Gibson - 2004

^{96 97} Rothaermel, Alexandre - 2009

⁹⁸ O'Reilly III, Tushman - 2008

kind of tension that could arise.⁹⁹ And for doing this it needs to diffuse and communicate an ambidextrous culture through the firm.

Instead for what concerns the executive role of management, a distinction must be done for the two possible structural organizations.

In structural ambidexterity management is fully responsible for choosing which kind of innovation has to be performed by each actor involved. In contextual ambidexterity instead the decision is up to each researcher, so management only has a role of coordination and creation of ambidextrous environment in which each one is able to make the best choice for the firm.¹⁰⁰

Finally, concerning human resources, it is again possible to make a distinction between structural and contextual. In Structural roles are defined, so most of the times a worker is able to perform only one kind of research; instead in Contextual researchers are able to perform both.¹⁰¹

Two different attributes can be addressed to human resources in an Ambidextrous Organization. First, they are able to execute a higher number of activities than normal researchers, so their job is widely enriched.

Second, they are able to create connections with other researchers and other parts of the firm in order to combine their efforts with others. These two attributes are clearly stronger in contextual ambidexterity, were there is more decisional autonomy.¹⁰²

⁹⁹ O'Reilly III, Tushman - 2008

¹⁰⁰ ¹⁰² Birkinshaw, Gibson - 2004

¹⁰¹ Chang, Yang, Chen - 2009

5. OPEN-AMBIDEXTERITY

Part 1 - Roadmap

After having discussed the peculiarities of the Open Innovation paradigm and of Ambidexterity, the purpose of this work is to assess whether and how it is possible to apply the latter to explain how a firm can make successfully Close and Open innovation at the same time.

For doing this the first, step is to analyze similarities between the two theories in search for enough connections. After that a framework will be developed in order to produce a comprehensive theory which considers in detail each aspect involved and provides explanation for the possible differences.

Part 2 - Similarities

The most important factor that has to be underlined while confronting the two theories, is that both involve a trade-off that can cause conflicts between different actors of the process.

In Ambidexterity the trade-off takes place between exploration and exploitation research for the reason explained in the previous chapter.^{102 103 104} In Open Innovation otherwise it is clear that a strong source of conflicts is the distinction between Research and Development functions. The first one is responsible for discoveries, so it takes all the features of a cost center, where results are not predictable and not always exploitable. The second one is responsible for implementation, so it takes all the features of a profit center, results are easy to forecast and provide an income.¹⁰⁵

¹⁰² O'Reilly III, Tushman - 2008

¹⁰³ Birkinshaw, Gibson - 2004

¹⁰⁴ Cao, Gedajlovic, Zhang - 2009

¹⁰⁵ Chesbrough - 2003

A more fundamental potential source of conflict that has to be considered is of course the one already mentioned, between research projects which follows a Closed approach, and the ones which follow an Open approach.

So the existence itself of such a trade-off is the central problem in both paradigms and makes it reasonable to search for a joint between them.

Actually some research on this subject has already been done in a paper¹⁰⁶ which examines the impact of different, internal and external, sources of innovation, on the Ambidextrous organization.

This has been the first step to open up the left side of the innovation funnel. Results proved that an Ambidextrous firm able to correctly balance internal and external sources of knowledge is likely to improve its own performances. In this process a key role is played by absorptive capacity,¹⁰⁷ which enables the firm to take full advantage of all the possibilities offered by the external environment.

No research has been done yet on the right side of the funnel, concerning the development of innovation.

So far the compatibility of Open Innovation and Ambidexterity has been assessed. Next necessary step is to proceed analyzing all the requisites of applicability in search for similarities. This will be done following the same top down structure used in the previous chapters, starting from the strategic level and finishing with the human resources level.

¹⁰⁶ Rothaermel, Alexandre - 2009

¹⁰⁷ Cohen, Levintal - 1989

Strategic requirements

- Alignment between innovation and strategic intent within the firm. In ambidexterity exploration and exploitation must be conducted coherently with the global strategy of the firm;¹⁰⁸ in the same way, in Open Innovation, every part of Research and Development, every exploited idea, every business model chosen must be aligned with the overall strategy for creating the part of value the firm is in charge of within the value chain.^{109 110}
- Presence of a strong strategic intent to help avoid any conflict. In Ambidexterity this means that exploration and exploitation should be conducted having in mind what the global goals of the company are, this prevents from conflict but also from bad performances of exploration due to the lack of motivation.¹¹¹ In Open innovation, Research and Development must act not for their own personal gain but for the purpose of creating value in the value chain.¹¹²
- Importance of communication. Strategy and mission must be promoted through the firm to create both the points just mentioned, strategic alignment and strategic commitment. Management is in charge of this task.^{113 114 115 116}
- Importance of flexibility and adaptability, in Ambidexterity concerns the ability of performing the right amount of exploration or exploitation, depending on the external context;¹¹⁷ in the same way in Open Innovation adaptability concerns the ability of selecting and eventually changing the business model used to exploit each technology in response to any environmental change.^{118 119}

^{108 111 114} O'Reilly III, Tushman - 2008^{109 116 118} Gaule - 2006¹¹⁰ Chesbrough - 2006^{112 115} Chesbrough - 2003^{113 117} Birkinshaw, Gibson - 2004¹¹⁹ Christensen - 2006

Organizational structure

- Importance of the presence of a strong organizational structure. In open innovation this regards making interconnections between the two different stages and with external components.¹²⁰ It is widely acknowledged that organizational structure affects business results more than the possession of distinctive technologies.¹²¹ In Ambidexterity the question is more subtle because the importance of organization depends on which kind of structure it is implemented. So in a structural approach it becomes important in defining the role of each actor, while in the contextual one it still has the important role of connecting Research and Development with the whole firm to overcome any tension.^{122 123}
- Presence of a strong incentive system. In both cases, as long as change management is involved, the correct usage of incentives is essential for avoiding conflicts and motivating actors to collaborate and act for the business's good.^{124 125 126 127 128}

Role of Management

- Management has a crucial role in the two approaches. In Ambidexterity but also in Open Innovation it has to create an environment which allows innovation to take place correctly,^{129 130} it must face any kind of tension and contrast and must work for the diffusion of strategy and innovation culture. Plus in Ambidexterity its role can be more active in a structural case, because it is in charge of deciding how much exploration and exploitation have to be done.¹³¹ In Open Innovation it is responsible for selecting the best placement

^{120 126 130} Chesbrough - 2006¹²¹ Christensen - 2006^{122 131} Birkinshaw, Gibson - 2004^{123 124 129} O'Reilly III, Tushman - 2008¹²⁵ Rothaermel, Alexandre - 2009¹²⁷ Gassman - 2006¹²⁸ Gaule - 2006

in the value chain, to find the best business model for pursuing that placement and for minimizing the impact of risks on the business.¹³²

Human Resources

- Workforce is directly responsible for the output of the innovation process. In both paradigms human resources must have enlarged competences, which allow to perform different kinds of research for what concerns Ambidexterity,¹³³ and that allows new mansions such as scouting for what concerns Open Innovation.¹³⁴ In addition is essential that any person involved in the Research and Development process is able to have strong connections with other internal and external actors, and to perform teamwork.¹³⁵ This is more important the more the knowledge environment is rich and open.

Part 3 - Missing Pieces

It has been explained how most of the requisites of both theories actually coincide. However the main problem in merging them is that Open Innovation usually needs features which are not included in the Ambidexterity model.

A reason to this could be that Ambidexterity is mainly referred to the traditional Closed Innovation paradigm, except for some research on external sources of knowledge.¹³⁶ For this reason the whole paradigm does not include any reference to the importance of external connections with suppliers, customers, competitors and with the academic world.

Open Innovation instead is, by definition, a paradigm based on the relationship that the R&D department must have outside the firm. For this reason a number of requisites have to be introduced to match these added issues.

¹³² Chesbrough - 2006

¹³³ Birkinshaw, Gibson - 2004

¹³⁴ Gaule - 2006

¹³⁵ Chesbrough - 2003

¹³⁶ Rothaermel, Alexandre - 2009

First of all the right side of the funnel needs to be analyzed with an open approach. This means extending ambidextrous capacities not only to the ability of balancing external and internal sources of knowledge but also to the ability of balancing external and internal paths to market. The firm must have competencies in evaluating the best way of exploiting the technologies that it possesses.

An example could be the presence of a department committed to the management of IP, which is responsible for deciding what knowledge has to be shared and what types of protection are needed.

Secondly the open approach should be applied to Ambidexterity through the whole Research and Development process. The purpose of this work is to extend the Ambidexterity theory and make it suitable to work in the Open Innovation context. The new paradigm could be called "*Open- Ambidexterity*".

The next paragraphs will provide an in-depth analysis of what the leverages involved in this Open-Ambidextrous paradigm are in order to provide a theoretical framework.

Part 4 - Leverages

Leverages presented in the following charts are the output of the analysis done on both innovation theories. The first chart refers to the Open aspect of innovation, while the second refers to the Closed one. Every leverage is considered under the two different perspectives of Structural and Contextual Ambidexterity.

