



UNIVERSITÀ  
DEGLI STUDI  
DI PADOVA

Sede Amministrativa: Università degli Studi di Padova

Dipartimento di Tecnica e Gestione dei Sistemi Industriali (DTG)

SCUOLA DI DOTTORATO DI RICERCA IN: INGEGNERIA GESTIONALE ED ESTIMO

INDIRIZZO: INGEGNERIA GESTIONALE

CICLO: XXIII

**ANALYSIS OF AMBIDEXTERITY  
IN THE SEARCH PHASE OF INNOVATION PROCESS:  
A PRACTICE-BASED APPROACH**

**ANALISI DELL' AMBIDEXTERITY  
NELLA FASE DI SEARCH DEL PROCESSO INNOVATIVO:  
UN APPROCCIO "PRACTICE-BASED"**

**Direttore della Scuola:** Ch.mo Prof. Giuseppe Stellin

**Coordinatore d'indirizzo:** Ch.mo Prof. Cipriano Forza

**Supervisori:** Ch.mo Prof. Roberto Filippini

Ch.ma Prof.ssa Anna Nosella

**Dottoranda:** Silvia Cantarello

Both scholars and practitioners extensively acknowledge the importance of innovation in an economic environment that is characterized by rapid technological changes, compression of product and process life cycles, a surge in competition and the succession of economic booms and busts. Recent development of the innovation literature clearly indicates that there are many tensions, paradoxes and dilemmas associated with innovation activities. The studies published on the theme also demonstrate that understanding, managing and resolving these tensions are key points for realizing successful innovation and ensuring firms' survival.

How tensions get reconciled is therefore attracting increasing interest in the research community which has introduced the concept of ambidexterity to describe the capability of firms to achieve and manage conflicting activities by realizing high levels of both in a simultaneous way.

Although ambidexterity is a relatively young theme, today it has become a central concept in management research, receiving contributions from various literature research streams. The recent expansion of the theme, with many papers published in the last two years, has produced a great number of contributions which call for a synthesis of recent results and development. This dissertation thus opens with a systematic review of existing studies on ambidexterity by using also "bibliometric analysis" techniques. This analysis allowed us to map and summarize the results achieved on the issue and to highlight some important methodological and theoretical gaps: we would like to address some of them in this dissertation.

The literature analysis showed first that most existing empirical studies have focused on the one hand on demonstrating the positive effects of ambidexterity and on the other on identifying the enabling factors of such a capability. How firms can develop, nurture and sustain ambidexterity capability, however, still remains a major point of discussion and the need for additional conceptual and empirical investigations about this issue persists.

Second, existing studies on ambidexterity, have identified three main solutions for resolving tensions: the structural separation of units for dealing with tensions (structural solution), the creation of a context where employees are encouraged to perform contradictory tasks at the same time (contextual solution) and the critical role played by managers in sustaining and guiding ambidexterity. The literature review however outlines that researchers have mainly focused attention on one single solution while there are no works that consider the possibility that these solutions are complementary and can coexist in the same organization.

Finally, organizations are recognized as being in continuous interaction with their competitive environment, and they co-evolve with it by reconfiguring their activities and design to meet environmental changes. It therefore appears unlikely that one single design

would provide the exhaustive functionality required to deal with the entire range of boundary conditions and new tensions that an organization faces over time. However, there are no studies that take a temporally sensitive perspective, capturing ambidexterity's co-evolution with the organization's environment.

Based on these considerations, the need for further studies aimed at analyzing how companies can achieve ambidexterity and how ambidexterity co-evolves with the competitive environment clearly emerges.

To better reveal the complexity of the phenomenon, the use of a more fine-grained unit of analysis is strongly recommended: using a granular level of analysis (as opposed to what has been done in empirical studies which adopt the firm or the business unit as the level of analysis) makes it possible to really answer the "how" question of such a complex phenomenon. Shifting the focus from the organization level to a more fine-grained level – such as a single organizational process, project or phase - can also open up interesting areas of research by allowing a more detailed picture to be depicted of the dynamics and mechanisms that lie at the basis of the development of ambidexterity capability. However, studies that examine ambidexterity at a micro level are relatively scarce.

Following these suggestions, we therefore decided to analyse ambidexterity capability in the "search phase" of the innovation process (early phase). This phase is in fact characterized by the tension between searching for knowledge that deepens and improves firms' existing core knowledge (Local Search) and simultaneously searching for completely new and unfamiliar knowledge that expands the existing knowledge base of the firm (Distant Search). How firms can deal with this tension, and therefore succeed in building ambidexterity capability in the search phase, is therefore the focus of this dissertation.

Consistent with the definition of capabilities as "constituted in the everyday practices", we have additionally decided to focus the attention on the analysis of the practices through which firms search for knowledge. Adopting a practices-based perspective represents in fact a worthwhile tool that allows us to obtain a closer understanding of complex and multifaceted phenomena such as ambidexterity capability.

Therefore our research questions are:

1. Are there any differences, in terms of search practices, between firms that show ambidexterity capability in the search phase of the innovation process and firms that do not show such a capability? What are these differences?
2. How can firms succeed in realizing ambidexterity capability in the search phase?
3. How does the achievement of ambidexterity capability change while co-evolving with the external environment?

In order to answer these research questions we followed a combined research approach. Given the different forms of the research questions (the first research question is a "What" form of question, while research questions two and three are a "How" form of question), two different methodologies are in fact used. The research approach of this dissertation can thus be broadly divided into two parts: a first part which aims to answer the first research question through a survey methodology where search practices (practices used to carry out the search for knowledge) are treated as a "black-box" and a second part that answers research questions two and three by adopting a case study methodology where the internal structure of search practices is examined.

To answer the first question we created a questionnaire designed to investigate the use of a set of practices for searching for knowledge with a double purpose: to generate knowledge in order to improve the knowledge base already present in the firm - "Local search" - or create completely new knowledge and expand the existing knowledge base of the company - "Distant search". The questionnaire also includes scales designed to measure the ambidexterity capability during the search phase. The questionnaire, which has been sent to a sample of Italian medium-high tech companies, allowed us to obtain a picture of the use of different practices for the generation of both local and distant knowledge. Through an exploratory factor analysis we have additionally identified reliable, valid and one-dimensional measures of search, linked to its two dimensions: "local search" and "distant search". The analysis conducted on the data, cluster analysis and comparison of clusters have also allowed us to verify that indeed there are differences between ambidextrous and non-ambidextrous firms in the search phase, and to identify the distinctive characteristics of those firms that have developed this capability, thus answering the first research question.

To answer the second and third research questions we have instead adopted a qualitative methodological approach. The qualitative research has involved one high-tech Italian firm, with the purpose of delving into how tensions that arise during the search phase of innovation process are managed and resolved. The case study has been conducted by adopting a longitudinal approach, through numerous interviews aimed at grasping the changes that have affected the search activities and the consequent achievement of ambidexterity. The case study has contributed to the literature on ambidexterity capability in two main ways. On the one hand it has enabled us to identify a potential three-phased process followed by the firm in achieving ambidexterity. On the other, the case study has clearly shown that there is no one single ambidextrous configuration that makes it possible to support all the environmental conditions that the organization must deal with over time. In other words, the organizational solution adopted to achieve ambidexterity changes over time, also depending on some features of the external environment.



Studiosi e managers ampiamente riconoscono l'importanza dell'innovazione per sopravvivere e competere in un ambiente competitivo sempre più turbolento e caratterizzato da rapidi cambiamenti tecnologici, da un aumento della concorrenza, dal susseguirsi di eventi improvvisi e spesso imprevedibili. Gli sviluppi più recenti della letteratura sull'innovazione indicano chiaramente che l'attività innovativa è caratterizzata da una serie di tensioni, paradossi e dilemmi: gli studi pubblicati sull'argomento dimostrano come la comprensione, gestione e risoluzione di tali tensioni rappresentino punti chiave per realizzare innovazioni di successo e per garantire la sopravvivenza delle imprese nel lungo termine, in particolare delle imprese appartenenti a settori high-tech.

Di conseguenza, nell'ultimo decennio, il tema della risoluzione delle tensioni sta destando sempre più interesse nella comunità scientifica, la quale ha introdotto il concetto di ambidexterity per descrivere la capacità delle imprese di gestire attività contrastanti realizzando alti livelli di entrambe in modo simultaneo.

Oggi l'ambidexterity rappresenta dunque uno dei temi centrali negli studi di Management, il quale sta registrando una crescita esponenziale di contributi sia empirici che teorici provenienti da diversi filoni di ricerca quali ad esempio l'"organization design", l'"organizational learning", l'"innovation management", lo "strategic management". Ne consegue che il dibattito sul tema, inizialmente focalizzato, sta diventando oggi sempre più complesso e sconnesso. Il presente lavoro si apre quindi con una revisione sistematica degli studi realizzati sul tema dell'ambidexterity, avvalendosi anche di tecniche di analisi bibliometrica. Questa analisi ha permesso di mappare e sintetizzare i risultati raggiunti sul tema e di evidenziare alcuni importanti gap sia di natura teorica che di natura metodologica.

In primo luogo emerge che gran parte degli studi esistenti, i quali utilizzano principalmente approcci quantitativi, si sono concentrati da un lato a dimostrare gli effetti positivi dell'ambidexterity e dall'altro a identificare i fattori che permettono di realizzare tale capacità. Come le aziende possono sviluppare, coltivare e sostenere capacità ambidestre rimane tuttavia una questione non ancora ben analizzata.

In secondo luogo, gli studi esistenti presentano tre principali soluzioni per la risoluzione delle tensioni: la creazione di unità dedicate fisicamente separate (soluzione strutturale), la creazione di un contesto nel quale i dipendenti sono incoraggiati a perseguire contemporaneamente obiettivi contrastanti (soluzione contestuale) ed infine il ruolo critico dei managers nel sostenere e guidare l'ambidexterity. La revisione della letteratura fa tuttavia emergere che gli studiosi tendono a focalizzare l'attenzione principalmente su una soltanto di queste soluzioni, mentre mancano studi che considerano la possibilità che le diverse soluzioni siano complementari e possano coesistere all'interno della stessa organizzazione.

Infine, è ampiamente riconosciuto che le organizzazioni interagiscono continuamente con un ambiente competitivo in evoluzione, cui devono essere in grado di adattarsi per sopravvivere in un'ottica di co-evolution. Appare dunque improbabile che una singola configurazione organizzativa riesca a soddisfare un ambiente competitivo che cambia e le conseguenti nuove tensioni che l'organizzazione deve affrontare. Gli studi esistenti adottano tuttavia una visione statica nell'analizzare l'ambidexterity; mancano studi che utilizzino una prospettiva longitudinale, in grado di affrontare questo problema, di analizzare cioè come l'ambidexterity evolve, in modo dinamico, con l'ambiente esterno.

Sulla base di queste considerazioni è emersa la necessità di ulteriori studi rivolti ad analizzare da un lato come le imprese riescono a realizzare l'ambidexterity e dall'altro come l'ambidexterity co-evolve con l'ambiente competitivo.

Per rivelare la complessità del fenomeno si è deciso di utilizzare un livello di analisi più "granulare". Diversamente da quanto fatto negli studi empirici esistenti, che adottano l'impresa o la business unit come unità di analisi, utilizzare un livello di analisi più circoscritto - un unico processo organizzativo, progetto o fase (per esempio la fase di search del processo innovativo) - permette infatti di studiare con maggior accuratezza come un fenomeno così complesso viene generato ed evolve nel tempo. Spostare il focus da un livello macro a livelli sempre più micro può inoltre aprire interessanti aree di ricerca, permettendo di delineare un'immagine dettagliata delle dinamiche e dei meccanismi che si trovano alla base dell'ambidexterity capability.

Sulla base di queste considerazioni abbiamo pertanto deciso di studiare l'ambidexterity nella fase di "search" del processo innovativo (definita anche early phase). Questa fase infatti è caratterizzata dalla tensione tra la ricerca di conoscenza che approfondisce e migliora la base di conoscenza esistente in azienda (Local Search) e la simultanea ricerca di conoscenza completamente nuova e lontana dalla base di conoscenze esistente in azienda (Distant Search). Come le imprese possono affrontare e gestire questa tensione, e quindi costruire l'ambidexterity capability nella fase di search, è il focus di questa tesi.

Coerentemente con la definizione di capability che vengono designate come il risultato di "everyday practices", abbiamo inoltre deciso di focalizzare l'analisi sulle pratiche messe in atto dalle imprese per ricercare conoscenza. Adottare una prospettiva "practices-based" rappresenta infatti un approccio valido per conseguire una migliore comprensione di fenomeni complessi e multiformi come l'ambidexterity.

Le domande fondamentali alla base di questa ricerca sono pertanto:

1. Esistono differenze, in termini di pratiche per il search, tra le imprese che hanno sviluppato capacità ambidestre nella fase di search ed imprese che non presentano tale capacità? Quali sono queste differenze?
2. Come possono le imprese realizzare l'ambidexterity nelle prime fasi del processo innovativo?
3. Come cambiano le soluzioni organizzative adottate dalle imprese per il raggiungimento dell'ambidexterity, co-evolvendo con l'ambiente competitivo?

Al fine di rispondere alle domande di ricerca sono stati utilizzati due diversi approcci: un primo approccio considera le pratiche per il search come una "black-box" per rispondere alla prima domanda di ricerca, mentre il secondo analizza le diverse dimensioni che costituiscono la struttura interna delle pratiche, per rispondere alla seconda ed alla terza domanda di

ricerca. Ai due approcci corrispondono due diverse metodologie di ricerca: studio quantitativo per l'approccio "black-box" e studio qualitativo per l'altro approccio.

Per rispondere alla prima domanda di ricerca è stato creato un questionario volto ad indagare l'utilizzo di un insieme di pratiche per il search con riferimento al duplice obiettivo che queste possono avere: generare conoscenza volta a migliorare la base di conoscenze già presente in azienda - "local search" - oppure generare conoscenza completamente nuova ed in grado di ampliare la base di conoscenze esistenti in azienda - "distant search". Il questionario comprende inoltre delle scale volte a misurare l'ambidexterity capability nella fase di search. Tale questionario, che è stato inviato ad un campione significativo di imprese italiane appartenenti a settori medium-high tech, ha dapprima permesso di ottenere un quadro sull'utilizzo delle diverse pratiche per la generazione di conoscenza. Tramite un'analisi fattoriale di tipo esplorativo, sono state inoltre identificate le dimensioni che descrivono il "local search" e "distant search"; tali dimensioni rispondono ai requisiti di attendibilità, validità e unidimensionalità. Le analisi condotte (cluster analisi e confronto dei clusters) hanno inoltre permesso di verificare che effettivamente esistono delle differenze tra imprese ambidestre e non ambidestre nel search e di identificare le caratteristiche distintive delle imprese che hanno sviluppato tale capacità, rispondendo pertanto alla prima domanda di ricerca.

Per rispondere alla seconda e alla terza domanda di ricerca è stato invece adottato un approccio metodologico di tipo qualitativo. L'indagine qualitativa ha coinvolto nello specifico una impresa high-tech italiana, con la finalità di indagare in profondità come essa è riuscita a gestire le tensioni che emergono nella fase di search del processo innovativo e, di conseguenza, a realizzare l'ambidexterity. Il caso è stato condotto secondo un'ottica longitudinale, con numerose interviste al top management finalizzate a cogliere i cambiamenti che hanno interessato le attività di search e le conseguenti soluzioni organizzative adottate per la realizzazione dell'ambidexterity. Lo studio di caso contribuisce alla letteratura sull'ambidexterity capability in due modi principali. Da un lato permette di delineare il processo tramite cui l'impresa riesce a realizzare l'ambidexterity colmando uno dei gap evidenziati dall'analisi della letteratura. Dall'altro lato il caso studio chiaramente mostra come non esista un' unica configurazione ambidestra che renda possibile sostenere tutte le condizioni ambientali che l'organizzazione deve affrontare nel corso del tempo. In altre parole, la soluzione organizzativa adottata per realizzare l'ambidexterity cambia nel corso del tempo, a seconda delle caratteristiche dell'ambiente esterno.



## ACKNOWLEDGEMENTS

This dissertation and related research could not have been realized without the support of many people to whom I address my most sincere thanks.

First of all, I would like to thank my mentors, Prof. Roberto Filippini and Prof. Anna Nosella, who have supported me throughout my doctoral journey. I firmly believe that I could not have received better support and I would like to express my deepest respect and gratitude to them. Even if they were very busy, they always found time to provide me with valuable and constructive feedback and advice on my research. Furthermore, I would like to thank them for all they have taught me: their passion for research and constant thirst for new knowledge, their openness, their determination and their outstanding experience are just a few of the aspects that I have been fortunate to be able to draw upon. In particular, I would like to stress the continuous encouragement and guidance I have received from Prof. Nosella. I have found her to be not only an excellent mentor, whose feedback was extremely valuable in designing and implementing my dissertation, but also a brilliant research colleague and a great friend during these three years: and I hope she will remain so.

Special thanks to Prof. Antonella Martini and her team at the University of Pisa (Dept. Electrical Systems and Automation). She is a member of the Innovation-Lab (Italy) and significantly contributed in the survey data collection process and in the creation of the report for the firms that answered the questionnaire. Thanks to her work we have been able to start creating an Italian network, in line with the aims of the international laboratory. I would like to thank her also for all the feedback and suggestions she gave me. Many thanks also to the whole “Innovation Lab” team and particularly to Prof. Bettina Von Stamm and Prof. John Bessant the main catalysts and supporters of this international initiative.

I would like to extend a special acknowledgement to all those who have acted as protagonists in making this dissertation possible.

In particular, the contributions of the Corporate R&D Manager and the Knowledge Manager at SAES Getters have been crucial. They have provided me with in-depth comments on the survey questionnaire as well as ongoing advice during the progression of the qualitative research at SAES Getters. They have proven to be extraordinarily involved and committed in the research and shared their experiences with great enthusiasm.

A special note and my warmest gratitude should also be extended to all the managers who have dedicated part of their precious time to completing the questionnaire. Without their contribution the achievements of this dissertation would not have been possible.

Furthermore, I would also like to thank my PhD colleagues who have made these years memorable and Prof. Cipriano Forza whose contribution has been pivotal to our PhD journey.

I must also extend my thanks to the working staff at the Department of Industrial Engineering - DTG (University of Padova).

Additionally, I would like to express my deepest gratitude towards my parents. My work would not have been possible without their love, support, understanding and limitless patience.

And finally, and not least, I wish to express my gratitude to a special person, Paolo. I have to thank him for having listened to me whenever I needed, for having kept me motivated, and for having put up with all my "crises". I hope we will share many more experiences and that he will be my life companion.