	Structural Ambidexterity Top-down approach, well defined roles of the research personnel, management is responsible for defining goals	Contextual Ambidexterity Bottom-up approach, management has a role of coordination; each researcher can choose what kind of research to perform
STRATEGY	The main goal is to create value for the firm. Every research project must produce such value. A clear positioning of the firm within the value chain must be made	
	<ul style="list-style-type: none"> - Strategic Alignment: management defines which research activities have to be done, selects business models¹³⁷ and way of exploiting knowledge in accord with strategic goals¹³⁸ - Strategic Intent: regards management which must be able to program research keeping in mind the global strategy and avoiding the pursuit of local interests^{139 140} 	<ul style="list-style-type: none"> - Strategic Alignment: single researchers, or teams, decide what type of research perform, select external partners and propose business models. Management has a coordination function^{141 142} - Strategic Intent: regards researchers mostly, because they are responsible for making decisions on how research is conducted with limited forms of management control¹⁴³
ORGANIZATIONAL STRUCTURE	It is important in order to leverage the many opportunities offered by the Open context. It is deeply influenced by the actual form of Ambidexterity (Structural or Contextual). One of the main issues is the presence of interconnections with the external environment	
	<ul style="list-style-type: none"> - Presence of a strong organizational structure with possibly different sub-units for the different parts of the process (Research and Development as well as Inbound and Outbound)^{144 145 146} - Importance of the presence of a connection with the external environment¹⁴⁷ 	<ul style="list-style-type: none"> - Organizational structure is important but its function is mainly of interconnection within the R&D department and with the external environment. Absence of different sub-units¹⁴⁸ - Importance of the presence of a connection with the external environment¹⁴⁹

¹³⁷ Chesbrough - 2006^{138 142} Gaule - 2006^{139 144 147 149} Chesbrough - 2003^{140 141 143 146 148} O'Reilly III, Tushman - 2008¹⁴⁵ Birkinshaw, Gibson - 2004

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INCENTIVE SYSTEM	Has a key role in enabling alignment between firm's priorities and R&D priorities. In addition its purpose is to motivate the internal R&D department to collaborate	
COMMUNICATION SYSTEM	<ul style="list-style-type: none"> - Incentives have the purpose of encourage the researchers to follow directions, avoiding the pursuit of local objectives in contrast with value creation ^{150 151} 	<ul style="list-style-type: none"> - Because of the high level of autonomy incentives have the purpose to match the choices of researchers with the company strategy ^{152 153}
	Communication has a double meaning. The internal one is referred to the necessity of diffusing both vision and technical information within the company. The external one concerns the important aspect of providing an interface with the external environment which allows the exchange of knowledge	
	<ul style="list-style-type: none"> - Inbound: the most important issue is technological communication within the different units that performs innovation. - Outbound: instauration of communication channels specifically designed for communication with external actors ¹⁵⁴ 	<ul style="list-style-type: none"> - Inbound: vision communication plays an important role for the creation of a culture of Open Innovation within the firm ^{155 156} - Outbound: must permit information exchange in both inward and outward directions. This regards not only technological information but also economical and strategic ones. Important role of IT technologies ¹⁵⁷

^{150 155} Gaule - 2006¹⁵¹ Birkinshaw, Gibson - 2004^{152 154} Chesbrough - 2003¹⁵³ Rothaermel, Alexandre - 2009¹⁵⁶ O'Reilly III, Tushman - 2008¹⁵⁷ Dodgson, Gann, Salter - 2006

OPEN-AMBIDEXTERITY

KM SYSTEM	<p>The role of the KM system in Open Innovation is radically different from the one belonging to the traditional closed approach. KM does not act as a simple repository of internal knowledge but is actively used to develop the best business model. The system is responsible not only for internal knowledge but mainly for the external one. It must keep track of progress made in the outside environment.</p> <p>Importance of the connection with other informative systems for allowing evaluation of performances and incentive system</p>	
	<ul style="list-style-type: none"> - Because of the structural organization, the role of repository, even with added functionalities of external interface, is still the most important ¹⁵⁸ 	<ul style="list-style-type: none"> - The system must provide detailed information to researchers so they can take better decisions regarding the innovation process ¹⁵⁹
MANAGEMENT	<p>Management plays a key role for R&D management in the new paradigm. First of all it is responsible for deciding the positioning of the firm within the value chain; then for the coordination of different strategic decisions such as the choice between external and internal sources and last but not least for the management of conflicts</p>	
	<ul style="list-style-type: none"> - Management is responsible to decide positioning in the value chain, research activities which have to be conducted and for assigning roles to researchers ^{160 161} 	<ul style="list-style-type: none"> - Management has a crucial role but it has mainly a support and coordination function and diffusion of Open Innovation culture throughout the firm ^{162 163 164}
ROLES	<p>Roles are the main difference between Structural and Contextual ambidexterity.</p>	
	<ul style="list-style-type: none"> - Roles defined by management, researchers are specialized in their own field ¹⁶⁵ - Birth of specialized figures for external connections usually defined "<i>scouts</i>" ¹⁶⁶ 	<ul style="list-style-type: none"> - Roles are not defined and each researcher benefits from a certain level of decisional autonomy ¹⁶⁷ - Autonomy means job enrichment and more responsibility ¹⁶⁸

¹⁵⁸ Dodgson, Gann, Salter - 2006

^{159 160 162 166} Chesbrough - 2003

^{161 164} O'Reilly III, Tushman - 2008

¹⁶³ Gassman - 2006

^{165 167 168} Birkinshaw, Gibson - 2004

OPEN-AMBIDEXTERITY

HUMAN RESOURCES AND COMPETENCIES	Human resources are very important but their specific characteristics are different in the different contexts	
	<ul style="list-style-type: none"> - Specific competences linked with the role of the researcher. So people working in internal research will possess academic competencies, while scouts will have good knowledge of the application field and evaluation capacities ¹⁶⁹ 	<ul style="list-style-type: none"> - Enrichment of the competencies needed, each researcher must be able to evaluate what type of research has to be performed. For this reason it must have managerial characteristics ¹⁷⁰

Chart 1. List of organizational leverages in Open Innovation

¹⁶⁹ Chesbrough - 2003

¹⁷⁰ Birkinshaw, Gibson - 2004

	Structural Ambidexterity Top-down approach, well defined roles of the research personnel, management is responsible for defining goals	Contextual Ambidexterity Bottom-up approach, management has a role of coordination; each researcher can choose what kind of research to perform.
STRATEGY	Strategic goal is the possession of a competitive advantage obtained with a product or service which has better functionalities and characteristics. In a closed approach this advantage is maintained avoiding any possible diffusion of knowledge to the external environment	
	<ul style="list-style-type: none"> - Strategic Alignment: management defines which research activities have to be done and what fields are to be studied to obtain advantage. It is also responsible for the decision between exploration or exploitation ¹⁷¹ - Strategic Intent: there is still a need for a strategic intent in management, but with less problems than the open case due to the lower complexity ¹⁷² 	<ul style="list-style-type: none"> - Strategic Alignment: single researchers, or teams, decide which types of research perform. Management has a coordination function ^{173 174} - Strategic Intent: research personnel is responsible for deciding whether to carry out radical or incremental research in coordination with global objectives ^{175 176}
ORGANIZATIONAL STRUCTURE	Organizational structure is closed to the external environment, but the importance of internal coordination remains. Characteristics vary from structural to contextual	
	<ul style="list-style-type: none"> - Presence of a strong structure, with possibly different units specialized in explorative and exploitative research ¹⁷⁷ 	<ul style="list-style-type: none"> - Structure has a role of support and interconnection within the R&D department and with the rest of the firm, especially with the top level ¹⁷⁸

^{171 173 175} Birkinshaw, Gibson - 2004

^{172 176 178} O'Reilly III, Tushman - 2008

¹⁷⁴ Gaule - 2006

¹⁷⁷ Rothaermel, Alexandre - 2009

INCENTIVE SYSTEM	Incentives still play a fundamental role in preventing conflicts within the internal R&D department and assuring the presence of strategic intent and alignment	
	- Incentives must enable alignment and prevent conflicts between the different sub-units of the R&D department performing incremental and radical research	- Incentives must grant coherence between researcher's choices and company goals ¹⁷⁹
COMMUNICATION SYSTEM	Communication means both sharing of culture and vision through the firm to obtain alignment, and facilitation of knowledge diffusion within different units of the firm to prevent the " <i>Ideas on the Shelf</i> " phenomenon. There is no outbound side of communication	
	- Inbound: importance of communication between sub-units to avoid conflicts ¹⁸⁰	- Inbound: it is necessary to have a strong communication of company goals to help strategic alignment ¹⁸¹ ¹⁸²
KM SYSTEM	In a closed context KM system is much more simple. There is no need for external sharing.	
	- The main role is that of being knowledge repository and sharing between units	- Added support function regarding decision making. Must help researchers decide which kind of research carry out
MANAGEMENT	Management plays a substantially different role in the two types of Ambidexterity, with a different level of authority	
	- Management is responsible for deciding positioning in the value chain, whose research activity has to be conducted and for assigning roles to researchers ^{183 184}	- Management has a crucial role but mainly for a supporting and coordinating function, enabling diffusion of culture and managing conflicts ^{185 186}

^{179 180 185} Birkinshaw, Gibson - 2004¹⁸¹ Rothaermel, Alexandre - 2009^{182 184 186} O'Reilly III, Tushman - 2008¹⁸³ Chesbrough - 2003

OPEN-AMBIDEXTERITY

ROLES	Roles are the main difference between Structural and Contextual ambidexterity	
	- Roles defined by management, researchers are specialized in their own field, performing incremental or radical research ¹⁸⁷	- Roles are not defined and each researcher benefits from a certain level of decisional autonomy ¹⁸⁸ - Autonomy means job enrichment and more responsibility ¹⁸⁹
HUMAN RESOURCES	Human resources are very important but their specific characteristics are different in the different contexts	
	- Specific competences linked with the role of the researcher. There will be researchers specialized in incremental research and others specialized in radical research ¹⁹⁰	- Enrichment of the competencies needed, each researcher must be able of evaluate what type of research has to be performed. For this reason it must have managerial characteristics ¹⁹¹

Chart 2. List of organizational leverages in Closed Innovation

Part 5 - Framework for Open-Ambidexterity

Organizational leverages presented are the fundamentals on which a framework for Open-Ambidexterity is built. The following framework provides an explanation of the role of each leverage and shows interconnections between them.

This will be used in the empirical part of this work as a guide to the analysis of real Open Innovation applications.

As it is possible to see in the image presented at the end of the paragraph, factors are grouped in three systems, plus an added one that works as a background.

Such background is made of leverages connected with corporate strategies. The reason of this is that, even if those aspects play a crucial role in the execution of Open Innovation and Ambidexterity, they are actually essential for most of the firm's activities. It is even possible to say that strategy is the actual connection between all processes that take place within the company.

For this reason both strategic intent and strategic alignment do not concern just the Innovation Process. This means that every action, in every one of the units, should be coherent with the global strategy.

In the analysis of empirical cases it will be necessary to understand how Research and Development are conducted in order to match this strategy and of course what is the role of Innovation within the firm. This last matter is deeply connected with the choice of positioning within the value chain.

The first main group of leverages is of course represented by the organizational structure. Under this label different aspects can be described such as actual organization of the R&D department, nature of external connections and last but not least the presence of a more Structural or Contextual organization.

Of course this type of information has to be analyzed first because it is much more easily and directly observable.

Within this group a sub-level has to be defined concerning the roles of the actors involved. This regards Management, Roles and Human Resources leverages presented before. In fact managers and researchers may actually have different duties, depending on the characteristics of the organizational structure, and may be in possess of different degrees of decisional autonomy.

The second group of leverages is the Knowledge Management System which includes both KM management and Communication management.

This group can be divided in three different levels of analysis. The first one, which concerns the actual physical management of information could be done through different technological approaches and with different intents. The second one refers to the management of information exchanges. This means internal exchanges, either within the R&D department, for example when a researcher accesses the database to gather information on previous research; or between R&D and other important functions such as marketing, production, administration and of course the top management. Of course it regards also the management of information exchanges with the external environment.

In this last issue there is the connection between Knowledge Management System and Organizational Structure and Strategy. It is necessary to decide which information has to be shared and which has to remain confidential. As said before core information needs to be kept inside the firm and protected, while other kinds of information need to be more open in order to exploit the presence of valuable external connections. Another interesting question is of course analyzing how decisions on the nature of each information are taken and who is in charge of them.

The last group is the Performance Measurement and Incentive System. This has a strong importance in granting that every action taken is directed towards Strategic Intent and Alignment.

Performance measurement needs to individuate who are the actors to be monitored, which variables to be evaluated and which are the goals. Such activities which could be easier in a Closed environment, becomes complicated in an Open context because of the need of evaluating both performances of the single Internal and External actors and the overall execution of the innovation process.

It is necessary to develop a trade-off between the need of respecting specific competences and the need of a global evaluation.¹⁹² The success of the process does not depend only on the final economical results but also on the good conduction of the collaboration with external actors. For this reason incentives must be structured so that, together with the performance of the single researcher, also the global result of collaboration is monitored and rewarded.¹⁹³

For what concerns connections with the other group, Knowledge Management, in its enriched function of support, and not just of repository, must provide useful information for the performance evaluation. Organizational structure is responsible instead for deciding performances to measure and for defining goals.

In the second section of this work every aspect of the framework will be analyzed on empirical cases in order to investigate how Italian firms manage Open and Closed aspects of Innovation.

¹⁹² Azzone - 2006

¹⁹³ Chesbrough - 2003

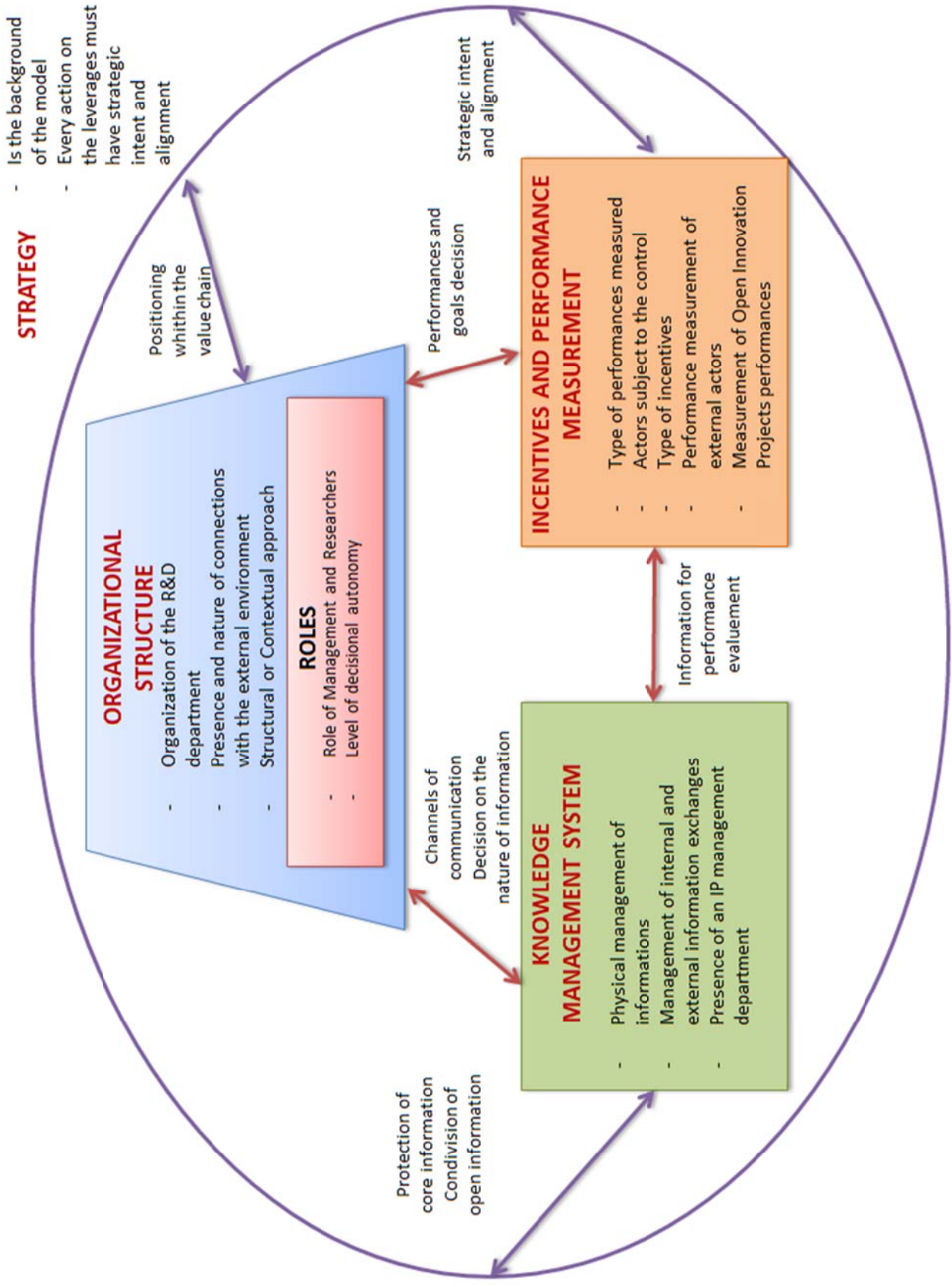


Figure 4. Framework for Open-Ambidexterity

SECTION 2 - EMPIRICAL ANALYSIS

6. EMPIRICAL ANALYSIS OF THE ITALIAN INNOVATION LANDSCAPE

Part 1 - Characteristics of Italian firms and of the Italian knowledge environment

The empirical part of this work has the purpose of studying how the innovation process works in a selection of Italian innovative firms in order to determine how Open they are in performing Research and Development. Each case study will be analyzed under the Open-Ambidexterity point of view and detailed information on the positioning of each leverage will be provided.

The study of Open Innovation in the Italian environment must necessarily consider the nature of the national context for what concerns number, size, and business of the innovative firms.

Of approximately 4,5 millions of Italian firms more than 4,25 millions, the 95% of them, have less than 10 total workers¹⁹⁴ (considering employees, management and owners). These usually belong to the craftsmanship sector, and by definition perform none or little Research and Development. The research must focus its attention on the remaining 0,25 million firms.

The main sectors are Production, Construction, Transport, Commerce, Tourism and General Services. Each one of these is likely to perform some kind of innovation.

Even though Open Innovation can successfully be applied to non-High Tech segments (Henry Chesbrough¹ and Adrienne Kardon Crowther - 2006), the choice of firms performing middle-high technology innovation has been considered more coherent with the theory proposed, and thus more likely to provide reliable results.

One more observation has to be done regarding firm size. Even concentrating the attention on bigger firms, it is necessary to consider Italian culture regarding the development of small and middle firms (usually called PMI - Piccole e Medie Imprese), perceived as a distinguishing value of the national context.

¹⁹⁴ Istat - 2010

Most of these firms have started as Family Businesses¹⁹⁵ and most of them still belong to some form of Family Management. For this reason research has been focused on middle-sized firms with a number of employees higher than 50, belonging to the electronic and communication sector.