*Silvia C.*

# TABLE OF CONTENTS

<b>ABSTRACT</b> .....	<b>I</b>
<b>SOMMARIO</b> .....	<b>V</b>
<b>ACKNOWLEDGEMENTS</b> .....	<b>IX</b>
<b>TABLE OF CONTENTS</b> .....	<b>XI</b>
<b>LIST OF TABLES</b> .....	<b>XV</b>
<b>LIST OF FIGURES</b> .....	<b>XIX</b>
<b>1 INTRODUCTION</b> .....	<b>1</b>
<b>1.1 RESEARCH BACKGROUND</b> .....	<b>1</b>
1.1.1 THE “TRADE-OFF” AND THE “PARADOX” APPROACHES.....	2
1.1.2 “PUNCTUATED EQUILIBRIUM” AND “ORGANIZATIONAL AMBIDEXTERITY” .....	3
<b>1.2 LITERATURE GAPS AND RESEARCH OBJECTIVES IN BRIEF</b> .....	<b>4</b>
<b>1.3 OVERVIEW OF PHD RESEARCH</b> .....	<b>6</b>
<b>2 STATE OF THE ART OF THE AMBIDEXTERITY LITERATURE</b> .....	<b>9</b>
<b>2.1 INTRODUCTION</b> .....	<b>9</b>
<b>2.2 A SYSTEMATIC REVIEW METHODOLOGY</b> .....	<b>11</b>
2.2.1 DATA COLLECTION .....	12
2.2.2 IDENTIFYING THE “CORE” OF AMBIDEXTERITY LITERATURE .....	15
<b>2.3 DESCRIPTIVE DATA ANALYSIS</b> .....	<b>17</b>
2.3.1 ANNUAL DISTRIBUTION OF PAPERS.....	17
2.3.2 SELECTED JOURNALS FOR SOURCE ARTICLES .....	18
2.3.3 DISTRIBUTION OF ARTICLES BY CHOSEN METHODOLOGY.....	19

<b>2.4</b>	<b>AN OVERVIEW OF THE AMBIDEXTERITY DEFINITION .....</b>	<b>20</b>
2.4.1	AMBIDEXTERITY CHARACTERIZATION .....	21
2.4.2	AMBIDEXTERITY ATTRIBUTES .....	22
2.4.3	THE MAIN SOURCES OF VARIATION IN THE CONCEPTUALIZATION OF AMBIDEXTERITY .....	22
<b>2.5</b>	<b>BIBLIOMETRIC ANALYSIS .....</b>	<b>25</b>
2.5.1	CITATION AMONG THE DOCUMENTS .....	26
2.5.2	BIBLIOGRAPHIC COUPLING ANALYSIS .....	29
<b>2.6</b>	<b>AMBIDEXTERITY IN EMPIRICAL PAPERS .....</b>	<b>35</b>
2.6.1	OUTCOMES OF AMBIDEXTERITY .....	36
2.6.2	ENABLERS OF AMBIDEXTERITY .....	37
2.6.3	UNIT OF ANALYSIS.....	39
<b>2.7</b>	<b>DISCUSSION .....</b>	<b>40</b>
2.7.1	LIMITATIONS .....	42
<b>3</b>	<b>LITERATURE GAPS AND RESEARCH QUESTIONS .....</b>	<b>43</b>
<b>3.1</b>	<b>LITERATURE GAPS .....</b>	<b>43</b>
<b>3.2</b>	<b>PROBLEM FORMULATION.....</b>	<b>45</b>
3.2.1	RESEARCH FOCUS .....	46
3.2.2	THE SEARCH PHASE OF INNOVATION PROCESS .....	47
<b>3.3</b>	<b>RESEARCH QUESTIONS .....</b>	<b>48</b>
<b>4</b>	<b>RESEARCH METHODOLOGY .....</b>	<b>49</b>
<b>4.1</b>	<b>FOR EACH QUESTION, ITS METHODOLOGY.....</b>	<b>49</b>
<b>4.2</b>	<b>PART 1 - SURVEY METHODOLOGY DESCRIPTION.....</b>	<b>53</b>
4.2.1	PHASE I: PRELIMINARY INTERVIEWS WITH MANAGERS.....	54
4.2.2	PHASE II: "SEARCH PRACTICES QUESTIONNAIRE" DEVELOPMENT .....	55
4.2.2.1	Searching practices assessment .....	56
4.2.2.2	Ambidexterity measure.....	59
4.2.2.3	Pilot testing.....	61
4.2.3	THE SAMPLE .....	61
4.2.4	DATA COLLECTION .....	63
4.2.4.1	Data collection method.....	63
4.2.4.2	Data collection procedure .....	65
4.2.5	ANALYSIS PROCEDURE .....	66
4.2.5.1	Preliminary data analysis .....	67

4.2.5.2	Factor analysis .....	68
4.2.5.3	Validity and Reliability test .....	71
4.2.5.4	Cluster analysis and Mann-Whitney U-Test .....	73
<b>4.3</b>	<b>PART 2 – CASE STUDY METHODOLOGY DESCRIPTION .....</b>	<b>75</b>
4.3.1	WHAT TYPE OF CASE STUDY? .....	75
4.3.2	A SINGLE CASE STUDY DESIGN .....	77
4.3.2.1	A longitudinal approach .....	78
4.3.2.2	Selecting an appropriate organization .....	79
4.3.2.3	The unit of analysis .....	79
4.3.3	QUALITY OF CASE STUDY RESEARCH.....	80
4.3.3.1	Construct validity .....	81
4.3.3.2	Reliability .....	81
4.3.4	SEARCH INSTRUMENTS.....	82
4.3.4.1	Investigation framework 1: the dimensions of practices .....	82
4.3.4.2	Investigation framework 2: the dimensions of competitive environment .....	84
4.3.4.3	Data collection .....	86
<b>5</b>	<b>SURVEY RESULTS - SEARCH PRACTICES AND AMBIDEXTERITY, A BLACK BOX APPROACH. ....</b>	<b>89</b>
<b>5.1</b>	<b>THE DATA FOR THE ANALYSIS.....</b>	<b>89</b>
<b>5.2</b>	<b>PRELIMINARY ANALYSIS .....</b>	<b>90</b>
<b>5.3</b>	<b>FACTOR ANALYSIS .....</b>	<b>95</b>
5.3.1	LOCAL AND DISTANT SEARCH DIMENSIONS: RESULTS OF EXPLORATORY FACTOR ANALYSIS .....	95
5.3.1.1	Emerging dimensions for Distant Search .....	96
5.3.1.2	Emerging categories for Local Search .....	106
5.3.2	CONFIRMATORY FACTOR ANALYSIS (CFA) ON “EXPLORATION COMPETENCE” AND “EXPLOITATION COMPETENCE” SCALES.....	113
<b>5.4</b>	<b>CLUSTERS IDENTIFICATIONS AND COMPARISON.....</b>	<b>121</b>
<b>5.5</b>	<b>DISCUSSION.....</b>	<b>127</b>
<b>5.6</b>	<b>FROM A BLACK-BOX TOWARDS UNPACKING PRACTICES.....</b>	<b>132</b>
<b>6</b>	<b>CASE STUDIES RESULTS - FROM PRACTICES TOWARDS AMBIDEXTERITY, OPENING THE BLACK BOX. ....</b>	<b>133</b>
<b>6.1</b>	<b>THE FIRM SELECTED: SAES GETTERS S.P.A. ....</b>	<b>133</b>
6.1.1	SAES BUSINESS DESCRIPTION.....	136

6.1.2	SOME MOTIVATIONS FOR THE SELECTION OF SAES GETTERS S.P.A. ....	137
<b>6.2</b>	<b>FINDINGS.....</b>	<b>139</b>
6.2.1	STAGE 1 (UP UNTIL 1970).....	140
6.2.1.1	Competitive environment .....	140
6.2.1.2	Strategic intent and search tensions .....	143
6.2.1.3	The resolution of the search tensions: realizing Ambidexterity.....	145
6.2.2	STAGE 2 (1971 - 2007) .....	147
6.2.2.1	Competitive environment .....	147
6.2.2.2	Strategic intent and search tensions .....	151
6.2.2.3	The resolution of the search tensions: realizing Ambidexterity.....	152
6.2.3	STAGE 3 (2008 ONWARDS).....	159
6.2.3.1	Competitive environment .....	159
6.2.3.2	Strategic intent and search tensions .....	162
6.2.3.3	The resolution of the search tensions: realizing Ambidexterity.....	163
<b>6.3</b>	<b>DISCUSSION .....</b>	<b>166</b>
6.3.1	FIRST PHASE: RECOGNIZE.....	168
6.3.2	SECOND PHASE: (RE-)CONFIGURE.....	170
6.3.3	THIRD PHASE: EXECUTE AND INTEGRATE .....	172
<b>7</b>	<b>CONCLUSIONS AND IMPLICATIONS.....</b>	<b>175</b>
7.1	ANSWER TO RESEARCH QUESTIONS .....	175
7.2	THEORETICAL CONTRIBUTIONS .....	178
7.3	PRACTICAL CONTRIBUTIONS.....	180
7.4	LIMITATIONS AND SUGGESTIONS FOR FUTURE RESEARCH .....	181
<b>8</b>	<b>APPENDIX A.....</b>	<b>183</b>
<b>9</b>	<b>APPENDIX B.....</b>	<b>187</b>
<b>10</b>	<b>REFERENCES .....</b>	<b>197</b>

## LIST OF TABLES

TABLE 1 - DISSERTATION STRUCTURE AND RESEARCH ACTIVITIES .....	7
TABLE 2 – EXISTING REVIEWS ON THE AMBIDEXTERITY THEME .....	10
TABLE 3 - TARGET DATABASES.....	13
TABLE 4 - SEARCHING CRITERIA IN SELECTED DATABASES.....	13
TABLE 5 - EXCLUSION CRITERIA.....	14
TABLE 6 – DISTRIBUTIONS OF PAPERS ACCORDING TO THE CONSTRUCT CENTRALITY .....	16
TABLE 7 - DISTRIBUTION OF THE NUMBER OF PUBLISHED ARTICLES BY YEARS AND SOURCE TITLE.....	19
TABLE 8 - PAPERS MAKING SUBSTANTIVE USE OF THE CONSTRUCT AND AVERAGING AT LEAST ONE LINK TO THE AMBIDEXTERITY LITERATURE PER YEAR. ....	27
TABLE 9 – FACTOR ANALYSIS RESULTS. ....	33
TABLE 10 – ROLE PLAYED BY AMBIDEXTERITY IN EMPIRICAL PAPERS .....	35
TABLE 11 – CODING SCHEMES .....	36
TABLE 12 – OUTCOMES OF AMBIDEXTERITY .....	37
TABLE 13 – ENABLING FACTORS .....	39
TABLE 14 – UNIT OF ANALYSIS .....	40
TABLE 15 - THREE CONDITIONS FOR THE CHOICE OF RESEARCH METHODS (ADAPTED FROM YIN, 2009).....	50
TABLE 16 – SELECTABLE METHODOLOGIES ON THE BASE OF THE RESEARCH QUESTION FORM .....	51
TABLE 17 – SOME MAIN SOURCES FOR EACH PRACTICE.....	58
TABLE 18 – “EXPLORATION COMPETENCE” AND “EXPLOITATION COMPETENCE” MEASURES ADOPTED FOR MEASURING AMBIDEXTERITY CAPABILITY WITHIN THE SEARCH PHASE .....	60
TABLE 19 – EFFECT SIZE, STATISTICAL POWER AND SAMPLE SIZE (FORZA, 2002) .....	63
TABLE 20 – ADVANTAGES AND DISADVANTAGES OF DATA COLLECTION TOOLS (FORZA, 2002).....	64
TABLE 21 – ANALYSIS CONDUCTED ON THE DATA COLLECTED.....	66
TABLE 22 – DIFFERENCES BETWEEN EXPLORATORY AND CONFIRMATORY FACTOR ANALYSIS (STEVENS, 1999) .	68
TABLE 23 - RECOMMENDED VALUE FOR FIT INDICES .....	73
TABLE 24 – CRITERIA FOR SELECTING A STATISTICAL TEST .....	75
TABLE 25 - MAIN OBJECTIVES AND CHARACTERISTICS OF THE THREE TYPES OF CASE STUDIES .....	77
TABLE 26 – CASE STUDY RESEARCH QUALITY TEST AND TACTICS (ADAPTED FROM YIN, 2009) .....	80

TABLE 27 - THE COMPETITIVE ENVIRONMENT DIMENSIONS .....	85
TABLE 28 – SOURCES OF EVIDENCE FOR THE CASE STUDY RESEARCH.....	87
TABLE 29 - EFFECT SIZE, STATISTICAL POWER AND SAMPLE SIZE (FORZA, 2002) .....	90
TABLE 30 – DESCRIPTIVE STATISTICS FOR “DISTANT SEARCH” PRACTICES .....	93
TABLE 31 - DESCRIPTIVE STATISTICS FOR “LOCAL SEARCH” PRACTICES.....	94
TABLE 32 - DESCRIPTIVE STATISTICS FOR “EXPLORATION COMPETENCE” AND “EXPLOITATION COMPETENCE” ..	94
TABLE 33 - KMO AND BARTLETT’S TESTS FOR “DISTANT SEARCH” .....	96
TABLE 34 - KMO AND BARTLETT’S TESTS FOR “LOCAL SEARCH” .....	96
TABLE 35 - AMOUNT OF VARIANCE EXPLAINED BY EACH FACTOR BASED ON EIGENVALUES.....	98
TABLE 36 - EXPLORATORY FACTOR ANALYSIS RESULTS FOR “DISTANT SEARCH” .....	100
TABLE 37 - CORRELATIONS BETWEEN THE SIX “DISTANT SEARCH” FACTORS.....	104
TABLE 38 – FIT INDICES VALUE FOR “DISTANT SEARCH” .....	104
TABLE 39 – ITEMS STATISTICS, INTER-ITEMS CORRELATIONS AND RELIABILITY TEST FOR “INTERNAL NETWORKING” .....	105
TABLE 40 – ITEMS STATISTICS, INTER-ITEMS CORRELATIONS AND RELIABILITY TEST FOR “MARKET SENTINEL” .	105
TABLE 41 – ITEMS STATISTICS, INTER-ITEMS CORRELATIONS AND RELIABILITY TEST FOR “ORGANIZATIONAL SUPPORT” .....	105
TABLE 42 – ITEMS STATISTICS, INTER-ITEMS CORRELATIONS AND RELIABILITY TEST FOR “IDEA COLLECTOR” ...	106
TABLE 43 – ITEMS STATISTICS, INTER-ITEMS CORRELATIONS AND RELIABILITY TEST FOR “OPENNESS TO EXTERNAL SOURCES” .....	106
TABLE 44 – ITEMS STATISTICS, INTER-ITEMS CORRELATIONS AND RELIABILITY TEST FOR “LISTENING TO THE CUSTOMER” .....	106
TABLE 45 - AMOUNT OF VARIANCE EXPLAINED BY EACH FACTOR BASED ON EIGENVALUES.....	107
TABLE 46 - EXPLORATORY FACTOR ANALYSIS RESULTS FOR “LOCAL SEARCH” .....	108
TABLE 47 - CORRELATIONS BETWEEN THE FOUR “LOCAL SEARCH” FACTORS .....	111
TABLE 48 – FIT INDICES VALUE FOR “DISTANT SEARCH” .....	112
TABLE 49 – ITEMS STATISTICS, INTER-ITEMS CORRELATIONS AND RELIABILITY TEST FOR “INTERNAL NETWORKING” .....	113
TABLE 50 – ITEMS STATISTICS, INTER-ITEMS CORRELATIONS AND RELIABILITY TEST FOR “LISTENING TO THE CUSTOMER” .....	113
TABLE 51 – ITEMS STATISTICS, INTER-ITEMS CORRELATIONS AND RELIABILITY TEST FOR “KNOWLEDGE COLLECTOR” .....	113
TABLE 52 - KMO AND BARTLETT’S TESTS FOR “EXPLORATION COMPETENCE” AND “EXPLOITATION COMPETENCE” .....	114
TABLE 53 - AMOUNT OF VARIANCE EXPLAINED BY EACH FACTOR BASED ON EIGENVALUES.....	115

TABLE 54 – CONFIRMATORY FACTOR ANALYSIS RESULTS FOR “EXPLORATION COMPETENCE” AND “EXPLOITATION COMPETENCE” .....	115
TABLE 55 - AMOUNT OF VARIANCE EXPLAINED BY EACH FACTOR BASED ON EIGENVALUES BY EXCLUDING ONE ITEM .....	116
TABLE 56 - CONFIRMATORY FACTOR ANALYSIS RESULTS FOR “EXPLORATION COMPETENCE” AND “EXPLOITATION COMPETENCE” BY EXCLUDING ONE ITEM.....	117
TABLE 57 - CORRELATIONS BETWEEN EXPLORATION AND EXPLOITATION COMPETENCES .....	118
TABLE 58 – FIT INDICES VALUES .....	118
TABLE 59 – ITEMS STATISTICS, INTER-ITEMS CORRELATIONS AND RELIABILITY TEST FOR “EXPLORATION COMPETENCE” .....	119
TABLE 60 – ITEMS STATISTICS, INTER-ITEMS CORRELATIONS AND RELIABILITY TEST FOR “EXPLOITATION COMPETENCE” .....	119
TABLE 61 - PERCENT OF CLUSTER CLASSIFICATIONS CORRECTLY CLASSIFIED AND CROSS-VALIDATION.....	122
TABLE 62 - CLUSTER ANALYSIS RESULTS: COMPARISON OF COMPETENCE EXPLORATION, COMPETENCE EXPLOITATION AND AMBIDEXTERITY MEANS BY CLUSTER. ....	123
TABLE 63 - DESCRIPTIVE STATISTICS.....	125
TABLE 64 - MANN WHITNEY U-TEST OUTPUT.....	127
TABLE 65 - MEAN VALUES OF THE DIFFERENT DIMENSIONS FOR AMBIDEXTROUS AND NON-AMBIDEXTROUS FIRMS WITHIN B2B, B2C AND BOTH B2B AND B2C GROUPS .....	130
TABLE 66 – TEST STATISTICS FOR B2B GROUP .....	131
TABLE 67 – TEST STATISTICS FOR B2C GROUP.....	131
TABLE 68 – TEST STATISTICS FOR B2B AND B2C GROUP .....	131
TABLE 69 - OVERVIEW OF SAES GETTERS GROUP’S MAIN CHARACTERISTICS (DATA FROM 2009) .....	134
TABLE 70 – SAES GROUP STRUCTURE .....	135
TABLE 71 – SAES’S OFFER DURING THE FIRST STAGE .....	141
TABLE 72 - THE COMPETITIVE ENVIRONMENT DURING STAGE 1 .....	142
TABLE 73 – SEARCH PRACTICES DIMENSIONS DURING STAGE 1.....	146
TABLE 74 - THE COMPETITIVE ENVIRONMENT DURING STAGE 2 .....	150
TABLE 75 - SUMMARY OF THE DIVISIONS ACCORDING TO AGGREGATES AND BUSINESS AREAS IN 2002.....	153
TABLE 76 - SUMMARY OF THE DIVISIONS ACCORDING TO BUSINESS UNITS AND BUSINESS AREAS IN 2004....	154
TABLE 77 - SUMMARY OF THE DIVISIONS ACCORDING TO BUSINESS UNITS AND BUSINESS AREAS IN 2005....	155
TABLE 78 – SEARCH PRACTICES DIMENSIONS DURING STAGE 2.....	158
TABLE 79 - THE COMPETITIVE ENVIRONMENT DURING STAGE 3 .....	162
TABLE 80 - SEARCH PRACTICES DIMENSIONS DURING STAGE 3 .....	165
TABLE 81 - OVERVIEW OF THE CHANGES IN THE COMPETITIVE ENVIRONMENT .....	169
TABLE 82 - SEARCH TENSIONS ACROSS THE THREE STAGES.....	169