This has been done in order to interview companies big enough to have a structured R&D department that could make the research sensible. Little use there would have been in considering firms so small that would perform very little innovation without a specific research function. At the same time the choice of excluding bigger firms helps focusing the attention on realities more similar to the general national environment excluding the eventuality of bigger firms with an abroad research department.

There has been a specific choice not to consider any small but highly innovative firms, such as the ones grown in the academic environment (i.e. incubator of Politecnico di Milano). These firms indeed perform a high amount of innovation, especially on the research side of the funnel, however they usually lack of a clear focus on the development part, and this means absence of business model management. In addition most of them are too recent to provide enough information. It would be useless to interview a firm which has performed only one research project in its whole life.

It is however true that these firms will be indirectly involved in the research as long as they usually play the part of the external actor for the interviewed firms.

One last mention must be done regarding the role of academic research in Open Innovation. Even though Italian universities don't have the same impact of foreign ones on industrial innovation, they play an important role through selected partnership and the raising of academic spin offs. It is indeed possible to observe the birth of innovation poles around important academic research centers.

¹⁹⁵ Banca D'Italia - 1994

Part 2 - Selection of firms

As it has been said the firms interviewed belong to the electronic and communication segment, and perform a middle level of innovation.

For what concerns geographical distribution, research has been focused on North-Italian firms operating in Lombardia. This is due mainly to logistic reasons but does not affect the quality of results because the selected area is indeed rich of innovative firms.

Of the four companies interviewed, two operate in the communication infrastructure business, one belongs to the automation and sensor segment and the last one is a consumer company that produces televisions.

All these are S.P.A. (Società Per Azioni, equivalent to Ltd or Inc) except one S.A.S. (Società in Accomandita Semplice, which is a family business). One of them has been traded on the MTA market of Borsa Italiana up to few years ago, and another one is still traded. They are middle sized companies with a number of employees higher than 50.

Company	Business Area	Employees	Sales*
Firm A	Communication Infrastructures	4500	497
Firm B	Sensors and Industrial Automation	610	124
Firm C	Television	50	120
Firm D	Optical Fiber	60	170

Chart 3. Selected firms

7. THE INTERVIEW

Part 1 - Type of interview

In order to obtain the required information for the analysis it is necessary to interview a person well aware of how the R&D process works. He must know with a certain precision both the managerial and the executive aspects of innovation, and be directly involved in all of them.

Top management usually does not fit these requirements because, although having a clear vision of strategic and economical aspects of innovation, it usually lacks any type of knowledge regarding organization and execution of the process.

For a similar reason, researchers working in the R&D department may be well informed on the practical aspects but remain unconscious of the strategic meaning of them.

In conclusion it has been decided that the ideal target of the should be the R&D manager, or equally a project manager that is responsible for the conduction of some R&D projects. These figures, being in charge not only of the organizational management of the process but also of the interaction with the top management, can provide detailed information on both aspects mentioned before.

For what concerns the type of interview, the decision fell upon a semi-structured direct interview. This has been reputed preferable to other indirect approaches because of the benefits coming from direct contact in terms of clearness.

Because of the complexity of innovation management, it has been necessary to deeply investigate the process, and this could only be done with a semi-structured interview in which the R&D manager describes every aspect of innovation.

This means that the majority of the analysis is based on an open dialogue with the only help of some specific questions to fulfill all the needed information. This is the only type of structure necessary in order to grant that every part of the framework has been covered. These aspects are listed in the following paragraph.

Part 2 - Interview management and checklist

Even though the interview was conducted in a de-structured way, it was necessary to analyze every aspect of the framework. For this reason specific questions were made in case one of the aspects was not mentioned in the dialogue, or in case its description was too imprecise.

As described in the theoretical section¹⁹⁶ strategy is considered as the background on which the whole innovation process is built. For this reason a question on the strategic relevance of Research and Development within the firm, has been considered as an ideal beginning of the interview. This usually led to the first part of the analysis in which the R&D manager usually described in detail how the process was managed in terms of structural organization, links with the external environment, roles of the actors involved.

The second part of the interview analyzed the two remaining groups of leverages concerning Knowledge Management and Performance Measurement.

To ensure all aspects have been covered a check list was made.

Strategy

- Strategic role of R&D within the firm
- Value chain positioning
- Actions directed to ensure Strategic Intent and Alignment

¹⁹⁶ See Section 1 - Chapter 5

Structural Organization

- Physical organization of the R&D department
- Steps of the innovation process (input, validation, actors involved)
- Role of management and researchers
- Presence and nature of connections with external actors

Knowledge Management System

- Physical management of information
- Management of knowledge exchanges (channels, nature of information, protection, sharing, actors involved)
- Presence and role of IP management

Performance Measurement and Incentive System

- Nature of the performance measurement
- Allocation of responsibility
- Incentives
- Evaluation of external actors
- Evaluation of Open research projects

This checklist will be used as a guide to the following analysis of the study results.

8. CASE STUDY

Part 1 - Firm A: Communication Infrastructures

The first firm analyzed operates in the communication market, providing technological infrastructure for telecommunications. It is an Italian traded company, with 90 years activity, with presence in the European and Middle-East area.

In addition to the communication area the firm operates also in the rail transport market and in the energetic one. However for the purpose of this interview only the telecommunication infrastructure part of the company has been analyzed.

Each one of the three company divisions has its own R&D department, and they usually work under the same company directions. This means that results obtained for the communication area are valid in the other areas as well.

Mission and Vision of the firm insist on the importance of innovation for the success of the company. In addition it must be observed that in recent times the company has been usually providing a package of products and services to its clients, and that has been operating on single projects. This means that both the Research and the Development aspects of innovation are well exploited.

Strategy

As said before innovation plays a fundamental role for the firm success. Operating on single projects means that every order needs to have a strong component of research and product development. Therefore most of the innovation activity is executed in this way.

In addition some specific research projects may be developed in order to pursue new competencies and technologies that can improve the product and service provided.

For what concerns value chain positioning the company still retains a certain verticalization and in fact covers a wide range of activities, from basic research to final product development. However this does not mean that it is not an open firm. Indeed the verticalization is inherent those fields in which it already possesses enough competencies to be highly efficient. For any other kind of research and development there is a strong interaction with external partners.

Structural Organization

As said before there are three different R&D departments for each of the company divisions. These departments are usually separated because of the different nature of innovation performed, and indeed the energetic unit is responsible for very little innovation.

Each department is managed by a Research Manager in charge of the interaction with the top management levels.

The typical input for a new research project is the Marketing unit and especially the wide sales forces operating on the whole national territory. Only in a few selected occasions the input comes from the top management for strategic purposes.

The R&D manager, together with a group of researchers, performs a first quick analysis of the inputs in order to determine which of the innovation projects could be valuable. This is done following both economical convenience and the company culture. A valuable project not fitting the overall company strategy is not usually developed.

Selected projects are further analyzed and a business plan is developed so to be presented to the top management in the budgeting period.

Budgeting is executed once a year in January. The R&D manager usually presents the business plan to the top management and works with them for the allocation of resources. This means that of all presented projects, only some will be developed.

The budgeting activity usually performs only resource allocation, in terms of project financing. This way the business plan presented contains the amount of internal and external resources that will be used in the process, but does not specify for what the external ones will be used, nor their nature.

It is usually direct responsibility of the Research Manager to decide for which of the innovation activity an external actor is needed, and who this actor is.

The choice between internal and external is typically taken considering corporate competencies, so it is difficult that resources are invested in the development of internal abilities without a specific top management commitment.

For what concerns the nature of the relationship with external actors, the typical contractual form is the "*Project Contract*". This means that there is a spot relationship just for the specific purposes of the project, and even when the partner is used in more projects no longer term agreement is done. The reason of this is the contractual power due to differences in sizes between the company and the external actors that are usually small, highly innovative firms, frequently belonging to the academic environment.

Knowledge Management System

The company has an information system that provides function of repository and data access both to internal and external actors. For what concerns external diffusion of information it is important to notice that it is not always possible to protect confidential information. Sometimes a partner must know some features,

technologies or solutions regarding the project that the firm would prefer to maintain secret. To manage this problem there are two typical solutions.

First the partner has access only to a dataset limited to his own interest. This means that if the external firm is collaborating in the development of a part of a bigger product or service, it usually does not possess information on the other parts.

Second, in order to protect the shared information a NDA (Non Disclosure Agreement) is made between the two companies. This of course prevents from direct diffusion of confidential data, but does not protect from indirect spillover.

The actors involved in the decision regarding the nature of information are both the R&D manager and the top management. Usually R&D selects which informations are to be shared with each partner, while top management is responsible of strategic decisions regarding IP.

Concerning this last topic, intellectual protection is considered very important. There is a company function specifically in charge of IP management. This function operates in collaboration with both researchers and top management for the evaluation of the convenience of protection. The final decision is however a duty of the top levels.

Additional IP management also regards the use of protected technologies, and the eventuality of external concession behind the payment of royalties.

Performance Measurement and Incentive System

Performance evaluation uses the typical approach of a closed firm. Each project is measured essentially for its respect of costs and times. The reason is that every aspect regarding its output has already been defined in the budgeting section. So a project is considered successful if it can provide the desired results without

exceeding planned costs and especially times. This means that goals are usually pre-defined by both the R&D manager and the top management.

Incentives usually depend on the global result of the whole project, in this way it is possible to motivate researchers to cooperate at best. However, because of the general culture about the use of external partners, no other incentive is needed to ease collaboration.

Finally, for what concerns the evaluation of external partners, the typical approach is to follow the same policy adopted in supplier's evaluation. Rules for this operation are defined by the quality management system. Similar rules are used for both *ex-post* and *ex-ante* evaluation. So it is possible to decide if an external actor is worth being a partner or not.

Part 2 - Firm B: Sensors and Industrial Automation

The second company interviewed operates in the Automation, System Integration, Sensor and Motion Control markets. It has been founded approximately 50 years ago as a Family Business and now is present in 11 countries, with 6 productive plants, and traded on the Borsa Italiana MTAX market.

Products of the different divisions are frequently used in the production of complex systems for industrial automation. There are three R&D departments, one for the Automation and System Integration function, one for Sensors and one for Motion Control. Even though these departments are separated, their integration is not infrequent due to the contextual nature of the output.

The importance of innovation is very high because of the extremely technological nature of the output. In addition, the variety of technologies and solutions included in the products makes a strong external interconnection with specialized partners necessary.

Strategy

The company provides highly specialized products to the industrial environment. This differentiation makes innovation essential for the development of distinctive products to correctly match market requirements.

For this reason the firm is market oriented and mostly positioned in the right part of the innovation funnel. However, for some limited cases, external actors are used even for product development.

The nature of traded firm makes the company culture very open, enabling external cooperation and integration.

Structural Organization

Each one of the three research departments has its own Research Manager for the organization of Research and Development and for interaction with other units.

The whole innovation process has a very classical approach. The nature of marketing oriented firm makes the marketing function responsible of providing the input for new research projects. These inputs directly come from the external environment, for example by request of clients or after an analysis of the competitors.

The marketing function is involved in the R&D process at many levels. The most important role is in selecting from all the inputs the ones more aligned with corporate strategy.

After this first filtering, it is duty of the research department to further analyze each purpose in order to produce a basic report defining its feasibility. Such report provides a first estimation of development costs and requirements, in terms of man-hours, and is meant to be presented to the top management in the budgeting section for validation.

Budgeting is made once a year and allocates resources to each project presented. It is important to say that at this point no kind of decision is made on the use of external actors.

Only after the approval, a detailed business plan is redacted in order to precisely estimate costs and time. It is at this point that the R&D department evaluates the use of external partners.

This decision is usually taken accordingly with the corporate global strategy. Non-core competencies are more likely to be externalized for a reason of convenience. For what concerns core knowledge instead, even if it is responsible for most of the added value of the product, internalization is not always the answer.

In some cases, such as the development of software interfaces and operative systems, even though these represent a critical feature of the final product, externalization is unavoidable, because of the presence of much more expert external actors. In addition it must be considered that the partner collaborating in Research and Development may frequently be also a supplier in the production phases.

In some cases it may happen that external collaboration is used only in the first part of the process, and once the internal function is able to conclude the remaining parts on its own, the partner is dismissed.

Regarding the nature of these actors, most of the time they are firms operating in a related segment, or universities highly specialized in that specific research field.

When detailed provisions on the goals of the innovation projects are definable, the firm makes project contracts with its partners. However there are cases in which these details are not foreseeable, and in these cases other contractual forms are to be used, such as *Body Rental*.

Knowledge Management System

The information technology system is the preferred mean of information repository and exchange. Particular attention is taken in the management of external information exchanges.

The nature of the products, and the complexity of the externalized functions imply that an external partner can usually access a great deal of core and highly confidential information. More than this, even when approaching possible actors, during the scouting activity, it is a dangerous activity because product specifications are given to them. The typical solution is the stipulation of a NDA to prevent any form of diffusion.

Then depending on the contractual power of the two counterparts it is possible that more restrictive agreements are made, for example obliging the partner not to work with any competitor.

For what concerns IP management, there is no function specifically devoted to its accomplishment. It is usually responsibility of the R&D manager to make decisions upon the possibility and the convenience of the protection. Top management is nevertheless involved as long as it has to give the final agreement.

A lawyer is entitled to assist him in any kind of legal question regarding the execution of IP.

An important observation must be made regarding the usage of IP not only for protection purposes but also for the positive effect on company reputation.

Performance Measurement and Incentive System

Performance evaluation is usually based on the respect of business plan parameters. Particular attention must be paid to the respect of both costs and times of execution.

For what concerns quality measurement, the last part of the process is quality validation. The process is not considered accomplished until this validation is passed. For this reason the time variable includes also evaluation on the results.

Because of that costs and time are the variables on which performances are based, the second is usually considered more important because of the impact of time to market on business success.

The company approach does not use any kind of incentive for external collaboration. Instead, considered that a good researcher is not always capable of coordination with other actors, it has been decided that the best solution is the

presence of a competent project manager, with the specific purpose of coordinating internal and external resources.

Finally, for what concerns the evaluation of external actors, this process is normally executed in the validation part at the end of the development. This issue becomes more complex if referring to *ex-ante* evaluation, because then a deeper and more accurate analysis is needed.

Part 3 - Firm C: Television

The third firm interviewed is an Italian firm that produces CRT and LCD televisions. It has been founded 65 years ago and is one example of the many Family Businesses present in Italy.

It is not a traded company, and the fact that it belongs to a family will be the most remarkable explanation of some anomalies in the management of Research and Development.

Even though it is a commodities business, the technological nature of the product makes innovation extremely important for the success of the product.

Some observations need to be done about the competitive context in which the company operates. The presence of big and strong international competitors, together with the reduced size of the firm, makes it necessary to act as a follower in a leader-follower environment. This means that the whole Research and Development process is strongly oriented on the right part of the funnel, and innovation inputs are influenced by external improvements.

As it will be explained later, this situation makes essential for the firm to be very open, especially in the research part, because leveraging external opportunities is the only way to survival.

Strategy

Company size and market contest deeply influenced strategic decisions on the positioning within the value chain. Being a small firm in a competitive context, with the presence of strong competitors, forced the firm to deeply focus on product development.

In addition the level of technology present in modern television production is so high that performing basic research requires a huge amount of resources.

At the same time this situation has important consequences on the openness of the firm. In fact the only way of successfully managing the innovation process is to integrate the many technological inputs that come from the external environment (chips, transistor, software suppliers) inside a competitive final product.

One last observation is necessary regarding strategic choices. It is specific purpose of the company to produce televisions that, while including many of the recent technological improvement (LCD, digital tuner, high definition), remains less complicated than the ones of the competitors.

In this way competition is more based on price leadership than on product differentiation. Direct consequence of this choice is the geographical positioning of most of the external partners.

Structural Organization

Research and Development is mostly concentrated on the right side of the funnel. This means that a small amount of basic research has been made in the past years and now this percentage is reduced to zero. The department responsible for innovation falls under the name "*Technical Office*", and is managed by a "*technical director*" not just in charge of product development but also of the production process development.

Due to the role of follower, the input for the launch of an innovation project usually comes from the external environment. When market leaders start commercializing television with new features there is no choice but imitation.

The nature of Family Business influences the way these projects are managed. First of all the only person responsible for the decision is the company CEO who is also the owner.

This decision is made at any time of the year, without any formal budgeting operation. The only kind of evaluation that is performed concerns technological feasibility. The main reason for this is the presence of a family that finances each project and does not require detailed provisions.

As it will be explained later the absence of a formal budget also influences the performance measurement activity.

External actors are usually suppliers of components. The main part of a television is made of a chip-board integrating these components.

Some parts like the processor are so complex that the firm cannot participate in their development at all. Other parts are usually co-developed with the suppliers to match the final requirements.

Speaking of geographical positioning, due to mainly economic factors, most of these suppliers are Chinese firms. Development collaboration is usually ruled by the same contracts which rule the supply activity.

Knowledge Management System

Information is stored in a simple database that mostly covers the repository function. A direct approach is used instead for external information exchanges. In this case it is not infrequent that the R&D personnel directly meets the supplier to perform the development.

It is interesting to notice a double implication in this exchange. Indeed, if the firm needs to share information for the development purpose, the suppliers also have some benefits from it in terms of knowledge of the western market requirements.

For what concerns IP, it must be noticed how, being the firm mostly concentrated on development processes, there is a lack of confidential information. For this reason, except one attempt of IP made some years ago, regarding a new analogical tuner, there is no need of an IP office; and it is actually preferable that knowledge could circulate freely.

Performance Measurement and Incentive System

The cited absence of budgeting influences the choices in terms of performance evaluation. It is not possible to measure the respect of times and costs of development.

Performance assessment is done instead through the analysis of economical results and most importantly through an analysis of the final product quality, in terms of defects and customer satisfaction.

Some last considerations must be made for what concerns the evaluation of external actors. The choice of them has been made by direct contact with some of the possible Chinese partners. However, due to the extremely high number of companies, the selection involved only a small number of the possible companies. These have been evaluated both on the quality of their products and, most importantly, on the cost of the relationship.

Part 4 - Firm D: Optical Fiber

The last interviewed company operates in the optical fiber market which is deeply integrated with networks and telecommunication. Born 18 years ago it is one of the most important Italian firms of the segment.

Even though it is not a traded company, it presents most of the characteristics of bigger firms, thanks to the belonging to a group of three firms operating in the communication sector.

Its products, although being mainly used as components of bigger technological solutions, include advanced technical solutions and are the result of a process of innovation that involves many external partners. Being a market oriented company is the cause of the shift towards the right part of the funnel, even though it executes a certain amount of basic research.

Some considerations must be done regarding the optical fiber market in Italy. Indeed this segment is deeply influenced by the high speed telecommunication market, and because of the actual situation regarding the diffusion of optical based broadband connections, usually referred to as digital divide, the actual market is smaller than the potential one. This however does not affect the performances that are nevertheless satisfying. And finally, in order to better exploit competences in a related market, the firm has developed some product for medical equipment.