TABLE 83 - ORGANIZATIONAL SOLUTIONS FOR RESOLVING TENSIONS AND THEIR CORRESPONDING INTEGRATION  
MECHANISMS ..... 172

TABLE 84 – AMBIDEXTERITY DEFINITIONS ..... 186

## LIST OF FIGURES

FIGURE 1 - DISTRIBUTION OF THE NUMBER OF PUBLISHED ARTICLES BY YEARS.....	17
FIGURE 2 - DISTRIBUTION OF PAPERS ACCORDING TO THE METHODOLOGY USED .....	20
FIGURE 3 - DESIGN OF THE EMPIRICAL ANALYSIS ON THE SOURCE PAPERS .....	26
FIGURE 4 - NETWORK OF CITATIONS BETWEEN THE SOURCE PAPERS.....	29
FIGURE 5 – BIBLIOGRAPHIC COUPLING ANALYSIS.....	30
FIGURE 6 – CO-CITATION ANALYSIS .....	30
FIGURE 7 - THE INNOVATION PROCESS .....	47
FIGURE 8 – DIFFERENT APPROACHES ADOPTED IN THIS DISSERTATION FOR STUDYING PRACTICES.....	52
FIGURE 9 – DATA COLLECTION PROCEDURE .....	65
FIGURE 10 - CONSTRUCT VALIDATION PROCESS (O’LEARY-KELLY AND VOKURKAR, 1998). .....	71
FIGURE 11 - THE DIMENSIONS OF PRACTICE (THE 7 Ps) .....	83
FIGURE 12 –DISTRIBUTION OF FIRMS IN THE DIFFERENT INDUSTRIES .....	91
FIGURE 13 – DISTRIBUTION OF FIRMS ACCORDING TO THEIR BUSINESS APPROACH.....	91
FIGURE 14 – SCREE PLOT FOR “DISTANT SEARCH” (EFA) .....	97
FIGURE 15 – “DISTANT SEARCH” DIMENSIONS MEAN VALUE BY INDUSTRY.....	102
FIGURE 16 - “DISTANT SEARCH” DIMENSIONS MEAN VALUE BY BUSINESS APPROACH .....	102
FIGURE 17 - SCREE PLOT FOR “LOCAL SEARCH” (EFA).....	107
FIGURE 18 - “LOCAL SEARCH” DIMENSIONS MEAN VALUE BY INDUSTRY .....	110
FIGURE 19 - “LOCAL SEARCH” DIMENSIONS MEAN VALUE BY BUSINESS APPROACH .....	110
FIGURE 20 - SCREE PLOT FOR “EXPLORATION COMPETENCE” AND “EXPLOITATION COMPETENCE” SCALES ....	114
FIGURE 21 - “EXPLORATION COMPETENCE” AND “EXPLOITATION COMPETENCE” DIMENSIONS MEAN VALUE BY INDUSTRY .....	120
FIGURE 22 - “EXPLORATION COMPETENCE” AND “EXPLOITATION COMPETENCE” DIMENSIONS MEAN VALUE BY BUSINESS APPROACH .....	120
FIGURE 23 – FIRMS DISTRIBUTION ACCORDING TO “EXPLORATION COMPETENCE” AND “EXPLOITATION COMPETENCE” .....	122
FIGURE 24 - CLUSTER ANALYSIS RESULTS .....	123

FIGURE 25 – DIFFERENCES AMONG SEARCH DIMENSIONS BETWEEN AMBIDEXTROUS AND NON-AMBIDEXTROUS FIRMS IN THE SEARCH PHASE.....	125
FIGURE 26 – LAINATE ORGANIZATION FOR INNOVATION .....	135
FIGURE 27 - SAES GROUP RESEARCH AND INNOVATION EXPENSES .....	138
FIGURE 28 – SAES POSITIONING IN THE EXPLORATION/EXPLOITATION SPACE.....	139
FIGURE 29 - THE SEARCH SPACE IN SAES.....	144
FIGURE 30 - HOW SAES RESOLVED THE SEARCH TENSIONS AT THE END OF THE FIRST STAGE .....	147
FIGURE 31 - A SCHEMATIC REPRESENTATION OF SAES’S ORGANIZATION DURING THE SECOND STAGE .....	153
FIGURE 32 - HOW SAES RESOLVED THE SEARCH TENSIONS DURING THE SECOND STAGE .....	159
FIGURE 33 - SAES’S FUNDAMENTALS CHARTS.....	161
FIGURE 34 - HOW SAES RESOLVED THE SEARCH TENSIONS DURING THE THIRD STAGE .....	166
FIGURE 35 - THE INTERPRETATIVE MODEL FOR BUILDING AMBIDEXTERITY.....	168

# 1 INTRODUCTION

## 1.1 Research Background

Scholars, practitioners and society at large extensively acknowledge the importance of innovation in an economic environment characterized by aggressive competition, rapid changes and a succession of economic booms and busts. Competitive pressure and increasing aggressiveness of competitors, rapidly changing and disruptive environments, frequent technological turnovers and shortening of product life cycles are all factors that characterize many industries in a globalized economy and require firms to continuously reconfigure structures and processes and sustain stability through replication and optimization in order to ensure steady performance for actual customers and, at the same time, generate innovations in order to meet or create future demands (Grant, 1996; Volberda, 1996; Jansen, Van Den Bosch and Volberda, 2005; Boer, Kuhn and Gertsen, 2006).

Along the same line, recent literature on organizational innovation (Lewis, Welsh, Dehler and Green, 2002; King, Anderson and West, 1991; Benner and Tushman, 2003; Anderson and Gasteiger, 2007), clearly indicates that there are many tensions, paradoxes, contradictions and dilemmas associated with innovation activities: successful firms should be able to manage and resolve opposing strengths and survive in the so-called “dark side” of innovation. Bledow, Frese, Anderson, Erez, and Farr (2009) in their work list some of the many tensions associated with the innovation process: in their panel they include incremental versus radical innovation (Chandy and Tellis, 1998), exploration versus exploitation (March, 1991), alignment versus adaptability (Gibson and Birkinshaw, 2004), autonomy and control (Gebert, Boerner and Lanwehr, 2003), divergent thinking versus convergent thinking (Guilford, 1950), today versus tomorrow (Hamel and Prahalad, 1994), and many others.

Understanding and managing these conflicting demands and conflicting activities are key points for realizing successful innovations and thus guaranteeing firms’ competitiveness and survival. For these reasons, the literature on innovation management has recently started to become increasingly focused on how tensions can be reconciled (Cameron and Quinn, 1988; Poole and Van de Ven, 1989; Adler, Goldoftas and Levine, 1999; Brown and Duguid, 2001; Katila and Ahuja, 2002; Benner and Tushman, 2003; Dougherty, 1992; Eisenhardt and Martin, 2000; Levinthal and March, 1993; March, 1991, 1996, 2006; Raish and Birkinshaw, 2008; O’Reilly and Tushman, 2004, 2008). Different approaches to resolving tensions have then been proposed.

### 1.1.1 The “Trade-off” and the “Paradox” approaches

---

It is very challenging to make opposing strengths and competing goals, from which tensions originate, coexist within the same organization for the reason that they typically require the concurrent presence of fundamentally different strategies, contexts and organizational structures.

Earlier researches that have addressed this issue (Hannan and Freeman, 1977; McGill, Slocum and Lei, 1992; Miller and Friesen, 1986; Ghemawat and Costa, 1993; Bierly and Chakabarty, 1996; Denison, Hooijberg and Quinn, 1995) assumed that a choice between opposing alternatives is obligatory. Under this perspective, organizations have to choose to emphasize one side of the coin at the expense of the other by adopting an “either/or” approach. These researchers consider the trade-off solution as the only possible one, while the simultaneous attainment of both strengths is judged as impossible to realize. Although managers and academics once stressed that a choice must be inevitably made, the increased pace of technology, globalization, and complexity all render this “either/or” strategy more and more ineffective thus leading to a shift in the way of thinking about tensions.

More recently, both academics and practitioners are in fact increasingly motivated to adopt a different approach, a “both/and” approach, supporting the concept that some synergies between the two poles exist (Lewis, 2000). As an example, Levinthal and March (1993), when dealing with the tension between exploration and exploitation, clearly point out that long-term survival and success depend on an organization’s ability to “engage in enough exploitation to ensure the organization’s current viability and to engage in enough exploration to ensure future viability” (Levinthal and March, 1993, p. 105). They argue that an organization that engages too much in exploitation, drives out exploration, which in turn leads to organizational inertia, competency traps, and the conversion of core capabilities into core rigidities and obsolescence. On the other hand, too much exploration, without rationalization, development and refinement, is the cause of many undeveloped ideas, of neglecting to improve and adapt existing routines and may thus prevent the organization from benefiting from economies of scale. In this way, the debate concerning the resolution of opposing strengths has moved from a trade-off approach to paradoxical thinking

In a special topic forum on *‘Paradox, spirals, and ambivalence: The new language of Change and Pluralism’*, Eisenhardt (2000) defines a paradox as “the simultaneous existence of two inconsistent states” (Eisenhardt, 2000, p. 703). Similarly, Lewis (2000) defines a paradox as the simultaneous existence of “contradictory yet interrelated elements” (Lewis, 2000, p. 760). Rather than aiming at compromising between opposite poles, where the organization chooses the right mix of opposites, Eisenhardt (2000, p. 703) posits that “vibrant organizations, groups, and individuals change by simultaneously holding the two states”. This duality of coexisting tensions creates an edge of chaos, not a bland halfway point between one extreme and the other.

Increasingly, therefore, researchers recognize the importance of synchronizing seemingly contradictory tensions. The question now arises is: how is it possible to support these contradictions in a simultaneous way?

### 1.1.2 “Punctuated Equilibrium” and “Organizational Ambidexterity”

---

If there is a wide consensus on the positive impact of the simultaneous management of conflicting activities, there is however little agreement on the mechanisms through which the management of tensions is actually achieved (Gupta, Smith and Shalley, 2006). Several managerial strategies dealing with innovation tensions are in fact identified in the literature. Current organizational theory offers at least two concepts (Gupta, Smith and Shalley, 2006) that appear to be worthwhile for understanding how conflicting demands might be managed in the context of innovation in organizations: “*Punctuated Equilibrium*” and “*Ambidexterity*”.

In “*Punctuated Equilibrium*”, organizations resolve paradoxes by taking into account the role of time (Poole and Van de Ven, 1989; Gersick, 1991; Volberda, 1998; Weick, 1982; Tushman and Romanelli, 1985; Burgelman, 2002; Siggelkow and Levinthal, 2003; Vermeulen and Barkema, 2001). According to the punctuated equilibrium view, firms embark on temporary fluctuations between one pole and the other and from time to time realize the best fit between the organizational structure, roles, tasks and environmental demands. If, for example, we take into consideration the studies on technological change, it is widely demonstrated that technological progress constitutes an evolutionary system punctuated by discontinuous change. During periods of incremental change, organizations adapt to these changes by incrementally varying existing products, services, and markets: several incremental innovations are generated to improve existing dominant designs, enhance and extend the underlying technology, and increase scale or efficiency (Tushman and Anderson, 1986). Periods of incremental change, however, are punctuated by discontinuous change: discrepancies between the external environment and the internal context become so deep, that firms decide to realize significant changes and experience complete reorganization and strategic reorientation (Tushman and Anderson, 1986; Ohja, Brown and Phillips, 1997). In the punctuated equilibrium model, changes are quite dramatic and concern the entire organization. Given this wide scope and the breadth of changes, all decisions are taken at the highest hierarchical level and then passed to lower levels through a top-down process. All the changes are planned and formalized: “the change process becomes a sequence of events in which a person (a) determines or defines what currently exists (what is A), (b) determines or defines its replacement (Not-A), (c) engages in action to remove what is currently there, and (d) implants its replacement” (Ford and Ford 1994, p. 773). The output of the process is thus an entirely new organization endowed with new strategic objectives and processes (Gersick, 1991). This is an expensive and risky process: changes through punctuated equilibrium mechanisms are thus quite uncommon (Weick and Quinn, 1999; Gersick, 1991).

“*Ambidexterity*” (Tushman and O’Reilly, 1996; Smith and Tushman, 2005; Gibson and Birkinshaw, 2004) is an alternative organizational solution to punctuated equilibrium models. Whereas punctuated equilibrium proposes a sequential vision, the notion of ambidexterity proposes that the two conflicting logics can be simultaneously supported within the same organization (Gupta, Smith and Shalley, 2006). Ambidexterity is usually defined as the ability of individuals to simultaneously use both of their hands with equal skill. According to the Oxford English Dictionary, ambidexterity is composed by “ambi”, meaning

“both” and dexter, meaning “right”. Literally referring to the rare characteristic of some people being equally skilled in using their left and right hands rather than being either “right-handed” or “left-handed”, recent organizational theorists adopt this quality as a metaphor to describe the small number of organizations that succeed in effectively and efficiently managing tensions (Tushman and O'Reilly, 1996; Birkinshaw and Gibson, 2004; O'Reilly and Tushman, 2004; Lubatkin, Simsek, Ling and Veiga, 2006; Raisch and Birkinshaw, 2008).

It is on the ambidexterity solution that this thesis is focalized. According to the existing literature on the theme, we define ambidexterity as:

*The ability of a complex and adaptive system to achieve and manage conflicting activities by realizing high levels of both in a simultaneous way.*

This definition highlights the idea of dexterity that is, not only realizing conflicting activities but realizing both activities to their maximum. We exclude organizations that present low levels for both the elements that determine the tension: these in fact should be more properly defined as “balanced”, but not ambidextrous. Additionally, by adopting this definition, we limit our focus to a simultaneous approach, thus excluding the sequential or punctuated equilibrium solution (Gupta, Smith and Shalley, 2006).

## **1.2 Literature gaps and research objectives in brief**

Even though a growing number of researchers in management and organization studies have addressed the theme of ambidexterity capability, there are still significant gaps in understanding such a phenomenon.

Literature analysis showed that first, most existing empirical studies have focused on the one hand on demonstrating the positive effects of ambidexterity and on the other on identifying the enabling factors of such a capability. How firms can develop, nurture and sustain ambidexterity capability, however, still remains a major point of discussion and the need for additional conceptual and empirical investigations about how firms can be ambidextrous persists.

Second, existing studies on ambidexterity, have identified three main instruments solutions for resolving tensions: the structural separation of units for dealing with tensions (structural solution), the creation of a context where employees are encouraged to perform contradictory tasks at the same time (contextual solution) and the critical role played by managers in sustaining and guiding ambidexterity. The literature review however outlines that researchers have mainly focalized the attention on one single solution while there are no works that consider the possibility that all these aspects are complementary and can coexist in the same organization.

Finally, organizations are recognized as being in continuous interaction with their competitive environment, and they co-evolve with it, by reconfiguring their activities and design to meet environmental changes. It appears therefore unlikely that one single design would provide the exhaustive functionality required to deal with the entire range of

boundary conditions and new tensions that an organization faces over time. However, there are no studies that take a temporally sensitive perspective, capturing ambidexterity's co-evolution with the organization's competitive environment.

Based on these considerations, the need for further studies aimed at analyzing how companies can achieve ambidexterity and how ambidexterity co-evolves with the competitive environment clearly emerges.

To better reveal the complexity of the phenomenon, we decided to use a more fine-grained unit of analysis. Using a granular level of analysis - a single organizational process, project or phase -, as opposed to what has been done in empirical studies that adopt the firm or the business unit as level of analysis, makes it possible to really answer the "how" question of such a complex phenomenon for the reason that it allows a more detailed picture to be drawn of the dynamics and mechanisms that are at the basis of the development of the ambidexterity capability. However, studies that examine ambidexterity at a micro level are relatively scarce. Prior research on ambidexterity has typically focused on the macro levels, like the firm or business unit.

Following this suggestion, we therefore decided to analyze ambidexterity in the "search phase" of the innovation process (early phase). This phase is in fact characterized by the tension between searching for knowledge that deepens and improves firms' existing core knowledge (Local Search) and simultaneously searching for completely new and unfamiliar knowledge (Distant Search). How firms can deal with this tension, and therefore build ambidexterity capability in the search phase, is the focus of this dissertation.

Consistent with the definition of capabilities as "constituted in the everyday practices" (Orlikowski, 2000; Seo and Creed, 2002; Nicolini, Gherardi and Yanow, 2003; Antonacopoulou, 2007), we have therefore focused the attention on the analysis of the practices put in place by the firm in order to search for familiar, mature, current or proximate knowledge that builds on a firm's existing knowledge – Local Search - and for unfamiliar, distant and remote knowledge – Distant Search. Adopting a practices-based perspective would represent in fact a worthwhile tool to obtain a closer understanding and for providing a micro-foundation of complex and multifaceted phenomena such as ambidexterity.

Therefore our research questions are:

- 1. Are there any differences, in terms of search practices, between firms that show ambidexterity capability in the search phase of the innovation process and firms that do not show such a capability? What are these differences?*
- 2. How can firms succeed in realizing ambidexterity capability in the search phase?*
- 3. How does the achievement of ambidexterity capability change while co-evolving with the external environment?*

### 1.3 Overview of PhD Research

Table 1 provides an overview of the dissertation structure and the research activities involved in each of these chapters.

After this introductory chapter, *Chapter 2* provides a literature review pertaining to the ambidexterity capability. In this chapter, after analyzing the evolution of the conceptualization of organizational ambidexterity, we use bibliometric techniques to explore the structure of the field. The analysis provides a detailed overview on the current literature concerning the issue of ambidexterity, highlighting in particular the areas where research efforts have been more focused and those areas that require further study.

Building on the results of the literature review and bibliometric analysis described in Chapter 2, in *Chapter 3* some theoretical and methodological gaps in the ambidexterity literature are presented, followed by the research questions that will guide the empirical analysis.

*Chapter 4* explains the research methodology applied in this PhD study. In particular, this research follows a combined research approach to obtain answers to the formulated research questions. Given the different forms of the research questions (research question 1 is a “What” form of question, while research questions 2 and 3 are a “How” form of question), two different methodologies are in fact implemented. The research approach of this dissertation can thus be broadly divided into two parts:

- PART 1: the aim is to answer research question 1 through a survey methodology
- PART 2: the aim is to answer research questions 2 and 3 through a case study methodology

Both survey methodology and case study methodology use “practices for search knowledge” as the unit of analysis, adopting however two different approaches. In PART 1, whose intent is to link search practices with ambidexterity capability, practices are in fact treated as a “black-box”. In PART 2, where the objective is to understand the dynamics that lead to Ambidexterity Capability, we need in fact to look inside the practices and examine their internal structure.

*Chapter 5* has the objective of answering the first research question, namely to verify if significant statistical differences regarding search practices exist between firms that have realized ambidexterity capability in the search phase of the innovation process and firms that have not realized such capability. The chapter thus presents the results of the statistical analysis conducted on data collected through the survey described in Chapter 4. Specifically, after a preliminary analysis of the data the results of exploratory and confirmatory factor analysis, of cluster analysis and of the Mann-Whitney U Test are presented. Discussions of the results are also provided.

In *Chapter 6* our objective is to answer the second and third research questions: “How can firms succeed in realizing ambidexterity capability in the search phase?” and “How does the achievement of ambidexterity capability change while co-evolving with the external environment?” The chapter thus presents the analysis of a firm that has succeeded in building and maintaining ambidexterity capability in the search phase. After quickly presenting the firm selected, we present the results of the longitudinal case study by describing the search tensions and the organizational solutions put in place by the firm to

face such tensions across three historical stages. Discussions of the empirical evidence are provided at the end.

Finally, *Chapter 7* presents the overall conclusions of this dissertation and provides an overview of the theoretical implications for research on the ambidexterity capacity. The chapter concludes with limitations of the current empirical research which provide important avenues for future research.

<b>DISSERTATION STRUCTURE</b>		<b>RESEARCH ACTIVITIES</b>
Chapter 1	<i>Introduction</i>	Research overview
Chapter 2	<i>State of the art of the ambidexterity literature</i>	Systematic review of the literature on the ambidexterity theme
Chapter 3	<i>Literature gaps and research questions</i>	Literature gaps and research questions overview
Chapter 4	<i>Research methodology</i>	Methodology overview
Chapter 5	<i>Survey results - search practices and ambidexterity, a black box approach</i>	Survey results and discussion
Chapter 6	<i>Case studies results - from practices towards ambidexterity, opening the black box</i>	Case study results and discussion
Chapter 7	<i>Conclusions and implications</i>	Overall results, limitations, feedback and future research issues.

**Table 1** - Dissertation structure and research activities



## 2 STATE OF THE ART OF THE AMBIDEXTERITY LITERATURE

This chapter provides a literature review of ambidexterity capability theme. After analysing the evolution of the conceptualization of organizational ambidexterity, we use bibliometric techniques to explore the structure of the field. The analysis provides a detailed overview on the current literature concerning the issue of ambidexterity, highlighting in particular the areas where research efforts have been more focused and those areas that require further study.

### 2.1 Introduction

Ambidexterity is a relatively young theme that is becoming a central concept in management research, receiving contributions from various research streams such as organizational learning, technological innovation, organizational adaptation, strategic management, and organizational design. The reason for this growing interest, in particular during the last two decades, is that ambidexterity is widely recognized and proved to be a key capability in helping to ensure firm performances (March, 1991; Katila and Ahuja, 2002; Bierly and Daly, 2007; He and Wong, 2004).

Such a rapid growth and expansion of the organizational ambidexterity concept during the last years have embraced an extremely broad spectrum of concepts, often related to different research fields, thus determining different nuances about the meaning and measurement of the construct. Accordingly to Raish and Birkinshaw, *“the initially focused debate on organizational ambidexterity has become disconnected and complex thus making it difficult to flow into a new research paradigm in organizational theory”* (Raish and Birkinshaw, 2008, p. 376): there seems to be in fact a lack of transparency in the vocabulary used, in the conceptualization and in the operationalization of the ambidexterity construct, and in respect of the different tensions considered (Raish and Birkinshaw, 2008). Raish and Birkinshaw (2008) additionally believe that this abuse is more and more contributing to inefficient delivery system changes, construct validity problems in research methodology and tool development, and a general tone of doom.

As a consequence, if the different contributes are not integrated, there is a concrete risk of propagating a highly fractioned view of ambidexterity (Argote, McEvily and Reagans, 2003).

In recent years there have been some papers that have systematically analyzed the ambidexterity theme, examining its different configurations and developing some

conceptual models. Table 2 provides a brief summary of the goals of the literature review published in 2008 and 2009.

The review of Raisch and Birkinshaw (2008), starting from the analysis of twenty papers on the theme of ambidexterity, for example, proposes a conceptual model that relates antecedents, moderators and outcomes of OA. On the same line, Simsek (2009) elaborates a multilevel explanation of the construct by adopting an input-process-output framework which distinguishes among ambidexterity components or processes, outcomes or outputs, antecedents or inputs (at organizational, inter-firm and environmental levels). Finally, Simsek, Heavey, Veiga and Souder (2009) in their review synthesize the various insights on ambidexterity's conceptualization in extant research and delineate four archetypes of ambidexterity using two primary dimensions underlying previous conceptualizations of this construct.

However, these previous review studies are partial and fragmented, for the reason that they take into consideration only a restricted number of papers (twenty and twenty-nine). As a consequence, they give us selected pieces of the jigsaw but not the whole picture.

<i>REVIEW</i>	<i>COVERAGE (n° of studies examined)</i>	<i>GOAL</i>
<i>Raisch and Birkinshaw (2008)</i>	20	To develop a comprehensive model that covers research into the antecedents, moderators, and outcomes of organizational ambidexterity
<i>Simsek (2009)</i>	20	To offer a model that specifies a more encompassing, multilevel explanation of ambidexterity
<i>Simsek, Heavey, Veiga and Souder (2009)</i>	29	To specify, substantiate, and extend the ambidexterity construct by developing a typology that highlights two primary dimensions (temporal and structural dimensions) that differentiate various uses of ambidexterity in the literature

**Table 2 – Existing reviews on the ambidexterity theme**

Therefore, an effort to review and synthesize all existing studies in the ambidexterity theme by adopting a systematic review methodology is still missing.

We have thus decided to conduct a systematic review of the papers published on the ambidexterity theme with the aim of providing a comprehensive framework on the theme, that allows to make a picture of the collective understanding of ambidexterity at this point in time and to assess what directions might be fruitful for future research: we expect that such a review will help in identifying gaps in the literature and therefore suggesting useful insights for future research.

Our review of the literature in particular seeks to answer the following research questions:

- (1) Which is the “core” of research on ambidexterity: which are the papers that can be truly considered as shaping the ambidexterity literature?
- (2) How has ambidexterity been defined? What are the element that build up the ambidexterity construct? Has ambidexterity conceptualization changed over time? What are the main sources of this variation?
- (3) Is there cohesiveness within the research community on the theme?
- (4) Which are the subfields that constitute the intellectual structure of ambidexterity literature?
- (5) How has ambidexterity been analyzed in the empirical papers?

## 2.2 A Systematic Review methodology

The assumption behind the systematic review method is that, in order to deeply understand the relevance of one’s research, it is necessary to understand related research in as broad and deep manner as it is possible (Fink, 2009).

Subjective reviews on the other hand tend to be idiosyncratic. Subjective reviewers choose articles, often without justifying why they are selected, and they may give equal credence to good and poor studies. As a consequence, the results of subjective reviews are often based only on a partial examination of the available literature. When doing a systematic research review, instead, the researcher has to systematically examine all sources and accurately describe and justify what he is doing, thus enabling someone else to determine objectively whether to agree on the result of the review or not.

The systematic review methodology thus first requires a clearly formulated question, a systematic and explicit procedure for identifying, selecting, critically evaluating relevant contributions to the literature, and finally analysing data from the available studies that are included in the review.

When conducting a systematic literature review, there are therefore several principles that it is a good practice to follow (Pittaway, Robertson, Munir, Denyer, and Neely, 2004; Tranfield, Denyer and Smart, 2003):

- *Transparency*: each search of the available research studies should be recorded, including making explicit the criteria and judgements by which retrieved lists of studies are whittled down.
- *Repeatability*: the method and searches should be easily followed and to some extent repeated by others to test rigour and update findings.
- *Clarity*: a clear, stepped series of searches should be presented, allowing any reader a full “audit trail” of how the review gets to the final list of studies.
- *Focus*: the review should ensure that there is a close and persisting relationship between a clearly formulated question and the identification of primary evidence that informs and situates such a question.

- *Relevance*: by broadening the scope, and emphasising evidence and the quality of that evidence, the review should promote research activity that builds on it, rather than replicate other studies.
- *Accessibility*: the review should be made available outside of the specialist subject community in the form of reports and searchable databases.
- *Broad coverage*: the review should use systematic strings and protocols within increasingly sophisticated electronic databases and bibliographic software packages thus allowing reviewers to cover the plethora of places and forms of publication.

Building on these principles, in the subsequent paragraphs we present the procedure followed in searching, selecting and analysing existing works published on the ambidexterity theme.

### 2.2.1 Data collection

Data can be collected by the researchers in different ways such as engaging a panel of experts to identify relevant papers or using knowledge of the existing literature to select articles. In contrast with these arguably subjective collection methodologies, a systematic review approach, as used in this study, removes the subjectivity of data collection by using a predefined selection algorithm, described below.

The first step consists in the identification of the key data sources. To this purpose, it is important to point that we have decided to limit the review to published journal articles, both practitioner oriented and academic. We feel that looking beyond these sources would be more of a narrative rather than systematic process because of a lack of any access to searchable bibliographical databases covering reports, book chapters, website, etc. For this reason, several relevant databases, and in particular those with higher number of returns, are taken into consideration as possible sources of information: ABI Proquest, Business Source Premier, ISI Web of Science, Emerald, and PsycINFO Cambridge Scientific Abstracts, as illustrated in Table 3

	<b>DATABASES</b>	<b>DATABASES DESCRIPTION</b>
X	<i>ABI – Proquest</i>	The database includes details on virtually every aspect of business and management.
V	<i>Business Source Premier</i>	Business Source Premier, designed specifically for business schools and libraries, provides nearly 3,300 full text scholarly publications, including more than 1,000 peer-reviewed journals.
V	<i>ISI Web of Science</i>	More than 5,700 major journals across 164 scientific disciplines.

<b>V</b>	<b>Science Direct</b>	Experimental Sciences as well as Social Science.
<b>X</b>	<b>Emerald</b>	Over 100 individual management journals from Emerald Full text, covering the major management disciplines
<b>X</b>	<b>PsycINFO Cambridge Scientific Abstracts</b>	Academic studies and practice literature in psychology – includes relevant material from Social Science, HR and organisational behaviour

**Table 3 - Target databases**

Among these databases, we have selected those that are found to have greatest coverage coupled to functionality and full article access consequent upon institutional subscription patterns. Hence, the selected database are: *ISI Web of Science*, *Business Source Premier* and *Science Direct*. Scientific journals indexed by *ISI Web of Science*, *Business Source Premier* and *Science Direct* databases additionally include the most important and useful publications, with a wide coverage of managerial and organizational topics (Gauthier, 1998).

Given the differences among the search engines of these databases, we make use of slightly different search techniques for each of the three databases.

Table 4 reports details on the criteria adopted in the paper collection phase, started in September 2008 and continuously updated till June 2010.

	<b>KEYWORDS</b>	<b>N° OF ENTRIES</b>	<b>N° AFTER EXCLUSION CRITERIA</b>
<b>EBSCO Business Source Premier</b>	Title = (Ambidextrous) OR Title = (Ambidexterity)	81	44
	Abstract = (Ambidextrous) OR Abstract = (Ambidexterity)	131	67
	Keywords = (Ambidextrous) OR Keywords = (Ambidexterity)	28	22
	Subject = (Ambidextrous) OR Subject = (Ambidexterity)	0	0
	Full Text = (Ambidexterity) OR Full Text = (Ambidextrous)	177	90
<b>ISI Web of Science</b>	Title = (Ambidextrous) OR Title = (Ambidexterity)	88	37
	Topic = (Ambidextrous) OR Topic = (Ambidexterity)	297	74
<b>Science Direct</b>	Title = (Ambidextrous) OR Title = (Ambidexterity)	22	10
	Abstract = (Ambidextrous) OR Abstract = (Ambidexterity)	94	13
	Keywords = (Ambidextrous) OR Keywords = (Ambidexterity)	16	8
	Full Text = (Ambidexterity) OR Full Text = (Ambidextrous)	561	79
<b>TOT PAPERS AFTER THE APPLICATION OF EXCLUSION CRITERIA AND DUPLICATE ELIMINATION</b>			<b>117</b>

**Table 4 - Searching criteria in selected databases**

The literature searches yields many more than 500 papers.

However, only a few papers result to be relevant for our objective. So we have screened the articles retrieved, in order to get at the relevant articles, by setting criteria for inclusion into and exclusion from the review (Table 5). For example, we have eliminated papers published in journals without impact factor. The decision to limit our sources to empirical works published in IF journals is due to the fact that these journals can be considered validated knowledge and are likely to have the highest impact in the field under investigation (Podsakoff, MacKenzie, Lee and Podsakoff, 2005). Additionally, we have excluded papers that do not refer directly to managerial, or organizational topics. Finally, we have identified and eliminated duplicate studies.

<b>EXCLUSION CRITERIA</b>	<b>REASONS FOR EXCLUSION</b>
<b>1</b> <i>Pre-1996 articles</i>	Contributions to ambidexterity theme were published after 1996 (when Tushman and O'Reilly published their seminal paper)
<b>2</b> <i>Foreign language</i>	Exclude articles not written in English on grounds of its being in a non-native tongue
<b>3</b> <i>Papers without IF</i>	Impact Factor because these can be considered validated knowledge and are likely to have the highest impact in the field (Podsakoff et al., 2005).
<b>4</b> <i>Medicine, surgery, psychiatry, neurosciences</i>	It does not refer directly to managerial, or organisational knowledge
<b>5</b> <i>Education (students, teachers, pupils, schools, children, adults)</i>	It does not refer directly to managerial, or organisational knowledge
<b>6</b> <i>Microbiology, chemistry, etc.</i>	It does not refer directly to managerial, or organisational knowledge
<b>7</b> <i>Computer science, artificial intelligence, information science, software engineering, etc.</i>	It does not refer directly to managerial, or organisational knowledge
<b>8</b> <i>Materials science, nuclear science and technology, biophysics, etc.</i>	It does not refer directly to managerial, or organisational knowledge

**Table 5 - Exclusion criteria**

## 2.2.2 Identifying the “core” of ambidexterity literature

---

A critical first step in uncovering the underlying structure of a field is to identify its intellectual core, that is to detect those documents that can be truly considered as shaping and giving the major contribution to the development of the theory on ambidexterity (McCain, 1990).

In the literature, often researchers use citation analysis to identify the intellectual core of a research stream, assuming that citation counts are a valid measure of importance and influence (Ramos-Rodríguez and Ruíz-Navarro, 2004). This procedure, however, presents two drawbacks. First, the use of the relevance criterion favors older documents to the detriment of more recent ones. This entails a static view of the theory, and does not capture the new trends being shaped in recent years thus representing a problem when analysing a young literature streams such as ambidexterity. Secondly, the bibliometric analysis requires a prior demarcation of the journals through which the theory is disseminated: these journals also publish papers corresponding to other theory trends and, conversely, some relevant works might have been published in other journals.

To avoid these problems, we use a method inspired by the work of Lane, Koka and Patack (2006). We therefore classifies each of the 117 papers retrieved in the databases, according to the centrality of the ambidexterity construct to the paper’s core topic by assigning a value, ranging from 1 to 6. The six categories used for this criterion, from the most central on ambidexterity to the least, are:

- 1) “The paper extends the construct’s definition”
- 2) “The paper is centred on the theme and its dynamics”
- 3) “The construct is part of the paper’s hypotheses and/or model”
- 4) “The construct is instrumental in developing the logic for the paper’s propositions or hypotheses”
- 5) “The paper uses the construct to explain the results”
- 6) “The paper uses the construct as a minor citation”.

The analysis of how central is ambidexterity theme to the paper’s core topic shows that about the 31.6 percent of the studies use the construct as a minor citation, with little or no discussion while the 21.4 percent use it only with the objective of explaining paper’s results (Table 6).

	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>
<b><i>CENTRALITY OF THE CONSTRUCT</i></b>	<i>The paper extends the construct's definition</i>	<i>The paper is centered on the theme and its dynamics</i>	<i>The construct is part of the paper's hypotheses</i>	<i>The construct is instrumental for the paper's propositions</i>	<i>The paper use the construct to explain the results</i>	<i>The paper uses the construct as a minor citation</i>
<b>NUMBER OF PAPERS</b>	<b>6</b>	<b>22</b>	<b>17</b>	<b>10</b>	<b>25</b>	<b>37</b>
	5.1 %	18.8 %	14.5 %	8.6 %	21.4 %	31.6%

**Table 6 – Distributions of papers according to the construct centrality**

Code 5 and 6 thus count for more than the 50 percent of the papers. For the 8.6 percent of papers ambidexterity plays an instrumental role in the development of the hypothesis or propositions. The remaining 38.4 percent groups those papers that are more centred on the theme and the dynamics that determine it or extend and refine the construct's definition (codes 1, 2 and 3). Almost half of these papers (about the 14.5 percent of the totality of papers) use the construct in the hypotheses. The number of papers that extend or refine the concept results to be quite limited: additionally, such studies are prevalently theoretical works.

The following analysis are limited to those contributions to the ambidexterity literature recognized as being the most influential (coding 1, 2 and 3). So, a total amount of 45 papers is fixed as the basis for all subsequent analysis.

In the paragraphs that follow we therefore first provide a descriptive analysis of our sample of papers (Paragraph 2.2). We then present an overview of the ambidexterity intellectual "core" in order to identify the main sources that made the initially focused debate on organizational ambidexterity to become quite disconnected, by looking at the different definitions of ambidexterity provided (Paragraph 2.3). Then we verify the cohesiveness within the research community and we describe the structure of the ambidexterity literature both quantitatively and visually by involving a series of objective, unobtrusive and quantitative techniques (bibliometric analysis) (Paragraph 2.4). Finally we focalize the attention on empirical papers and analyzed the level of analysis adopted and the role played by ambidexterity (distinguishing between papers that analyze the antecedents of ambidexterity and papers that are focused on the outputs associated to ambidexterity in empirical works (Paragraph 2.6).