Strategy

The company produces components for optical fiber networks. For this reason the strategic positioning of the innovation process is in the middle of the value chain.

Even though a small amount of basic research is conducted, most innovation regards product development.

In order to correctly generate added value within the value chain, it is essential that the firm is open both towards suppliers and clients.

Structural Organization

The R&D department is composed by a small number of people and directed by a R&D manager with extended responsibilities concerning not only innovation management, but also IP management and economical evaluation.

Research is conducted through the uses of innovation projects. The input causing the launch of a new project usually comes from market needs.

Each project is approved annually by the top management in cooperation with the R&D manager. Approval is made through the compilation of a feasibility report which evaluates output specifications, costs and times of the development.

The need for a budgeting approval is motivated by the necessity of finding external financing, in addition to the internal one. To obtain resources it is therefore essential to present a detailed business plan.

Choices on the use of external actors are usually made after the assignment, and the responsible of the decision is the R&D manager. The choice between internal or external development of each part of the process is usually made accordingly to the capabilities of the firm.

The typical contractual form of the relationship is a project contract. No longer forms of cooperation are established. A particular case of external collaboration which does not fall under regular contracts is the use of expertises regarding limited parts of the project. This is usually done by the R&D manager himself, and the information exchanged is so limited that there is no risk of diffusion of core knowledge. Sometimes also academic partners are involved in the innovation process.

Knowledge Management System

Information is physically stored and exchanged through the company's informative system. For what concerns exchanges outside the firm, considered the limited amount of information implied, the use of emails and internet is sufficient.

The typical approach to external sharing of information is the signing of a NDA which prevents unwanted diffusion. However the nature of the product does not make information protection an important issue.

The company has indeed some IP patents, but the reason of their execution is not the protection of distinctive knowledge but the economic advantage coming from the payment of royalties from the clients.

Again a misuse of the IP has to be noticed. First of all patents are used to improve the firm's reputation. Second, and not less important, sometimes patents are a way to create barriers to the entrance of new competitors.

In a market with a limited number of players, it is not infrequent that a client specifically requires a product that contains protected solutions, for both a matter of image and assurance against possible complaints. For this reason, competitors which try to gain market share using price differentiation, which is possible since they do not have the added expenses due to the patent, cannot sell their product.

Performance Measurement and Incentive System

The approach to performance measurement is typical of a traditional closed innovating firm. Research projects, as long as they fulfill all the requirements proposed in the budgeting section, are evaluated for their respect of times and costs. Of these, the final cost is the real important variable and it incorporates any consideration relative to time and product quality.

For what concerns external actors evaluation, the approach remains substantially unvaried. In case of the absence of relevant problems with the partner, the cost is the preferred term of comparison both in *ex-ante* and *ex-post* evaluation.

The R&D department has a relatively small size, for this reason there is no specific incentive to collaboration. In addition company culture motivates researchers to use external support in every field that is not specific competence of the firm.

SECTION 3 - RESULTS AND CONCLUSIONS

9. STUDY RESULTS

Part 1 - Overview of results

Interviews provided a wide set of informations regarding the management of innovation in an open context. Each one of the analyzed firms practices both the Open and Closed aspects of the R&D process. For this reason results are useful to give empirical support to the presented framework regarding Open-Ambidexterity.

It is possible to observe that the output of each empirical case is substantially coherent with the global theory, although some differences have been shown, mainly caused by the specific situation of each company.

In the following paragraphs an in depth analysis of the results will be given. Each one of the four groups which form the presented framework (Strategy, Structural Organization, Knowledge Management System, Performance Measurement System) will be detailed in every considered aspect.

The qualitative nature of the information collected does not allow any kind of statistical and quantitative analysis. However, because of the limited number of firms present in the sample, this qualitative approach gives much more relevance to the results, making it possible to perform hypothesis on the connection between organizational solutions and the specific characteristics of each firm.

Part 2 - Results analysis

Strategy

Each one of the selected firms operates in a context in which innovation is essential for the development of competitive products and services. For this reason, even in the smaller ones, R&D departments are given an important role and a high level of resources.

For what concerns the Open Innovation analysis, it is necessary to observe that every company performs the R&D process in a very open way. The nature of external actors can generally be divided in three different categories. The first one is represented by firms operating in a deeply related context, such as Clients, Suppliers and in rare cases even Competitors. The second one includes usually small and highly innovative firms highly specialized in a specific field of research. Usually these are either academic start-ups or spin-offs and are deeply focused on basic and non-applied research. The last category refers to universities and other types of academic institutions, such as research centers, which cooperate with the firm in specific research projects.

Value chain positioning typically shows a significant shift towards the middle-right section of the innovation funnel. This means that, even considering the differences related to the specific context of each company, all of them are mostly product or service oriented. For this reason the development activity plays a fundamental role in the process, while fewer resources are dedicated to basic research.

As it will be discussed later, one of the possible and most reliable reasons is the overall nature of the selected firms. Middle-size dimension and market structure make them focus on applied research rather than on the expensive and uncertain basic research.

One last observation must be done regarding company culture and strategic intent and alignment. It has been observed how company vision and goals are generally well penetrated within the R&D department so presented projects are usually coherent with the overall strategy. In addition the choices regarding the use of external partners is typically taken considering the set of competencies already present within the firm. This means that usually no investments are made in developing new abilities except rare cases motivated by specific top management commitment.

Structural Organization

The typical organization solution, adopted by every one of the analyzed companies, is the presence of a single and specific R&D department for each one of the marketing segments. Depending on the size of the business, such department is managed by one or more R&D managers in charge of R&D coordination and of the relationship with the top manager and other internal and external units.

No physical separation is made for what concerns the management of Open and Closed innovation or the execution of the Research and Development parts of the process.

The marketing oriented nature of each firm makes the market needs the first and most important input for the launch of new innovation projects. Only a small percentage of cases is motivated by the specific top management intention of expanding the firm's competencies and accessing new possible markets.

Every interviewed firm performs Research and Development through the launch of specific innovation projects. The main approach for this launch is the redaction of a Business Plan, or feasibility report used to estimate costs, times and benefits of the project. The approval phase is usually executed once a year during the budgeting

period. In this operation resources are allocated and goals are set for future performance evaluation.

The only registered difference in this approach is represented by a less structured approach to the innovation process which only requires a technical feasibility assessment without any business plan analysis. As it will be explained later, this approach is motivated by the specific nature of the considered firm which being a family business, does not need to produce dedicated documentation for approval purposes.

Resource allocation is made disregarding any consideration on the use of external partners in the process. In more structured firms the only evaluation made regards the amount of the investment which will be used for this cooperation.

Once projects have been approved in the budgeting operation, it is responsibility of the R&D manager to decide whether and for which purposes recur to external competencies. It is also them who are in charge of coordination between resources involved.

Typically, the choice of externalization is determined considering the firm's competencies. Non-core innovation activities are more likely to be performed outside the boundaries of the firm for a reason of economical convenience.

For what concerns core competencies the choice must necessarily follow an in depth analysis of the external context. It is generally true that those activities executed inside the firm are preferred, in order to not diffuse confidential information. It is also true that sometimes the presence of external actors highly specialized in that field, or either the high level of resources required for the development of that kind of competencies, make it unaffordable to internalize some core activities.

It should be finally noticed that the typical form of involvement of external partners is, when possible, the signing of a project contract. For this reason cooperation is usually a spot activity which ends at the end of the specific innovation project. This does not however mean that the same external partner cannot be used in more projects for a long time.

Knowledge Management System

Information is usually stored on the company's information system and collected in databases. The complexity of the information system is directly proportional to the firm size, for this reason smaller firms usually adopt simple informative solutions, while bigger ones have enough resources to implement specific on-purpose informative systems.

For what concerns information exchange, internal access usually happens through the cited informative system. A different set of situations is observable for the external information diffusion. In this case the selected channel depends on the actual nature and complexity of the information involved. When a frequent and complex exchange is needed, the typical solution is the access of the external actor to the company's information system. In other cases, both frequency and complexity are lower, and this allows the use of other channels, for example typically internet based ones (such as e-mails), or even direct meetings.

Concerning the importance and secrecy of the information exchanged, the adopted way of protection is to let the partner access only a limited set of information, concerning just the part of the project which involves him directly.

For legal purposes, a NDA is the common approach to any kind of external relationship. Such agreement is signed not only when a formal contract is stipulated, but also when the partner is approached for *ex-ante* evaluation.

The use of IP is more relevant the more the firm is active in the Research part of the process. Only one of the firms has a specific patent office, while others delegate IP management to the R&D department itself.

Decisions on the eventuality of making patents are usually taken by the top management but it is the R&D manager who is responsible for all the evaluation processes needed to assess the convenience of a patent.

Most of the time IP protection is made in order to gain benefits from the royalties deriving from the use of the patent. However in many cases a different reason which concerns the company image is involved. In many cases patents are not made for protection but as a way to advertise the quality of the technology included in the product in order to raise its appeal.

Performance Measurement and Incentive System

No evidence of specific performance measurement solution has been found concerning the evaluation of Open Innovation projects. The typical approach to this activity is essentially based on the traditional solutions regarding project evaluation.

The most relevant variables considered are times and costs. Considering that any specification regarding the final output of the process has already been made in the business plan approval, the only remaining parameters are the respect of both estimated times and costs to the final development.

For what concerns quality evaluation, this activity is usually considered as an integrating part of the process which has to be executed at the end of the Development section. For this reason, when considering the total development times, quality assessment is indirectly involved.