## 2.3 Descriptive Data Analysis

In this paragraph we provide a description of the papers sample on the base of their year of publication, journal selected for publication and methodology implemented by the 45 papers that we classified as the “core” of the ambidexterity literature.

### 2.3.1 Annual distribution of papers

It is in 1976 that Duncan introduces the term “ambidexterity” into the organizational and managerial fields describing as ambidextrous those organizations that establish multiple structures (“dual structures”) for coping with different tasks that may differ in terms of their complexity. Even if Duncan is widely considered the father of “organizational ambidexterity”, the main contributions to the conceptualization of the theme comes from the paper of Tushman and O’Reilly published in 1996 and titled “*Ambidextrous Organizations: managing evolutionary and revolutionary change*”.

By looking at the trend represented in Figure 1, it is possible to observe a six years long period following the date of publication of the Tushman and O’Reilly’s paper, from 1997 to 2002, which can be classified, in practice, as years of inactivity (only one paper published). Afterwards, some papers on the topic starts coming out since 2004, when Birkinshaw and Gibson publish their work “*Building ambidexterity into an organization*”. An exponential increase of the number of papers published then characterizes the last six years. From 2008 to 2009 in particular it is possible to find the most fertile years: many theoretical and empirical papers on the theme are written. This suggests that this field is still growing and there is wide room available for more research: ambidexterity is still an embryonic theme to nourish.

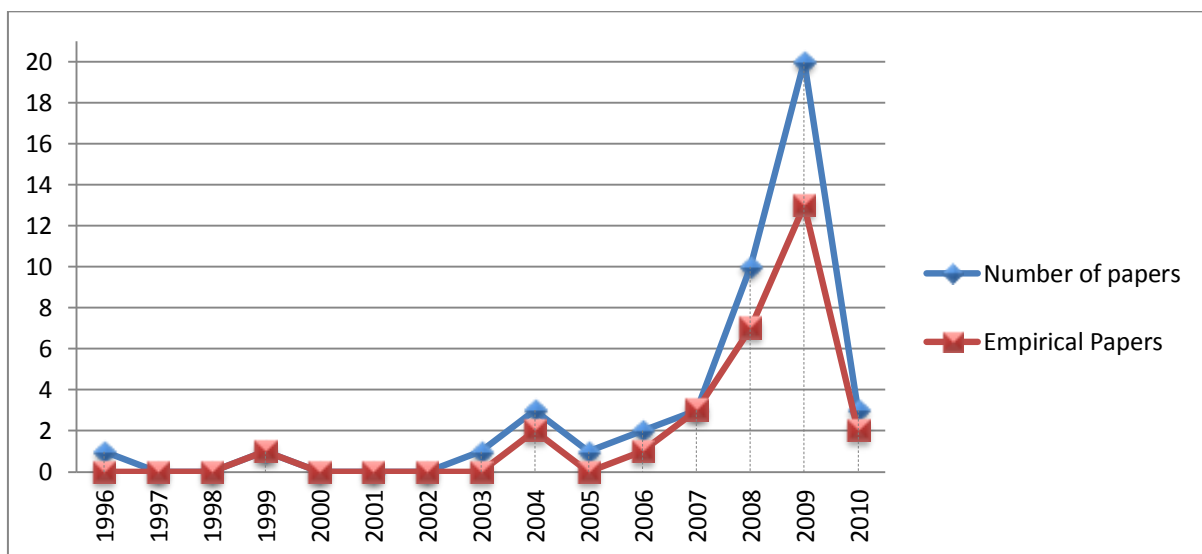


Figure 1 - Distribution of the number of published articles by years

### 2.3.2 Selected journals for source articles

Table 7 presents the distribution of these articles by journals and by years thus underlining the temporal evolution of publications in each journal. Analysing which journals the source documents are published in helps to characterize the body of literature of interest: journals are in fact assumed to have a limited scope, and, in this sense, they can be used as proxies to uncover theoretical fields. However, there can be specialized as well as general journals (Wallin, 2008).

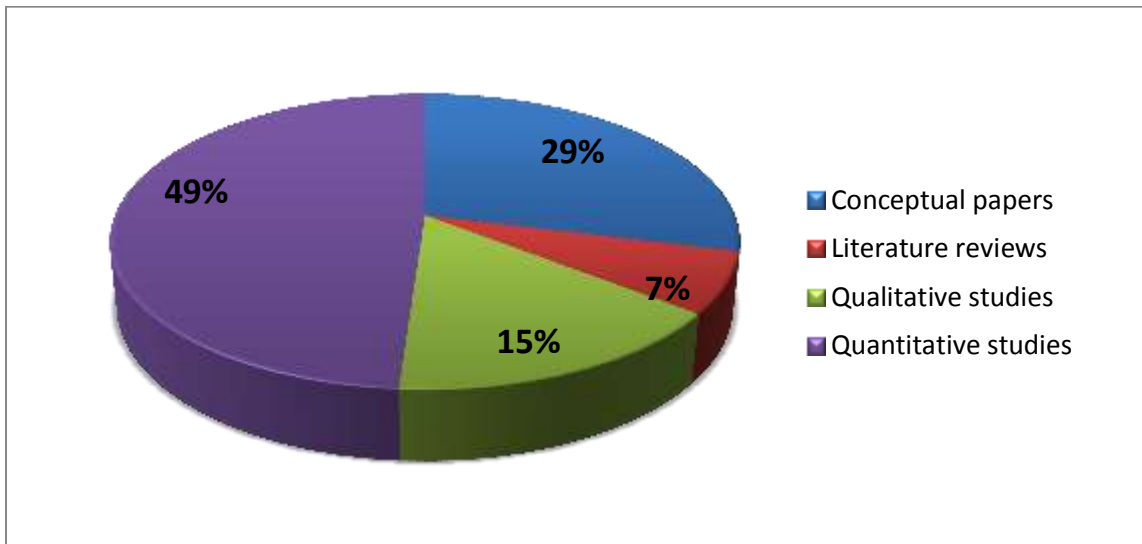
As we can notice from Table 7, the largest number of articles are published in “*Organization Science*” (widely recognized in the fields of strategy, management, and organization theory) and the runner-up is “*Journal of Management Studies*” (that publishes articles mainly on organization theory and behaviour, strategic and human resource management). Such Journals provide a great contribution to the theme in particular in 2009, when Organization Science publishes a special issue on the theme.

Journals such as “*Academy of Management Journal*”, “*Journal of Management*”, “*Leadership Quarterly*”, “*Long Range Planning*”, “*Management Science*” and “*Strategic Management Journal*” dedicate some attention on the topic in the last five years.

Fifteen out of twenty-three journals (about 65 percent) enter the dataset as source journals only one time. This list include Journals such as the “*International Journal of HRM*”, the “*Journal of Operation Management*”, “*Industrial Marketing Management*”, “*Entrepreneurship: Theory & Practice*”: these journals are quite different in terms of scope of the content treated and the audience they address and only enter the list during the last time bracket thus indicating an expansion of the ambidexterity theme to new theoretical fields. The International Journal of Human Resource Management for example focuses on future trends in human resource management, drawing on empirical research in the areas of strategic management, international business, organizational behaviour, personnel management and industrial relations; the Journal of Operation Management publishes empirical research with a significant impact on operation management theory and practice etc.

<i>JOURNALS</i>	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	<i>TOT</i>
<i>Organization Science</i>				1					1	1				8		<b>11</b>
<i>Journal of Management Studies</i>													1	5		<b>6</b>
<i>Academy of Management Journal</i>									1		1					<b>2</b>
<i>Journal of Management</i>											1		1			<b>2</b>
<i>Leadership Quarterly</i>														2		<b>2</b>
<i>Long Range Planning</i>													1		1	<b>2</b>





**Figure 2** - Distribution of papers according to the methodology used

## 2.4 An overview of the Ambidexterity definition

Academic ambidexterity literature addresses the ambidexterity topic from several different perspectives such as organizational learning, technological innovation, organizational adaptation, strategic management, and organizational design. It is highly probable that this expansion of interest has caused the ambidexterity theoretical construct to evolve as authors adapt it over time to their research needs. Ambiguity often emerges along with the evolution of constructs. In what follow, we therefore conduct an analysis of the definitions of ambidexterity (where available), adopted in the empirical papers that make substantive use of the construct, in order to identify the key elements that build up the ambidexterity construct and how authors have adapted the ambidexterity construct to their research needs.

We structure this analysis in three steps that respectively investigate:

- a. The way in which the paper characterizes the relationship of the ambidexterity construct to the firm
- b. The ambidexterity attributes that emerge from the definition
- c. The main sources of variation in the definitions of ambidexterity

#### 2.4.1 Ambidexterity characterization

---

In this paragraph we analyze the way in which each paper characterizes the relationship of the ambidexterity construct to the firm. This indicates the extent to which the definitions provided characterize ambidexterity in accordance with the original definition provided by Tushman and O'Reilly that described ambidexterity as a "capability". Thus, we consider a discussion characterizing ambidexterity as a capability to be evidence of the highest level of understanding and a discussion characterizing it in a different way as evidence of the lowest level of understanding.

Concerning the first analysis, about the characterization of ambidexterity, the results of our analysis show that most of the papers conceptualize ambidexterity as an organizational capability while only a few papers do not view ambidexterity as a capability (see "Appendix A" for a comprehensive list of the definitions). These last papers either consider ambidexterity as a firm's general status of organization without any additional specification (Carmeli and Halevi, 2009) or depart from the original conceptualization. Han and Celly (2008) and Judge and Blocker (2008) for example coin the term "*strategic ambidexterity*" to describe "*the capability that enables a firm to carry out inherently paradoxical strategies that embody and manifest two main strategic objectives*", Tiwana (2008) speaks about "*alliance ambidexterity*" in order to indicate "*the capacity to simultaneously exhibit alignment with alliance objectives and adaptiveness to changes in the environment*", Kristal, Huang and Roth, (2010) describe "*ambidextrous supply chain strategy*" as "*a viable strategic choice by which manufacturers can leverage sources of external supply chain knowledge to build internal competencies and capabilities*" while Mom, Van den Bosch and Volberda, (2009) describe ambidexterity as a behaviour, "*a manager's behavioral orientation toward combining exploration and exploitation related activities within a certain period of time*".

What emerges, however, is a clear agreement and temporal continuity, apart from a few isolated cases, on the conceptual definition of ambidexterity as a capability: ambidexterity definitions are in fact aligned with the original definition of the construct. It is interesting to notice how more recent works equate ambidexterity not merely with a capability but with a *dynamic* capability, a capability to recombine and integrate resources in order to adapt to market and technological changes (Eisenhardt and Martin, 2000; Lavie, 2006; O'Reilly and Tushman, 2008). This conceptualization "*emphasizes the key role of strategic leadership in appropriately adapting, integrating and reconfiguring organizational skills and resources to match changing environments*" (O'Reilly and Tushman, 2008, p. 187).

## 2.4.2 Ambidexterity attributes

---

Looking at the different definitions of ambidexterity, we note that the most recurrent attributes used when defining the construct are *simultaneity* and *reconciliation* of tensions that are present in almost all the definitions (Appendix A). This indicates the presence and sharing of a common basis of attributes along the studies on the theme.

In a recent work, Cao, Gedajlovic, and Zhang (2009) put in evidence a significant ambiguity in the conceptualization of the construct concerning the extent to which ambidexterity involves a firm's effort to simply balance opposite poles of the tension or to match the magnitude of the opposite poles of the tension (Cao, Gedajlovic, and Zhang, 2009). Adopting one perspective or the other implicates important consequences for the operationalization of the construct. This question is clearly described by Cao, Gedajlovic, and Zhang (2009) as follows:

*"Firm A has a score of 10 on exploration and 5 on exploitation, whereas Firm B has a score of 5 on both exploration and exploitation. Which of these firms is more ambidextrous? The answer to this question depends on how a researcher conceptualizes ambidexterity. If ambidexterity is conceptualized as the balancing of exploration and exploitation, Firm B is much more ambidextrous than Firm A. On the other hand, if ambidexterity is conceptualized as the combined magnitude of exploration and exploitation, the opposite conclusion is drawn, and Firm A is seen to be significantly more ambidextrous than Firm B"* (Cao, Gedajlovic, and Zhang, 2009, p. 783)

More recent research works show a tendency to involve another attribute when defining ambidexterity that deeply specify and focus the ambidexterity discourses. Simsek (2009), Andriopoulos and Lewis (2009), Andriopoulos and Lewis (2010), De Visser, de Weerd-Nederhof, Faems, Song, Van Looy and Visscher (2009) for example, when defining ambidexterity include the term excellence (or synonymous). According to these authors ambidexterity is not the simultaneous pursuit of contrasting strengths but the achievement of "high levels" of both strengths.

## 2.4.3 The main sources of variation in the conceptualization of ambidexterity

---

While the previous two paragraphs have outlined the common attribute shared by almost all the papers published on the ambidexterity issue, we are now going to describe one of the most important sources of variation that has caused some confusion in the interpretation of the ambidexterity concept: the application of the ambidexterity concept to distinct tensions faced by organizations. The word "ambidexterity" nowadays covers in fact an extremely broad spectrum of concepts. Some examples of contradictory yet co-existing,

interdependent and valuable elements are presented in the organizational and managerial literature such as the tension between alignment and adaptability, the comfort of the past and the uncertainty of the future, exploration and exploitation of business or exploitation and exploration of knowledge. This divergence in the literature is mainly due to the necessity of the authors to adjust the ambidexterity concept to the literature stream they belong: as a result organizational learning, technological innovation, organizational adaptation, strategic management, and organizational design have focalized attention on quite different tensions. Appendix A contains a chronological list of relevant studies into the ambidexterity topic and presents a number of examples of tensions identified in the reviewed articles with an indication of the literature stream to which such papers belong.

The origins of the organizational ambidexterity should be traced back to the *organizational design* theory, thanks to the work of Tushman and O'Reilly (1996). Tushman and O'Reilly (1996) are in fact the first authors to develop the idea of ambidextrous organizations. They associate ambidexterity to the coexistence of mechanistic - which rely on standardization, centralization, and hierarchy - and organic - which rely on high levels of decentralization and autonomy - features. Following this seminal work, organizational theory scholars have long discussed the challenge of using organizational features that make management of tensions possible. Adler, Goldoftas, and Levine (1999) claim that firms may resolve paradoxes by combining mechanistic and organic features. Gibson and Birkinshaw (2004) state that the management of tensions occurs through the development of a collective organizational context and suggest that an organizational context characterized by a combination of stretch, discipline, support, and trust facilitates ambidexterity. Gulati and Puranam (2009) rely on the tension between formal organization - the normative social system designed by managers - and informal organization - the emergent pattern of social interactions within organizations. Thus, from the organizational design perspective ambidexterity can be defined as a firm's ability to operate complex organizational designs that provide useful ground for the management of tensions.

Another widely debated tension comes from the *organizational learning* literature: it is the tension between exploration and exploitation (March, 1991). March (1991), in his pioneering article, differentiates between exploitation and exploration. As March notes, "*the essence of exploitation is the refinement and extension of existing competencies, technologies, and paradigms*" while "*the essence of exploration is experimentation with new alternatives*" (1991: 85). Exploitation refers to learning gained via local search, experiential refinement, and selection and reuse of existing routines while exploration refers to learning gained through processes of concerted variation, planned experimentation, and play. This reflects other classifications into different modes of organizational learning, such as generative versus adaptive learning (Nemanich and Vera, 2009), local search versus long jump (Im and Rai, 2008; Kang and Snell, 2009). Nemanich and Vera (2009), for example, associate exploration with a feed-forward learning process supporting novelty and exploitation with a feedback learning process supporting continuity. According to Im and Rai (2008) and Kang and Snell (2009) "*exploration results from a relatively broad and generalized search to expand the firm's knowledge domains into unfamiliar or novel areas and exploitation, on the other hand, relies on more narrow, localized and in-depth search in order to obtain well-defined solutions pertinent to a firm's existing knowledge domains*". Researchers adopting the organizational learning perspective thus define ambidexterity as a firm's ability to combine the two orthogonal types of learning.

Closely connected with the organizational learning literature is the *innovation management* literature that concentrates on the strain that exists between radical and incremental innovation. While the studies within the organizational learning field regard exploration and exploitation as different forms of the learning process through which innovations are born, in studies within the innovation management field exploration and exploitation are usually used as synonymous of the innovative outcomes (products or services): 'radical innovation' and 'incremental innovation', respectively. Following this line, researchers such as Benner and Tushman (2003) and He and Wong (2004) and have explicitly encompassed the idea that exploitative innovations are designed to meet the needs of emerging customers or markets - "exploitative innovation denotes technological innovation activities aimed at improving existing product-market positions" (He and Wong, 2004, p. 483) - while exploratory innovations meet the needs of existing customers or markets - "exploratory innovation denotes technological innovation activities aimed at entering new product-market domains (He and Wong, 2004, p. 484). Subsequent studies have adopted and further developed the exploitative and exploratory innovation categories. As an example, Li, Lin and Chu (2008), Jansen, George, Van den Bosch and Volberda (2008) and Jansen, Tempelaar, Van den Bosch and Volberda (2009) define exploratory innovations as innovation designed to meet the needs of emerging customers and markets, to offer new designs, to create new markets, or to develop new channels of distribution, and exploitative innovations as innovation designed to meet the needs of existing customers or markets and to broaden existing knowledge and skills, to improve established designs, to expand existing products and services, and to increase the efficiency of existing distribution channels. Andriopoulos and Lewis (2009, 2010) offer an alternative framework for examining exploitation/exploration tensions by unpacking the nested paradoxes of innovation into profit vs. breakthroughs, tight vs. loose coupling with customers, and discipline vs. passion. Researchers adopting the innovation management perspective thus define ambidexterity as a firm's ability to combine the two orthogonal types of innovation: radical and incremental.

More recently the ambidexterity theme has received increasing attention from the *strategic management* literature and the first signals of an interest from the *strategic alliances*, the *operation management*, the *international venturing* and the *open innovation* literature are also coming to light. As a consequence, new definitions for ambidexterity emerge that are closely connected with the tension analyzed. Lin, Yang and Demirkan (2007), for example, build on the tension between explorative alliances and exploitative alliances to describe ambidexterity as "*the simultaneous and balanced presence of both existing and new partners in a firm's alliance network*". In 2008 Han and Celly (2008) and Judge and Blocker (2008) coined the new concept of "strategic ambidexterity" which is defined as "*the capability that enables a firm to carry out inherently paradoxical strategies that embody and manifest two main strategic objectives*". Tiwana (2008) uses the term "alliance ambidexterity" to designate the capacity of firms to simultaneously exhibit alignment with alliance objectives and adaptiveness to changes in the environment. Lichtenthaler and Lichtenthaler (2009) point to a new type of ambidexterity by combining internal knowledge management processes and external knowledge management processes. Bodwell and Chermack (2010) define as ambidextrous those organizations that succeed in embracing and balancing deliberate and emergent approaches to strategy at the same time. Kristal, Huang and Roth (2010) assign the attribute "ambidextrous" to supply chain strategy

defining it as “a manufacturing firm’s strategic choice to simultaneously pursue both supply chain exploitation and exploration practices”.

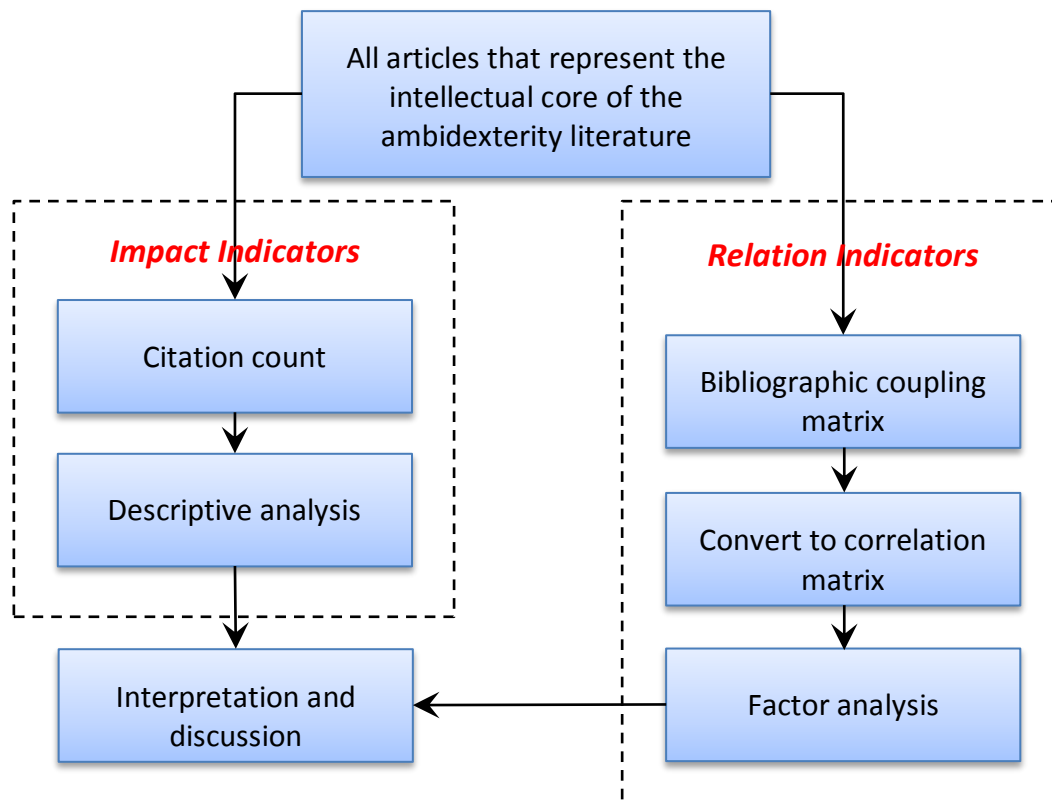
## 2.5 Bibliometric analysis

In this paragraph our aims are to verify if there is cohesiveness within the research community on the ambidexterity theme and to identify the knowledge structure of the ambidexterity literature both quantitatively and visually. The methodology used for this purpose is bibliometric analysis that involves a series of objective and quantitative techniques: these techniques have recently become popular with more online databases available for use (Garfield, 1979; Pilkington and Teichert, 2006). Bibliometric techniques refer to “the collection, the handling, and the analysis of quantitative bibliographic data, derived from scientific publications” (Veerbek, Debackere, Luwel, and Zimmerman, 2002, p. 181). The data input to bibliometric studies is the information that can be found in documents or specific parts of documents: in particular, for our analysis, we build on the reference list that is one of the most commonly used data input.

*Citation analysis* and *bibliographic coupling analysis* on the 45 papers of our sample are the techniques selected. The study analysis is in fact conducted carried out in two separate stages. Figure 3, adapted from McCain (1990a), summarizes the steps that are followed in this study. Bibliometric analyses have in fact usually been classified into two groups, according to whether they yield activity or relationship indicators.

The former stage (“Impact Indicators”) provides data relating to the centrality of the source papers in order to identify the works that present higher impact on the scientific community. A citation analysis is therefore used to compute the frequency of citation of the bibliographic references used in all the articles analyzed.

The later stage (“Relation Indicators”) traces the links and interaction between different researchers and allows to identify the subfields that constitute the intellectual structure of the theme under investigation. A bibliographic coupling analysis is thus implemented in order to obtain a quantification of the proximity between the papers in our sample by analysing the correlation matrix. By running a Factor analysis on the data contained in the correlation matrix, it is in fact possible to identify a number of factors (that groups together the papers) which represent the literature subfields.



**Figure 3** - Design of the empirical analysis on the source papers

### 2.5.1 Citation among the documents

The direct citation links between the source articles papers are analyzed in order to establish whether these documents form a coherent body of literature. The logic of citation analysis is that citations form explicit links between papers (Garfield, 1979) that describe the flows of knowledge within ambidexterity literature. Citation analysis is in fact based on the assumption that authors cite prior works which they deem important (both in positive and negative ways). Thus, frequently cited documents are said to have a greater influence on the progress of science than less cited documents (Culnan, 1987; Tahai and Meyer, 1999). The citing articles can be seen as the research front of the selected field and the cited articles as the intellectual base of that field (Persson, 1994).

We thus use citation analysis to trace the linkages among those contributions to the ambidexterity literature recognized as being the most influential (the 45 papers). In order to visualize more clearly the directions in which the field is moving, as well as the linkages between different pockets of intellectual activity, we also map the intellectual structure graphically. One of the characteristics of a well-defined community of researchers is a network of citations among their papers that centers on a core set of papers delineating the constructs, theories, and methodologies shared by the community (Garfield, 1979; Kuhn,

1970; Merton, 1973). We underlying idea is that the less tightly a paper is linked into a research community's citation network, the greater the risk is that the authors are deviating from the community's norms regarding its core construct (Lane, Koka and Pathak, 2006).

We thus construct a database containing all the references of each paper of our sample and use SITKIS (Schildt, 2002) and UCINET software, to determine how frequently each of the 45 papers of our sample has (1) been cited by other papers within the set or (2) has cited other papers in the set. This convey the two measures of centrality reported in Table 8:

- "citation sent" (the number of times a given paper cites the other 44 papers)
- "citation received" (the number of times a paper is cited by the other 44 papers).

The former represents the authors' positioning of the paper relative to the ambidexterity literature, whereas the latter reflects other authors' perceptions of that paper's contribution to the literature. Both measures ("sent citations" and "received citations" counts) have temporal biases (papers that were published earlier have in fact a better chance of getting cited, whereas those published later have more opportunities to cite other papers); these biases counterbalance each other. For that reason it is necessary to create a third centrality measure ("average links per year") by adding each paper's number of sent and received citations and then dividing that sum by the number of years covered by the sample to calculate the average annual number of links to and from the ambidexterity literature.

<b>AUTHOR(S)</b>	<b>YEAR</b>	<b>JOURNAL</b>	<b>CITATIONS SENT</b>	<b>CITATIONS RECEIVED</b>	<b>AVERAGE LINKS PER YEAR<sup>1</sup></b>
Gibson and Birkinshaw	2004	<i>Academy of Management Journal</i>	2	34	2.40
Tushman and O'Reilly	1996	<i>California Management Review</i>	0	33	2.20
He and Wong	2004	<i>Organization Science</i>	1	29	2.00
Raisch and Birkinshaw	2008	<i>Journal of Management</i>	8	17	1.67
Lubatkin, Simsek, Ling and Veiga	2006	<i>Journal of Management</i>	6	18	1.60
Smith and Tushman	2005	<i>Organization Science</i>	4	20	1.60
Benner and Tushman	2003	<i>Academy of Management Review</i>	1	22	1.53
Gupta, Smith and Shalley	2006	<i>Academy of Management Journal</i>	2	20	1.47
Raisch, Birkinshaw, Probst and Tushman	2009	<i>Organization Science</i>	20	1	1.40
Adler, Goldoftas and Levine	1999	<i>Organization Science</i>	0	19	1.27

**Table 8** - Papers making substantive use of the construct and averaging at least one link to the ambidexterity literature per year.

<sup>1</sup> Average links per year = (citations received + citations sent) / 15 years

We find that more than half of the papers examined average less than 0.5 links per year to other papers in the ambidexterity literature while only 10 papers (22 percent) average one or more links to the literature per year. This short list includes two of the papers that extend or refine the definition of ambidexterity (Tushman and O'Reilly, 1996; Gibson and Birkinshaw, 2004) and three papers that make ambidexterity a central component of their hypotheses or propositions (Adler, Goldoftas and Levine, 1999; He and Wong, 2004; Lubatkin, Simsek, Ling and Veiga, 2006). The remaining papers are conceptual papers centered on the ambidexterity theme and its dynamics (Smith and Tushman, 2005; Benner and Tushman, 2003; Gupta, Smith and Shalley, 2006) or literature reviews (Raisch and Birkinshaw, 2008; Raisch, Birkinshaw, Probst and Tushman, 2009).

In order to obtain a visual representation of the degree of cohesiveness among the source articles, the results obtained with this analysis of citations are plotted (Figure 4). Red color indicates for those articles that cite other papers of the samples and that are not cited by them, green color designates the articles cited by other articles of the sample and that do not cite any article in the sample, blue color finally designates the papers that both cite and are cited by other papers in the sample. The size of the dots representing the papers is proportional to the sum of citations received and given.

When looking at the network, it is possible to observe that all source articles are connected by citations to other source papers. We can interpret this in two ways. First, the sample is more field-like than a random sample. Second, the field has some properties of cumulativeness, as new papers appear to build on previous works in the field. Unexpectedly, several papers that extend the construct's definition do not meet the one-link-per-year criterion: this is not only due to the fact that they have been published in 2008 and 2009.

Further examination actually reveals that both the number of sent citations in these papers and the number of received citations from other ambidexterity papers is quite limited. This result seems to suggest that the researchers using the ambidexterity construct have not developed a strong, focused research community, and, hence, in particular during the last three years. This is on line with our previous observation about the increasing attention towards the ambidexterity theme by different and new theoretical fields.

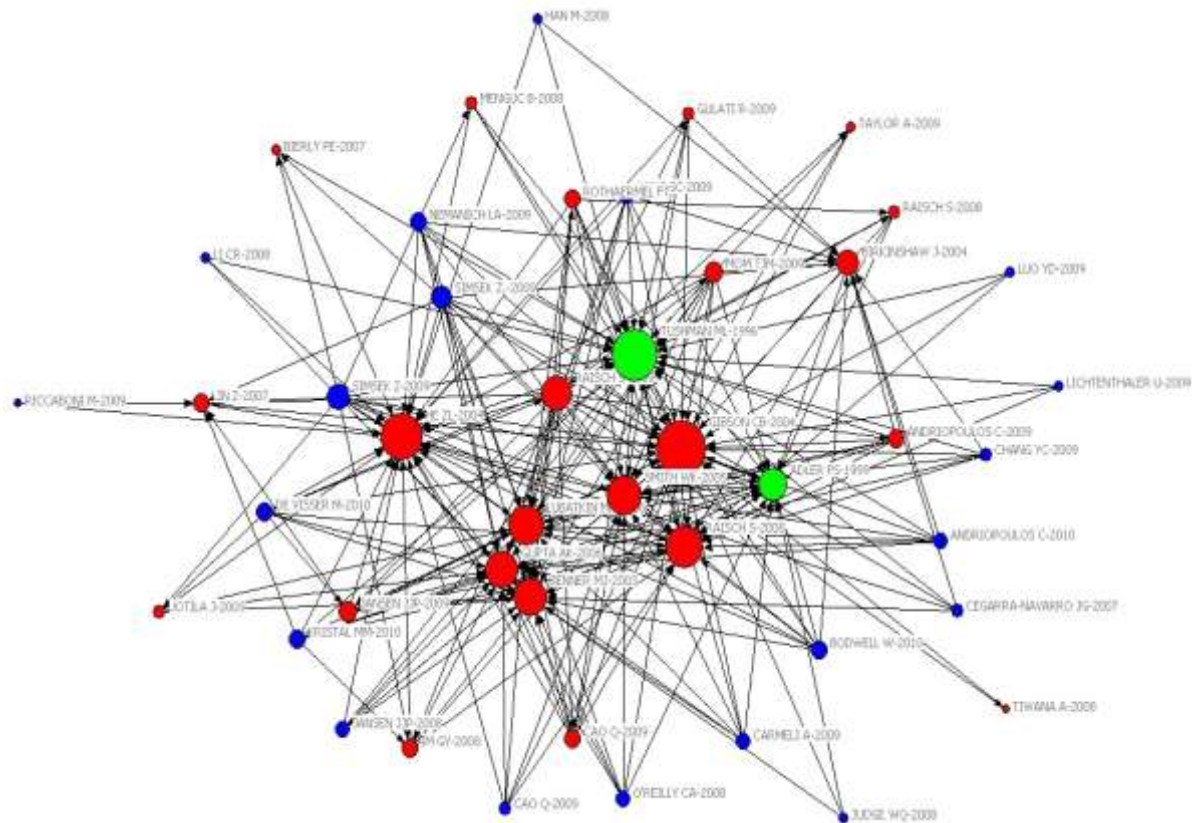
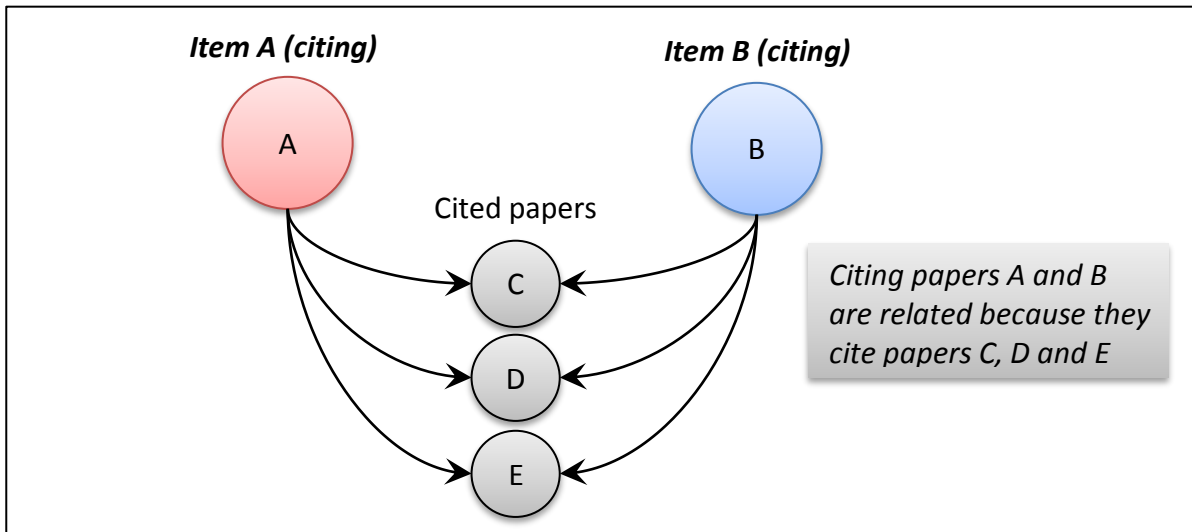


Figure 4 - Network of citations between the source papers

### 2.5.2 Bibliographic coupling analysis

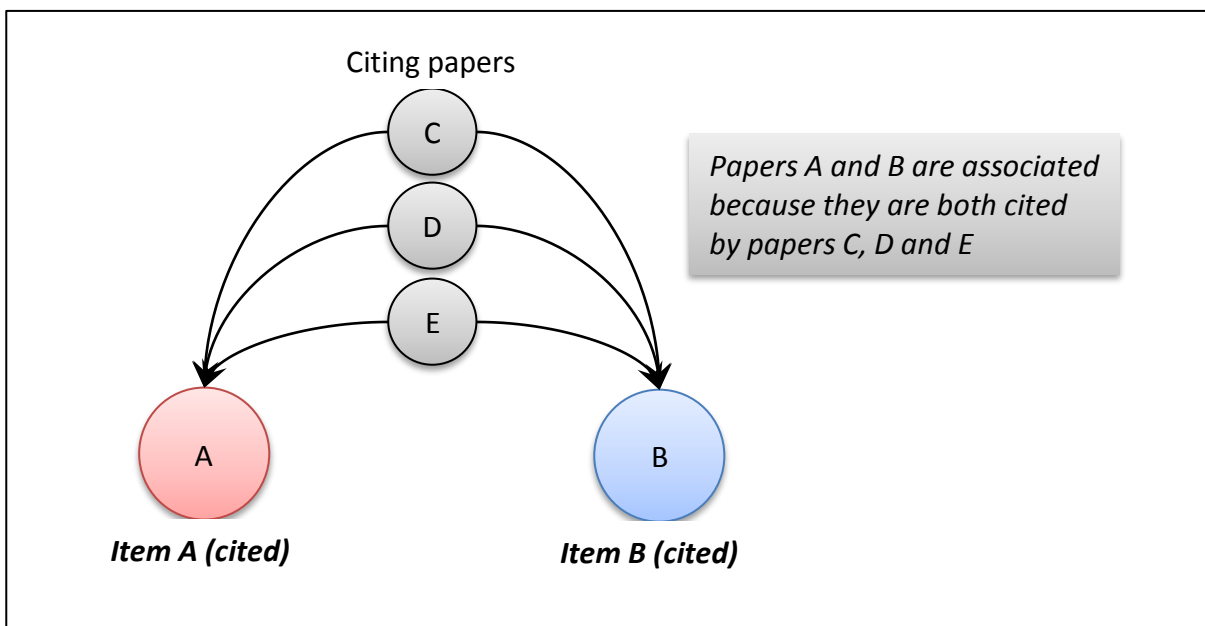
The second stage of the bibliometric analysis has the objective of examining the relationships among the articles that contribute to the development of ambidexterity research field to highlight the subfields that constitute the intellectual structure of the ambidexterity literature. To this purpose, two main bibliometric methods are suggested by researchers: *bibliographic coupling* and *co-citation analysis*.

Bibliographic coupling technique is introduced by Kessler in 1963 and represents one of the key historical antecedents of co-citation analysis. The technique gives the measure of the relation between two papers. Based on the assumption that it is probable that two papers that have many common references are reporting on a similar research topic, the bibliographic coupling strength between two papers is defined as the number of common references cited by both papers. Two papers are thus related because they cite the same third text (Figure 5).