The only exception to this kind of performance measurement solution is represented by the third analyzed firm. As said before the absence of a formal

business plan makes the impossibility of measuring the respect of time and costs unavoidable. In such cases the evaluation is mainly based on the quality and customer satisfaction measurement on the final product.

In none of the presented cases there was the need for specific incentives to external collaboration. The only adopted solution is the use of a whole project evaluation to motivate both internal and external actors to work at their best in order to provide the best possible results.

One last word must be spent for what concerns the evaluation of the external actor's performances. Usually both *ex-ante* and *ex-post* analysis is based on the same procedure applied for the judgment of any kind of external partner, such as the supplier. In some cases this operation was reduced to a mere comparison on the costs of the cooperation.

10. CONCLUSIONS AND FINAL REMARKS

Part 1 - Conclusions

The purpose of this work has been to analyze how an Open Innovating firm can succeed in managing both Open and Closed aspects of the innovation process. Considering that, except some radical totally closed companies, in most cases there is a hybrid combination of Open and Closed activities, and that these usually need radically different organizational solutions, a correct management becomes essential for the success and the survival of the firm.

The traditional paradigm bases competitive advantage on the possession of differential competencies and technologies that improve the quality of both processes and product or services. A firm which wants to succeed needs to invest money and resources in developing a strong R&D department able to provide new technologies and knowledge. The increased gain coming from innovation can be used to further improve and finance the research process, thus creating a virtuous circle which takes the firm to market leadership. It is clear that secrecy is essential in order to avoid the diffusion of core knowledge that would result in the loss of the competitive advantage.

The new paradigm, enabled by the failure of the traditional approach, caused by the radical evolution of the knowledge environment, focuses on the importance of the connection with the external environment. The great number of highly specialized actors, together with the accessibility to a wider and richer range of information, makes it necessary to leverage external opportunities, in order to execute the best possible innovation.

It is clear how this new paradigm is based on a radically different conception regarding innovation management. Where Closed Innovation needs to prevent information diffusion, Open Innovation makes this diffusion essential.

A firm which has to perform some Open and some Closed innovation activities is, for this reason, at risk of great internal conflicts that, if not managed properly, would eventually lead to the failure of the R&D process.

In order to explain how the correct management of so different paradigms is possible, the *Organizational Ambidexterity* theory has been analyzed. Such theory was born to explain how it is possible that the exploration and the exploitation parts of innovation can be performed together without affecting the quality of the output. This is a situation similar to the Open vs. Closed trade-off, because also exploration and exploitation are radically different activities that could generate internal conflicts.

Merging the two theories provided a framework for a new theory defined *Open-Ambidexterity*. The leverages influencing the management of the Open Innovation process have been grouped in four main groups and the links between each of them have been explained.

This framework has been used to analyze how Open-Ambidexterity can be applied to a selection of Italian firms belonging to the electronic and communication segment. The R&D managers of four firms have been interviewed to understand how innovation is managed.

It is necessary to say that all the considered companies are middle sized and positioned towards the market side of the value chain. As it will be explained later this aspect deeply influences many of the organizational solutions taken in R&D management.

In the following pages the results concerning every aspect of the framework will be analyzed in detail.

Strategy

The selected firms operate in markets where technological aspects of the products are important. The nature of middle-sized companies makes it unavoidable to perform innovation in an open way. In fact the level of technologies involved does not allow the internal conduction of the whole process, due to the high amount of resources required. In addition, the presence of specialized external actors would make the internalization of many research activities useless.

Concerning value positioning, it has been noticed how most of the firms is positioned towards the left part of the innovation funnel, the one concerning product development. The level of basic research conducted is directly proportional to the company size. The reason for this is that most of the basic research involved in the considered markets has such a high technological level that the reduced dimensions do not allow to perform it internally.

In fact, most of the performers of basic research in these fields are usually big multinational companies which have both the economic and human resources needed to manage the process successfully. An exception to this could be seen in some small highly innovative firms which performs almost only basic research. In that case the reason is the highly level of specialization and the typical belonging to the academic environment.

Conclusion could be made that the choices regarding value chain positioning are related to the nature itself of the typical Italian middle-sized firm.

This fact leads to what concerns the diffusion and penetration of the open culture within the firm which usually allows researchers to act with Strategic Intent and Alignment. The nature itself of the firm makes it unavoidable to perform the innovation process without the use of external actors. For this reason researchers

are well aware of the necessity of openness, are usually able to decide what parts of the process need to be externalized and are able to perform cooperation.

In conclusion, strategic choices regarding externalization are usually well defined, so it is very likely that each company does not invest resources in developing new competencies, different from the ones already owned.

Organizational Structure

The organizational aspects are the most important for what concerns the application of the Open-Ambidexterity theory to real cases.

The structural organization of the R&D department does not involve any functional separation between the execution of Open and Closed or Research and Development. From an ambidextrous point of view this is similar to a Contextual approach. However it must be considered that the limited amount of available resources may be the actual reason of this choice. Indeed as it will be explained, most of the management approach is top-down conducted, in a way very similar to the Structural solution.

Indeed this Structural approach becomes clear when considering the management approach of the innovation project management. Even though it is usually responsibility of researchers, and especially of the R&D manager, to perform the analysis of feasibility on the innovation ideas; it is the top management who is responsible for the allocation of resources. The use of budgeting means a top-down imposition on both output and requirements of the process.

It is true that this approach to innovation management deeply reflects a traditional attitude towards project management typical of most Italian firms. Another example of this is the importance itself given to cost related factors in the performance evaluation process. Such attitude of bureaucracy is in contrast with

one of the main requisites of Open-Ambidexterity which is the importance of flexibility and adaptability.¹⁹⁷ It is clear how the use of budget forces decision regarding new projects to be taken once a year, and that could result in a late response to market needs, that in a rich knowledge environment, should be faced as soon as possible.

The exception represented by the third firm, that actually performs innovation in a much more contextual and responsive way, has to be considered carefully. It is true that this solution is more in line with the general requirements of the open context in which the firm operates. However the reason of such behavior is to be found in the specific condition of family business. This means that, without the presence of a family that directly finances the innovation process, the company wouldn't be able to operate in such a flexible way.

Therefore it could be said that the main reason for the use of budgeting, and the choice of a structural approach, is mainly determined by the limitations deriving from the need of financing.

Another observation concerns the contractual form of the partnership. The extensive use of project contracts is in one way a sign of flexibility, because the absence of long-term relationship allows the firm to always select the best external actors. However the form itself of such contract imposes some limitation on the nature of the collaboration, because outputs and resources are pre-defined in the budgeting section and cannot be adapted.

Evidence of a more Contextual approach can be found instead in the level of decisional autonomy given to the R&D department regarding the choice of external actors. If it is indeed true that budgeting imposes a top-down approach for what concerns goals and resources of any innovation project, researchers are usually free to select which partner use and for which type of purpose.

¹⁹⁷ See Section 1 - Chapter 5

Knowledge Management System

Two types of conclusion must be taken regarding knowledge management within the firm.

The first one concerns the nature of information exchanges and the decision regarding the confidential nature of information.

The need for strong partnership integration implies that many confidential and core informations are to be exchanged in order to perform innovation at best. Of course, in order to prevent this, the amount of shared knowledge is limited to that essential information concerning the specific part of the research project. The choice on the nature of information is again responsibility of the research personnel. This does not totally cover from the risk of knowledge spillovers, so it is common that a NDA is signed to protect the company.

The second and more important aspect is the use of IP. The choice of value chain positioning makes it clear that the amount of basic and radically innovative knowledge produced is very low. For this reason there is not much need for patent protection, and the actual use of IP is mainly related to the economic advantage deriving from royalties. In addition it has been shown how alternative uses of patent are frequently chosen, much more related to corporate image than to protection.

In terms of Ambidexterity, the IP management is a hybrid approach of Contextual and Structural. The top management is usually responsible to take the final decision on the execution of the patent; but it is generally the R&D department which selects ideas to be protected and performs all the necessary evaluations.

Performance Measurement and Incentive System

The question of performance measurement shows a general inadequacy of the solution implemented by the interviewed firms. The typical approach is mainly based on the evaluation of costs and development time. The output of the process has been pre-determined during the budgeting. The only kind of judgment is taken looking at the respect of the defined terms of development.

This is in contrast with the necessity of an *ad-hoc* developed performance measurement system specifically designed upon the requirements of open innovation processes.

It is true that the use of a global evaluation usually incorporates the effect of the external collaboration, however no type of analysis is performed to determine whether the choices made regarding the process has been the best possible. This way the company is not able to determine if it would have been better to internalize some of the externalized issues, making specific investments for the development of new competencies, and of course not even the opposite type of evaluation is possible.

The only kind of measurement of the external collaboration performances is made through the evaluation of the external actors, usually with the same tools used for supplier evaluation. In some cases this assessment is reduced to a mere cost comparison.

Of course, as said before, it is very likely that the structured approach to innovation management is the direct cause of this lack of an adequate performance measurement system. The whole process is indeed focused on the respect of budgeting decisions, so once these are fulfilled the project is considered successful.

The last consideration must be done regarding the need for specific incentives to enable external collaboration. None of the presented firms had the necessity of using specific forms of motivation except the use of global evaluation as a way of analyzing the overall output of the process and not the single contribution.

The reason of this can be seen in the presence of a strong culture of externalization, motivated by the already cited size of the firm. This permits the rapid diffusion of the open culture within the firm, and researchers are well aware that the only way to manage complex innovation issues is through external cooperation.