**Figure 5 – Bibliographic coupling analysis**

Closely related to the subject of bibliographic coupling is that of co-citation. Co-citation measure is introduced in 1973 by Small. Assuming that references are symbols of knowledge, it is highly probable that two references that have many common papers (large co-citation count between them) are exemplar references for one or more common subspecialties (White and Griffith, 1981): the more often they are cited together, the stronger the relationship and the more likely they belong to the same research front, sometimes referred to as an “invisible college” (Crane, 1972). Co-citation analysis thus refers to documents which are related because they are cited together by several other documents. The relation is not established actively by the documents in question but is created by third documents referring to them (Figure 6).



**Figure 6 – Co-citation analysis**

While bibliographic coupling (Kessler, 1963) and co-citation analysis (Marshakova, 1973; Small, 1973) both trace their roots back several decades, co-citation analysis is adopted as the de facto standard in the 1970s, and enjoys that position of preference ever since: bibliographic coupling was essentially displaced by co-citation clustering (Zhao and Strotman, 2008; Boyack and Klavans, 2010). However, only recently there has been a resurgence in the use of bibliographic coupling that is challenging the historical preference for co-citation analysis (Boyack, 2009; Jarneving, 2005, 2007; Sandström and Sandström, 2009): this is due to the fact that bibliographic coupling allows researchers to avoid several problems of co-citation analysis. In particular, a critical issue for the applicability of co-citation analysis to our data concerns the temporal distribution of the papers published: as previously showed, ambidexterity is a twenty years old theme that has received a great attention in particular during the last four years. By adopting a forward-looking perspective, co-citation analysis fails in supporting current trends as it is not the current works that are mapped in co-citation analysis, but the older works. As a consequence, it will take a certain time before a paper appears in co-citation studies that are based on citations to that paper. Thus, in our opinion, bibliographic coupling, being retrospective, is the technique that should be chosen for the analysis of the ambidexterity literature.

Bibliographic coupling method begins with a mathematical representation of the links between papers and the references that they cite through the construction of the paper-reference matrix: the rows in the matrix correspond to papers in the sample while the columns correspond to the wall references (Morris, 2005). The elements of the matrix are equal to 1 if a paper cites a particular reference, 0 otherwise.

The next step is to construct the Bibliographic Coupling matrix. This matrix is a symmetric by matrix that lists the number of common references cited by two different papers of the sample. The diagonal of this matrix contains the counts of the number of references cited in each paper. The raw bibliographic coupling matrix is then converted into a matrix of Pearson's correlation coefficients. Correlation coefficients represent a measure of similarity between two works. They are preferred to frequencies, since they make it possible to standardize the data, thus providing a better basis for subsequent statistical analyses (Rowlands, 1999).

The last steps of bibliographic coupling analysis involves applying various multivariate techniques to analyze the data, and interpret the findings. In this study, we make use of factor analysis to explore the underlying structures of the interrelationships between the selected papers. Factor analysis allows to classify the core articles into related sets, called factors, by detecting the structure on the basis of varying degrees of relatedness among the articles. The factors comprise relatively homogenous groupings of articles that may represent a subfield, research front, or community of interest.

Factors are extracted by Principal Component Analysis (PCA) and their number is determined based on the Kaiser's criterion (Kaiser, 1960; Hair, Anderson, Tatham and Black, 1998). To clarify the loadings, that represent the correlation between a given article and the factor, or the degree to which the article belongs to that set, the components are rotated by Varimax rotation method for its simplicity and rigor (Nunally, 1978): rotation in fact maximizes the variance of squared loadings on a factor thus producing a subset of variables with high loadings, and the rest with low-loadings (Kim and Mueller, 1978; Fabrigar, Wegener, MacCallum and Strahan 1999).

As shown in Table 9, the analysis resulted in a four-factor model. Factor analysis allows us to identify subfields that correspond to the extracted factors: each subfield represents an intellectual theme defined by the papers who load highly on that subfield/factor. To be consistent with the literature prescriptions, only papers with loadings above  $\pm 0,4$  are included in a factor. Loadings of the same article on more than one factor indicate that it is related secondarily to additional factors (Table 9).

We label the factors obtained as:

- 1) Foundations: Structural ambidexterity
- 2) Contextual Solution
- 3) Enabling factors and consequences of ambidexterity
- 4) Cross-boundary perspective

<i>AUTHOR(S)</i>	<i>FACTOR 1</i>	<i>FACTOR 2</i>	<i>FACTOR 3</i>	<i>FACTOR 4</i>
Benner and Tushman (2003)	<b>0.84155</b>			0.30016
Gupta, Smith and Shelley (2006)	<b>0.81685</b>		0.44549	
He and Wong (2004)	<b>0.78627</b>			
O'Reilly and Tushman (2008)	<b>0.71308</b>	0.33425	0.52621	
Tushman and O'Reilly (1996)	<b>0.67869</b>			
Birkinshaw and Gibson (2004)		<b>0.83859</b>	0.34983	
Gibson and Birkinshaw (2004)	0.43896	<b>0.78863</b>		
Andriopoulos and Lewis (2010)			<b>0.83263</b>	
Andriopoulos and Lewis (2009)		0.48189	<b>0.81672</b>	
Bodwell and Chemack (2010)		0.35820	<b>0.78990</b>	
Cao, Simsek and Zhang (2009)			<b>0.87875</b>	
Cao, Gedajlovic and Zhang (2009)	0.42463		<b>0.80572</b>	
Chang , Yang and Chen (2009)		0.44762	<b>0.82945</b>	
De Visser, de Weerd-Nederhof et al. (2010)	0.31311		<b>0.85078</b>	
Im and Rai (2008)	0.51287		<b>0.73333</b>	
Jansen, George et al. (2008)	0.30124		<b>0.78349</b>	0.31413
Jansen, Tempelaar et al. (2009)	0.32446		<b>0.77225</b>	0.35739
Li, Lin and Chu (2008)	0.33249	0.36933	<b>0.65603</b>	0.33171
Mom, van den Bosch and Volberda (2009)	0.,33385	0.46145	<b>0.74491</b>	
Nemanich and Vera (2009)			<b>0.90521</b>	
Raisch, Birkinshaw et al. (2009)	0.39355		<b>0.76810</b>	
Simsek (2009)	0.44210	0.43751	<b>0.73675</b>	
Rothaermel and Alexandre (2009)	0.48417		<b>0.68360</b>	0.43824
Carmeli and Halevi (2009)	0.37303	0.44888	<b>0.68827</b>	
Lichtenthaler and Lichtenthaler (2009)	0.38005		0.47609	<b>0.68523</b>
Luo and Rui (2009)	0.31872	0.38726	0.32699	<b>0.65772</b>

Adler, Goldoftas et al. (1999)	0.53974	0.62023		
Cegarra-navarro and Dewhurst (2007)	0.56165		0.58892	0.47755
Gulati and Puranam (2009)	0.59388	0.48905	0.54667	
Han and Celly (2008)	0.50804	0.53488	0.39539	
Judge and Blocker (2008)	0.60764	0.42463	0.36301	0.39971
Kang and Snell (2009)	0.55846		0.69642	
Kristal, Huang and Roth (2010)	0.56166		0.58396	0.40849
Lin, Yang and Demirkan (2007)	0.67483		0.53571	
Bierly and Daily (2007)	0.65614			0.44007
Lubatkin, Simsek et al. (2006)	0.62357	0.31589	0.56059	
Smith and Tushman (2005)	0.63021	0.31695		0.43727
Menguc and Auh (2008)	0.58570	0.52096	0.44523	
Raisch and Birkinshaw (2008)	0.55709	0.34829	0.61259	
Raisch (2008)	0.47626	0.65047	0.47359	
Riccaboni and Moliterni (2009)	0.55817		0.61489	
Simsek, Heavey et al. (2009)	0.48849	0.47087	0.65988	
Taylor and Helfat (2009)		0.68271	0.51704	
Tiwana (2008)			0.51324	0.61915
Uotila, Maula et al. (2009)	0.61903		0.67586	

**Table 9 – Factor analysis results<sup>2</sup>.**

Factor 1 (“*Foundations: the structural solution*”) comprises what appears to be the structural center of the ambidexterity domain and it is heavily weighted towards the papers that received the greatest number of citations within our sample. This is indicative of the fact that these are truly foundational papers within the field; they deal with the issue of “Structural ambidexterity”, a first organizational solution proposed by Tushman and O’Reilly, to face contrasting tensions within an organization. All the papers included within this factor build in fact on organizational design solution for solving tensions. “Structural ambidexterity” advocates for a physical separation between opposing activities, via loosely coupled and differentiated units, each of which specialized in pursuing one specific goal through the development of different competencies, systems, incentives, processes, and cultures. The factor is thus revelatory of the key issues and concerns within the body of research on structural ambidexterity: it is suggestive of the structural separation required for managing the tensions within the organization, and of the a pivotal role for managers in enabling the integration and in maintaining the connections between different units. Following Tushman and O’Reilly (1996), Benner and Tushman (2003) and Gupta, Smith and Shalley (2006) strongly support that only a physical separation of contrasting and

<sup>2</sup> Extraction method: Principal Component Analysis with Varimax Rotation. Only factor loadings higher than 0.3 are reported.

inconsistent units should convey to the resolution of tensions. They add that these highly differentiated but loosely coupled subsystems should also have different measurement and incentives, and distinct managerial teams and must be strategically integrated by the senior team. Finally, He and Wong (2004) are the first researchers that provide empirical support to the argumentation of Tushman and O'Reilly regarding the power of structural ambidextrous organization in attaining superior performance.

Factor 2 ("Contextual solution") encompasses the paper of Gibson and Birkinshaw (2004) and Birkinshaw and Gibson (2004). These papers present another form of the organizational solution to cope with tensions and paradoxes: Contextual ambidexterity. In their publication, titled "Building ambidexterity into an organization", they show that ambidexterity may arise from features of the organizational context in terms of cultural values and norms rather than from implementing dual structures. In their view, ambidexterity is not so much realized at the structural level, but at the one of individuals (Gibson and Birkinshaw, 2004; Birkinshaw and Gibson, 2004). Provided with a favorable context, individuals are in fact indirectly pushed to organize their working time so as to integrate both opposite activities in the course of their daily tasks. Thus, while the structural definition posits dual structures as the means to achieve ambidexterity, the contextual definition proposes building a carefully selected set of systems and processes that "enable and encourage individuals to make their own judgments about how to divide their time between antagonistic demands" (Gibson and Birkinshaw, 2004, p. 210).

Factor 3 ("Enabling factors and consequences of ambidexterity") contains the greatest number of papers in our panel (17 out of 45). The papers, published in 2009 and 2010, mainly concern on providing a better understanding of the enabling factors and consequences of ambidexterity. We will come back and deeper analyze this point in paragraphs 7.1.6.1 and 7.1.6.2. This factor also contains connections between ambidexterity and a key set of other theoretical perspectives in Management research. Like factor 1, this factor highlights some key themes within ambidexterity research, including the role of management, innovation, and organizational learning.

Factors 4 ("Cross boundary perspective") constitutes only a minor part of the research on ambidexterity, consisting of only two articles. It includes the contribution by Lichtenthaler and Lichtenthaler (2009) and Luo and Rui (2009) that analyze ambidexterity by adopting a broader perspective that goes beyond the organizational boundaries. Luo and Rui (2009) for example, provide theoretical and practical implications of ambidexterity in the context of global business: ambidexterity, accordingly to the authors, arises from the openness of the firm towards cooperation with partners, suppliers, distributors, regulators, and competitors at home and abroad. Lichtenthaler and Lichtenthaler (2009) study on the same line, points to new types of ambidexterity: instead of focusing only on exploration and exploitation that occur inside the firm, they sustain that ambidexterity may arise also from the alignment of internal and external knowledge processes, by adopting an open perspective.

## 2.6 Ambidexterity in empirical papers

Moving on from conceptual issues, this section provides a review of how ambidexterity has been treated in the empirical papers. We follow the procedure laid out by Chandler and Lyon (2001) in excluding one article (Lin, Yang and Demirkan, 2007) whose observations were based on mathematical modeling. We thus analyze 27 papers.

All these empirical papers adopt a cross sectional design: no papers that make use of a longitudinal approach are not retrieved.

For each paper, in this paragraph we analyze the level of analysis adopted and the role played by ambidexterity. The choice of level of analysis plays a critical role in in constraining the focus of researchers and in yielding great variety in interpretation of constructs (Low and Mac Millan, 1998). As regard the role played by ambidexterity, it is possible to distinguish those studies that focus on the enabling factors of ambidexterity, those factors that serve as an impetus for the development of ambidexterity (in papers that focus on the enabling factors considers ambidexterity as an output) from studies that focalize on the outcomes of ambidexterity (in this case ambidexterity is considered as an input) (Table 10).

	<b>AMBIDEXTERITY AS AN OUTPUT (focus on the enablers)</b>	<b>AMBIDEXTERITY AS AN INPUT (focus on the outcomes)</b>	<b>AMBIDEXTERITY BOTH AS AN INPUT AND AN OUTPUT</b>
<i>Case study</i>	6	0	0
<i>Survey</i>	7	11	3
<b>TOT</b>	<b>13</b>	<b>11</b>	<b>3</b>

**Table 10** – Role played by ambidexterity in empirical papers

All articles are coded along the three dimensions of *outcomes*, *enablers* and *levels of analysis*. We derive the categorization of outcomes and enabling variables by compiling the most commonly used variables in all empirical articles of our sample while the last categorization, concerning the level of analysis, is based in large part on Chandler and Lyon (2001) categories.

Table 11 lists the schemes employed to code each article.

<b>OUTCOMES</b>		<b>ENABLING FACTORS</b>		<b>LEVEL OF ANALYSIS</b>	
<b>1</b>	Financial performances	<b>1</b>	Managers' ability and attributes	<b>1</b>	Individuals
<b>2</b>	Innovation performances	<b>2</b>	Formal and Informal mechanisms	<b>2</b>	Team

4	Other	3	Organizational Structures	3	Business unit
		4	Context and culture	4	Firm
		5	Other	5	Alliances
				6	Processes and activities
				7	Macro-environment
				8	Multilevel

**Table 11 – Coding schemes**

### 2.6.1 Outcomes of Ambidexterity

As anticipated in the introduction, one of the reason that determined the growing interest towards the OA theme is the evidence of a strong positive link between OA and performances. As a consequence a large amount of empirical papers are designated to test such relationships. As can be seen on Table 12, financial and firm performances are the most studied dependent variable.

The first authors that tested this relationship have been He and Wong (2004). Building on a sample of 206 manufacturing firms, they demonstrate that the interaction between explorative and exploitative innovation is positively related to sales growth and that the relative imbalance between both innovation types is negatively related to sales growth. Similar results are found by Gibson and Birkinshaw (2004), who test the “ambidexterity hypothesis” adopting a business-unit level of analysis. The scale they use includes items such as: “This business unit is achieving its full potential”, “People at my level are satisfied with the level of business unit performance”, “This business unit does a good job of satisfying our customers” and “This business unit gives me the opportunity and encouragement to do the best work I am capable of”. In the same way, in 2006, Lubatkin Simsek, Ling and Veiga find that the joint pursuit of an exploitative and exploratory orientation positively affects performance measured by using an eight-item scale developed by Gupta and Govindarajan (1986) that includes items such as growth in sales, growth in market share, return on equity, and return on total assets. They used data from 139 small- and medium-sized enterprises. More recently, Cao, Gedajlovic and Zhang (2009) measure firm performances in terms of sales growth, profit growth, market share growth, operational efficiency, cash flow from market operations, and market reputation. Uotila, Maula, Keil and Zahara (2009) verify the “ambidexterity hypothesis by using the market-based measure of Tobin’s Q as dependent performance variable: this allows them to capture both short-term performance and long-term prospects.

Apart from financial and firm performances, more recent works analyze the impact of different structures on innovation performances: these papers however are still limited. De Visser, de Weerd-Nederhof, Faems, Song, Van Looy and Visscher (2009) assess the impact of ambidexterity on different kinds of firm innovation performance (i.e., derivative versus breakthrough). Their findings point to the relevance of adopting structural ambidexterity, where firms make an explicit distinction between incremental and radical NPD processes

and organize them in a different way. Rothaermel and Alexandre (2009) verify the positive impact of ambidexterity on the firm innovativeness, proxied by the total number of patents assigned to the firm.

In addition, there are examples of other outputs of ambidexterity that could be retrieved in the papers inventoried. These outputs concern for example the customer capital that represents the contributions to current and future revenues that result from an organization's relationship with its customers (Cegarra-Navarro and Dewhurst, 2007), research commercialization (Chang, Chen, 2009) and knowledge sharing (Im and Rai, 2008).

<b>FINANCIAL PERFORMANCES</b>	Bierly and Daly (2007) Menguc and Auh (2008) Uotila, Maula, Keil and Zahara (2009)	Han and Celly (2008) Rothaermel and Alexandre (2009)
<b>INNOVATION PERFORMANCES</b>	de Visser, de Weerd-Nederhof, Faems, Song, Van Looy and Visscher (2009)	Rothaermel and Alexandre (2009)
<b>FIRM PERFORMANCES</b>	Cao et al. (2009) He and Wong (2004) Lubatkin, Simsek and Veiga (2006)	Gibson and Birkinshaw (2004) Im and Rai (2008) Kristal, Huang and Roth (2010)
<b>OTHER</b>	Cegarra-Navarro and Dewhurst (2007) Im and Rai (2008)	Chang, Yang and Chen (2009)

**Table 12 – Outcomes of ambidexterity**

### 2.6.2 Enablers of Ambidexterity

In this paragraph we present an overview of the major enabling factors that serve as an impetus and facilitate the development of organizational ambidexterity (Table 13).

Much of the existing literature equates structural ambidexterity with spatial separation at the business unit or corporate level thus identifying organizational structure and formal and informal structural mechanisms as the main enabling factors for building ambidexterity.

Adler, Goldoftas and Levine (1999) in a case study of the Toyota Production System, describe the functioning of four organizational mechanisms (namely metaroutines, job enrichment, partitioning and switching) used in the production process to manage the efficiency and flexibility paradox. Jansen, Tempelaar, Van den Bosch and Volberda (2009), on the same line, indicate structural differentiation as a critical factor that can help ambidextrous organizations to maintain multiple inconsistent and conflicting demands. They additionally point to the need for coordination and integration of differentiated exploratory and exploitative activities and identify formal and informal integration mechanisms (e.g., contingency rewards and social integration, cross-functional interfaces and connectedness) that mediate the relationship between structural differentiation and ambidexterity.

Andriopoulos and Lewis (2009 and 2010) highlight the importance of a mix of integration and differentiation recognized as powerful and complementary mechanisms for the management of paradoxes.