Part 2 - Limits of the work and suggestions for future research

This work provided a solid theoretical framework regarding the application of Ambidexterity to the Open Innovation theory. The empirical analysis has been made upon a selection of four middle-sized Italian firms. The nature of the information acquired is essentially qualitative because of the limits of the sample. For this reason it was impossible to make any kind of statistical evaluation of the information acquired.

In order to perform a complete validation of the presented model of Open-Ambidexterity, a larger research should be conducted involving a higher number of innovative firms. Also the extension of the dataset to companies belonging to other innovative sectors would be desirable.

Further improvements of the analysis could also include a research on foreign firms which could provide both different points of view on the subject and better academic relevance.

During the analysis some evidence has been found regarding the relationship between company size and value chain positioning. It seems that basic research is more likely to be performed by either big multinational companies that have enough

human and economic resources, and small, highly innovative, academic startups and spinoffs. Middle-sized companies are instead more likely to concentrate on the development part of the process. Future research could investigate this aspect in order to provide a better definition of the Open Innovation subject.

REFERENCES

- *Azzone - 2006 - Sistemi di controllo di gestione. Metodi, strumenti e applicazioni - ETAS - Book*
 - *Banca D'Italia - AAVV - 1994 - Proprietà, modelli di controllo e riallocazione nelle imprese industriali - Report*
 - *Birkinshaw, Gibson - 2004 - Building ambidexterity into an organization - Sloan Management Review, Vol. 45, pp. 47-55 - Article*
 - *Bonner, Walker - 2004 - Selecting influential business-to-business customers in new product development: relational embeddedness and knowledge heterogeneity considerations - Journal of Product Innovation Management, Vol. 21, Issue 3, pp. 155–169 - Article*
 - *Cao, Gedajlovic, Zhang - 2009 - Unpacking organizational ambidexterity: dimensions, contingencies, and synergistic effects - Organization Science, Vol. 20, No. 4, pp. 781-796 - Article*
 - *Carpenter, Petersen - 2002 - Capital market imperfections, high-tech investment, and new equity financing - Economic Journal, Royal Economic Society, Vol. 112, pp. F54-F72 - Article*
 - *Chang, Yang, Chen - 2009 - The determinants of academic research commercial performance: towards an organizational ambidexterity perspective - Research Policy, Vol. 38, pp. 936-946 - Article*
 - *Chesbrough - 2003 - Open Innovation: The New Imperative for Creating and Profiting from Technology - Harvard Business School Press - Book*
-

REFERENCES

- *Chesbrough - 2006 - Open Innovation: researching a new paradigm - Oxford University Press - Book*
 - *Chesbrough - 2006b - Why companies should have open business models - MIT Sloan Management Review, Vol. 48, Number 2, pp. 22-28 - Article*
 - *Chesbrough - 2007 - Open business models: how to thrive in the new innovation landscape - Harvard Business School Press - Book*
 - *Chesbrough, Rosenbloom - 2002 - The role of the business model in capturing value from innovation: evidence from Xerox Corporation's technology spin-off companies - Industrial and Corporate Change, Vol. 11, No. 3, pp. 529-555 - Article*
 - *Chiaroni, Chiesa, Frattini - 2008 - Patterns of collaboration along the bio-pharmaceutical innovation process - Journal of Business Chemistry, Vol. 5, No. 1, pp. 7-22 - Article*
 - *Christensen - 2006 - Whither core competency for the large corporation in an Open Innovation world? - in Open Innovation: Researching a New Paradigm, Oxford University Press, pp. 35-61 - Book*
 - *Christensen, Olesen, Kjær - 2005 - The industrial dynamics of Open Innovation: evidence from the transformation of consumer electronics - Research Policy, Vol. 34, pp. 1533-1549 - Article*
 - *Cohen, Levintal - 1989 - Innovation and Learning: the two faces of R&D - Economic Journal, Royal Economic Society, Vol. 99, pp. 569-596 - Article*
 - *Cohen, Levintal - 1990 - Absorptive capacity: a new perspective on learning and innovation - Administrative Science Quarterly, Vol. 35, No. 1, pp. 128-152 - Article*
-

REFERENCES

- *Dahlander, Gann - 2008 - How open is innovation? - Research Policy, Vol. 39, Issue 6, pp. 699-709 - Article*
 - *Dalglish, Newton - 2001 - The relationship between firm survival and innovation: an introduction to the literature - Innovation: Management, Policy & Practice, Vol. 4, pp. 209-214 - Article*
 - *De Visser, De Weerd-Nederhof, Faems, Song, Van Looy, Visscher - 2010 - Structural ambidexterity in NPD processes: a firm-level assessment of the impact of differentiated structures on innovation performance - Technovation, Vol. 30, Issues 5-6, pp. 291-299 - Article*
 - *Dodgson, Gann, Salter - 2006 - The role of technology in the shift towards open innovation: the case of Procter&Gamble - R&D Management, Vol. 36, No. 3, pp. 333-346 - Article*
 - *Ettlie, Bridges, O'Keefe - 1984 - Organization strategy and structural differences for radical versus incremental innovation - Management Science, Vol. 30, No. 6, pp. 682-695 - Article*
 - *Fredberg, Elmquist, Ollila - 2008 - Managing Open Innovation - present findings and future directions - Chalmers University of Technology - VINNOVA Report*
 - *Gassman - 2006 - Opening up the innovation process: towards an agenda - R&D Management, Vol. 36, Issue 3, pp. 223-228 - Article*
 - *Gassman, Henkel - 2006 - Towards a theory of open innovation: three core process archetypes - R&D Management Conference - Conference Paper*
 - *Gaule - 2006 - Open Innovation in action: how to be strategic in the search for new sources of value - H-I Network - Book*
-

REFERENCES

- *Hagedoorn - 1993 - Understanding the rationale of strategic technology partnering: inter-organizational modes of cooperation and sectorial differences - Strategic management journal, Vol.14, pp. 371-385 - Article*
 - *Istat - 2010 - Struttura e dimensione delle imprese, anno 2008 - Report*
 - *Laursen, Salter - 2006 - Open for innovation: the role of openness in explaining innovation performance among U.K. manufacturing firms - Strategic Management Journal, Vol. 27, Issue 2, pp. 131–150 - Article*
 - *Lilien, Morrison, Searls, Sonnack, Von Hippel - 2002 - Performance assessment of the lead user idea-generation process for new product development - Management Science, Vol. 48, No. 8, pp. 1042-1059 - Article*
 - *Koellinger - 2008 - The relationship between technology, innovation, and firm performance: empirical evidence from e-business in Europe - Research Policy, Vol. 37, Issue 8, pp. 1317-1328 - Article*
 - *Mac Duffie, Helper - 2005 - Collaboration in supply chains: with and without trust - Wharton School, U. of Pennsylvania - Article*
 - *Mansfield - 1990 - Academic research and industrial innovation - Research Policy, Vol. 20, Issue 1, pp. 1-12 - Article*
 - *March - 2001 - Exploration and Exploitation in organizational learning - Organization Science, Vol. 2, No. 1, pp. 71-87 - Article*
 - *Olson, Bakke - 2001 - Implementing the lead user method in a high technology firm: a longitudinal study of intentions versus actions - Journal of Product Innovation Management, Vol. 18, No. 6, pp. 388-395 - Article*
-

REFERENCES

- *O'Reilly III, Tushman - 2007 - Ambidexterity as a Dynamic Capability: Resolving the Innovator's Dilemma - Stanford University Graduate School of Business Research Paper, No. 1963 - Article*
 - *O'Sullivan - 2002 - Framework for managing business development in the networked organization - Computers in Industry, Vol. 47, Issue 1, pp. 77-88 - Article*
 - *Raisch, Birkinshaw, Probst, Tushman - 2009 - Organization strategy and structural differences for radical versus incremental innovation - Management Science, Vol. 30, No. 6, pp. 682-695 - Article*
 - *Reinganum - 1989 - The timing of innovation: Research, development, and diffusion - Handbook of Industrial Organization, Vol. 1, Chapter 14, pp. 849-908 - Book*
 - *Roberts - 1998 - Managing innovation: The pursuit of competitive advantage and the design of innovation intense environments - Research Policy, Volume 27, Issue 2, pp. 159-175 - Article*
 - *Roper, Du, Love - 2008 - Modelling the innovation value chain - Research Policy, Vol. 37, Issues 6-7, pp. 961-977 - Article*
 - *Rosenbloom, Spencer - 1996 - Engines of innovation: U.S. industrial research at the end of an era - Harvard Business School Press - Book*
 - *Rothaermel, Alexandre - 2009 - Ambidexterity in technology sourcing: the moderating role of absorptive capacity - Organization Science, Vol. 20, No. 4, pp. 759-780 - Article*
 - *Schumpeter - 1942 - Capitalism, socialism and democracy - Book*
-

REFERENCES

- *Van de Ven - 1986 - Central Problems in the Management of Innovation - Management Science, Vol. 32, No. 5, pp. 590-607 - Article*
 - *Von Hippel - 1988 - The sources of innovation - Oxford University Press - Book*
 - *Xu, Houssin, Caillaud, Gardoni - 2010 - Macro process of knowledge management for continuous innovation - Journal of Knowledge Management, Vol. 14, Issue 4, pp. 573 - 591 - Article*
 - *Zaltman, Duncan, Holbek - 1973 - Innovations and Organizations - John Wiley & Sons Inc. - Book*
 - *Zedwits, Gassman - 2002 - Market versus technology drive in R&D internationalization: four different patterns of managing research and development - Research Policy, Vol. 31, Issue 4, pp. 569-588 - Article*
-