Other enabling factors widely discussed in the literature concern the abilities and the characteristics of the managers, that play a critical role in sustaining and guiding ambidexterity. Tushman and O'Reilly (1996) in their seminal work in fact state that ambidexterity is facilitated by the top-management team's internal processes. Following this indication, researchers have recently begun to investigate the characteristics of the management as a supporting factor for realizing ambidexterity. Lubatkin, Simsek, Ling and Veiga (2006), for example, find that top management team behavioral integration (collaborative behavior, information exchange, and joint decision making) facilitate the processing of disparate demands essential to attaining ambidexterity in SMEs. Jansen, George, Van den Bosch and Volberda (2008) delineate the attributes that senior team should present in order to sustain ambidexterity: shared vision, social integration, contingency rewards. In addition, they shows that transformational leadership increases the effectiveness of senior team attributes in building ambidexterity. Taylor and Helfat (2009) analyze the role of middle management in fostering organizational ambidexterity by creating organizational linkages.

Finally, a strong contribution for building ambidexterity comes from the context and the organizational culture. The number of papers that examine in depth this point is quite limited. Adler, Goldoftas and Levine (1999) find that distinctive values, culture, and leadership are essential contextual conditions for ambidexterity. Five years later, Gibson and Birkinshaw further analyzed these aspects, providing a more comprehensive description of the contextual antecedents of ambidexterity. On analyzing data collected from 41 business units, Gibson and Birkinshaw find empirical evidence that it is possible to achieve ambidexterity through a combination of stretch, discipline (defined as hard elements), support and trust (defined as soft elements). Nemanich and Vera (2009) furthermore suggest that the presence of a learning culture encompassing psychological safety, openness to diverse opinions, and participation in decision making, support ambidexterity in acquisition integrations.

<b>MANAGERS' ABILITY AND ATTRIBUTES</b>	Adler, Goldoftas and Levine (1999) Cao, Simsek and Zhang (2009) Lubatkin, Simsek, Ling and Veiga (2006) Rothaermel and Alexandre (2009) Taylor and Helfat (2009) Nemanich and Vera (2009)	Jansen, George, Van den Bosch and Volberda (2008) Jansen, Tempelaar, Van den Bosch and Volberda (2009) Mom, Van den Bosch and Volberda (2009)
<b>FORMAL AND INFORMAL MECHANISMS</b>	Adler, Goldoftas and Levine (1999) Andriopoulos and Lewis (2010) Jansen, Tempelaar, Van den Bosch and Volberda (2009) Rothaermel and Alexandre (2009)	Andriopoulos and Lewis (2009) Cao, Simsek and Zhang (2009) Mom, Van den Bosch and Volberda (2009)

<b>ORGANIZATIONAL STRUCTURES</b>	Adler, Goldoftas and Levine (1999) Raisch (2008) Mom, Van den Bosch and Volberda (2009) Taylor and Helfat (2009)	Jansen, Tempelaar, Van den Bosch and Volberda (2009) Li, Lin and Chu (2008) Rothaermel and Alexandre (2009)
<b>CONTEXT AND CULTURE</b>	Adler, Goldoftas and Levine (1999) Im and Rai (2008) Nemanich and Vera (2009)	Gibson and Birkinshaw (2004) Luo and Rui (2009)
<b>OTHER</b>	Li, Lin and Chu (2008)	Tiwana (2008)

**Table 13 – Enabling factors**

### 2.6.3 Unit of analysis

In this paragraph we present an overview of the unit of analysis adopted in the empirical papers. Authors were fairly clear about specifying the level of analysis chosen in the paper: in those limited cases where the level of analysis is not explicitly indicated, the review process of data sources, models, and results provide enough information about the intended level of analysis.

Our results (Table 14) show that a large amount of the studies analysed focuses on one single level of analysis: only two papers adopt a multi-level or cross-level approach. Among the single-level based studies, 18 out of 27 papers are conducted on the firm level, 2 on the business unit level, 3 on the network level while only 1 makes use of team level and 1 of individual level.

This suggests that most of the OA researchers focus on the same level of analysis (firm level). However, some have also begun to conduct more multilevel research. What is still lacking is a clear understanding of the interconnections, reciprocal influences and nesting arrangement between levels, that is individuals are nested in teams, which are themselves nested in business units, and so on. In addition the papers that adopt a micro level of analysis are still relatively scant.

<b>INDIVIDUALS</b>	Mom, Van den Bosch and Volberda (2009)	
<b>TEAM</b>	Nemanich and Vera (2009)	
<b>BUSINESS UNIT</b>	Adler, Goldoftas and Levine (1999)	Gibson and Birkinshaw (2004)

<b>FIRM</b>	Bierly and Daly (2007) Cao, Simsek and Zhang (2009) Cegarra-Navarro and Dewhurst (2007) Chang, Yang and Chen (2009) Gulati and Puranam (2009) Han and Celly (2008) He and Wong (2004) Jansen, George, Van den Bosch and Volberda (2008)	Jansen, Tempelaar, Van den Bosch and Volberda (2009) Li, Lin and Chu (2008) Lubatkin, Simsek, Ling and Veiga (2006) Luo and Rui (2009) Menguc and Auh (2008) Raisch (2008) Rothaermel and Alexandre (2009) Uotila, Maula, Keil and Zahara (2009)
<b>ALLIANCES</b>	Im and Rai (2008) Kristal, Huang and Roth (2010)	Tiwana (2008)
<b>PROCESSES AND ACTIVITIES</b>	De Visser, de Weerd-Nederhof, Faems, Song, Van Looy and Visscher (2009)	Taylor and Helfat (2009)
<b>MULTILEVEL</b>	Andriopoulos and Lewis (2009)	Andriopoulos and Lewis (2010)

**Table 14 – Unit of analysis**

## 2.7 Discussion

There are several reasons that have motivated this review of existing works on the theme of ambidexterity. First, a growing interest expressed by academics and practitioners towards the issue of ambidexterity. This growing interest is accompanied by contributions from an increasing variety of research domains that are in turn leading to increasing complexity and difficulties in integrating the different contributions. Second, the issue of ambidexterity is very young and there are still many contributions that can be provided by researchers so that it will develop into a research paradigm.

What emerges is therefore a clear need to provide a detailed overview of the current literature concerning the issue of ambidexterity, highlighting in particular the areas where research efforts have been more focused and those areas that require further study.

The objectives of this preliminary analysis of the existing studies on ambidexterity were:

- a) to provide an overview of the different definitions given by scholars with the aim of identifying common features and possible sources of discontinuity in the conceptualization;
- b) to verify the cohesiveness within the research community on the theme
- c) to identify the subfields that constitute the intellectual structure of the ambidexterity literature
- d) to review how the ambidexterity theme has been addressed in empirical papers

To reach these objectives a systematic review of the literature has been implemented: in particular we systematically sample a large number and broad range of papers rather than focusing on some selected key papers thus differing from prior reviews and avoiding the risk of biases.

First we classified each paper in order to identify those papers that give substantial contributions to the ambidexterity literature. Second, we analyzed the different contributions by coding the definitions and the usage of the ambidexterity construct. Third we examined the citation patterns within the literature and implemented a series of objective and quantitative techniques, bibliometric techniques that allowed us to describe the structure of the ambidexterity literature both quantitatively and visually. Finally, we focused on empirical papers and analyzed the antecedents and consequences of ambidexterity and the level of analysis used.

With reference to the first analysis, what emerges is that the majority of the papers resulting from the search of the different databases present little or no discussion of ambidexterity capability. These papers contain only passing references to Tushman and O'Reilly (1996) or Gibson and Birkinshaw (2004), the two seminal works on ambidexterity. We thus feel that a great number of researchers take the ambidexterity concept for granted and do not examine it closely or critically.

We therefore focused our attention to those papers that make a noteworthy use of the ambidexterity construct. By looking at the reciprocal citation between these papers, we have verified that all the source articles are connected by citations to other source papers. This indicates that some properties of cumulativeness exist, as new papers appear to build on previous works in the field. However, even if analyses indicate that some cumulativeness is present, nowadays it covers an extremely broad spectrum of concepts thus causing a lack of consistency on the development of the ambidexterity capability concept. Ambidexterity is in fact frequently depicted using a variety of oppositional concepts, coming from different literature streams: organizational learning, technological innovation, organizational adaptation, strategic management, and organizational design have in fact focalized attention on quite different tensions

To identify the subfields that constitute the intellectual structure of the ambidexterity literature bibliometric analysis techniques - bibliographic coupling analysis and factor analysis - have been conducted. These techniques helped us make sense of how the ambidexterity literature is developing and taking shape. What emerges in particular is that, as a research domain still in its early stages of development, it remains tightly focused on foundational issues, as we have shown: structural solution, contextual solution and enabling factors and consequences of ambidexterity. Factor analysis however underlines a recent tendency within the ambidexterity literature to connect with a key set of other theoretical perspectives in management research such as open innovation.

Finally, in order to analyze how the ambidexterity theme has been addressed in empirical papers, we have classified the empirical papers according to the role played by ambidexterity, and distinguished those studies that focus on the enabling factors of ambidexterity from studies that focalize on the outcomes of ambidexterity, and the level of analysis adopted. Looking at the enabling factors, structural separation is considered as the main element necessary for handling the situations where an organization faces opposing, paradoxical options. However, the literature shows that it is crucial to consider not only organizational structure but also the context, processes and systems within the organization that facilitate and encourage the organizational units and employees to do contradictory tasks at the same time. Other enabling factors widely discussed in the literature concern

those abilities and characteristics of managers that play a critical role in sustaining and guiding ambidexterity.

Looking at the consequences, one of the reasons that has determined the growing interest towards ambidexterity is the evidence of a strong positive link between ambidexterity and performance. As a consequence a large number of empirical papers have been designated to test such relationships. Financial and firm performances are the most studied dependent variables. Lastly, concerning the level of analysis adopted by the empirical papers, our results show that a large amount of the studies are conducted on the firm or business unit level of analysis while papers that adopt a micro level of analysis are still relatively scarce.

Taken together, these results are coherent with those of Raish and Birkinshaw (2008): *“the initially focused debate on organizational ambidexterity has become disconnected and complex thus making it difficult to flow into a new research paradigm in organizational theory”* (p. 376). It is possible that this lack of development results mainly from the dominant use of research methods which are more appropriate for testing, rather than developing theory. In our opinion, therefore, new ideas and perspectives are far more likely to be added if qualitative methods are used to examine the ambidexterity capability.

Finally, to the extent that the papers chosen reflect the core intellectual structure of the field as a whole, the analysis that has been carried out raises some questions about gaps and future directions. In chapter three that follows, we thus present the major gaps identified, followed by the research questions that will guide our empirical analysis.

---

### 2.7.1 Limitations

All methodologies have their limitations and bibliographic coupling and factor analysis are no exception. First, there is some level of subjectivity in identifying the intellectual core of the field, which is a critical point in carrying out the analysis. To face with this problem, we have adopted the method suggested by Lane and used two different researchers who separately classified the papers. Second, the problem that all citations are treated in the same way, when in fact they are not, represents one of the main problems of bibliometric methods (Cronin, 1984). Third, the time that it takes for publication as well as the year of publication can result in recent but influential authors being underrepresented; we tried to resolve this problem using bibliographic coupling instead of co-citation, i.e. we adopted a retrospective approach that allowed us to support current trends and not only the older ones.

Despite these limitations, bibliometric techniques have found many applications in a variety of fields, and are a valid tool for exploring the intellectual structure and the evolution of a field.

## 3 LITERATURE GAPS AND RESEARCH QUESTIONS

The literature review described in chapter two suggests important issues for further research that are described in this chapter. This chapter therefore highlight the major gaps identified, followed by the research questions that will guide our empirical analysis.

### 3.1 Literature gaps

Since the pioneering work of Tushman and O'Reilly (1996), a growing number of researchers in management and organization studies have addressed the phenomenon of ambidexterity, as depicted in the previous section. As a result, over the last couple of years, 'ambidexterity' has evolved into a leitmotif which has inspired researchers in various disciplines with different perspectives and varying research questions. The reason for this growing interest is that ambidexterity is widely recognized and proven to be a key capability in helping to ensure firm performances (March, 1991; Katila and Ahuja, 2002; Bierly and Daly, 2007; He and Wong, 2004).

Researchers in fact strongly agree that firms' long-term survival and success depend on their ability to simultaneously improve existing knowledge ensuring the organization's current viability and engage in leveraging varied and completely new knowledge to ensure future viability (Levinthal and March, 1993, Taylor and Greve 2006). In other words, long-term performance and survival could be realized only if firms succeed in resolving the tension between the conflicting processes of exploration and exploitation by performing both to their maximum, namely by realizing the ambidexterity capability.

Several empirical works have thus been conducted in order to demonstrate the "Ambidexterity Hypothesis", i.e. to provide direct evidence of the positive effect of ambidexterity on firm performance. Building on a sample of 206 manufacturing firms, He and Wong (2004), for example, demonstrate that ambidexterity is positively related to sales growth. Similar results have been found by Gibson and Birkinshaw (2004), who test the "Ambidexterity Hypothesis" adopting a business-unit level of analysis. In the same way, in 2006, Lubatkin Simsek, Ling and Veiga find that the joint pursuit of an exploitative and exploratory orientation positively affects performance measured by using an eight-item scale developed by Gupta and Govindarajan (1986) that includes items such as growth in sales, growth in market share, return on equity, and return on total assets. More recently, Cao, Gedajlovic and Zhang (2009) measure firm performances in terms of sales growth, profit growth, market share growth, operational efficiency, cash flow from market operations, and market reputation. Uotila et al. (2009) verify the "Ambidexterity Hypothesis"

by using the market-based measure of Tobin's Q as the dependent performance variable. Rothaermel and Alexandre (2009) confirm the positive impact of ambidexterity on firm innovativeness. Many other examples can be found.

Another growing body of research has instead focused on analysing the conditions and enabling factors of Ambidexterity capability such as: the organizational structure, the context and top management's characteristics. As we can see, most of these papers analyze a specific typology of enabler. Much of the existing literature identifies organizational structure and formal and informal structural mechanisms as the main enabling factors for building ambidexterity. Jansen, Tempelaar, Van den Bosch and Volberda (2009), for example, indicate structural differentiation as a critical factor that can help ambidextrous organizations to maintain multiple inconsistent and conflicting demands. They additionally point to the need for coordination and integration of differentiated exploratory and exploitative activities and identify formal and informal integration mechanisms that mediate the relationship between structural differentiation and ambidexterity. Adler, Goldoftas and Levine (1999) in a case study of the Toyota Production System, describe the functioning of four organizational mechanisms (namely metaroutines, job enrichment, partitioning and switching) used in the production process to manage the efficiency and flexibility paradox. Another current of thought instead outlines that a strong contribution to Ambidexterity comes from the context and the organizational culture. Adler, Goldoftas and Levine (1999) find that distinctive values, culture, and leadership are essential contextual conditions for ambidexterity. Five years later, Gibson and Birkinshaw further analyze these aspects, providing a more comprehensive description of the contextual antecedents of ambidexterity. Finally, other enabling factors widely discussed in the literature concern the abilities and the characteristics of the top management. Tushman and O'Reilly (1996) in their seminal work state that ambidexterity is facilitated by the top-management team's internal processes. Following this indication, researchers have recently begun to investigate the characteristics of management as a supporting factor for realizing ambidexterity. Lubatkin, Simsek, Ling and Veiga (2006), for example, find that top management team behavioural integration (collaborative behaviour, information exchange, and joint decision making) facilitate the processing of disparate demands essential to attaining ambidexterity in SMEs. Jansen, George, Van den Bosch and Volberda (2008) delineate the attributes that the senior team should possess in order to sustain ambidexterity: shared vision, social integration, contingency rewards. Taylor and Helfat (2009) analyze the role of middle management in fostering organizational ambidexterity.

In particular, what emerges is that research on ambidexterity has focused rather on the performance implications of applying structurally or contextually ambidextrous organizational designs and on the associated enabling factors, than on explaining how firms can develop, cultivate and sustain ambidexterity capability: there remain therefore major points of discussion and the need exists for additional empirical investigations. More studies are, in our opinion, recommended to address this issue, unpacking all these elements that underlie the ambidexterity capability: analyzing ambidexterity at a more micro level, through the lens of organizational practices and routines to discover the artefacts and processes underlying the development of this capability would represent, in our opinion, a useful tool for expressing the complexity of an organization embedded on ambidexterity and providing a micro-foundation of such a multifaceted phenomenon.

Furthermore, existing studies on Ambidexterity focus on the analysis of the structural separation of units for dealing with tensions, on the creation of a context where employees are encouraged to perform contradictory tasks at the same time or on the critical role played by managers in sustaining and guiding ambidexterity. Through a deep analysis of these papers it is however possible to find some complementarities between these different solutions. Tushman and O'Reilly (1996), for instance, cite a common culture and vision, supportive leaders and flexible managers as important requirements enabling structural ambidexterity. Gibson and Birkinshaw's notion of "Organizational Context" explicitly includes the structural context. O'Reilly and Tushman (2008) state that organizational ambidexterity is not simply a matter of structure: it involves a clear strategic intent, an overarching vision and values, an aligned senior team with the ability to manage tensions as a key prerequisite for building ambidexterity. However, there are no works that either investigate whether these solutions are complementary or mutually exclusive alternatives and if they can coexist within the same organization. We believe that it would be interesting to develop some more insights on these topics.

Finally, organizations are recognized as being in continuous interaction with their competitive environment, which represents a primary source of opportunities as well as threats. So, similar to what happens in nature, firms need to co-evolve with the competitive environment for survival (Nelson and Winter, 1982; Helfat, 1997; Helfat and Peteraf, 2003; Lavie, 2006). As a consequence, organizations have to continuously reconfigure their activities and design to adapt to environmental changes in order to resolve the tensions that continuously arise (Tushman and Anderson, 1986; Webb and Pettigrew, 1999): it appears unlikely that a single design provides the exhaustive functionality required to deal with the entire range of boundary conditions and new tensions that an organization faces over time. Thus, studies employing a longitudinal perspective can deal with this issue, analyzing how ambidexterity co-evolves, in a dynamic way, with the external environment. However, there are no studies that take a temporally sensitive perspective, capturing ambidexterity co-evolution with the organization's environment and strategies.

### 3.2 Problem Formulation

Based on these considerations, the need to advance knowledge about how ambidexterity is realized and how it co-evolves with the competitive environment can be clearly seen and hence the problem statement for this thesis is:

*"How can firms realize ambidexterity capability and how does this capability evolve?"*

To answer this problem formulation, a number of research questions will be presented as a guide. Before presenting the research questions it is however necessary to further focus the research context.

### 3.2.1 Research focus

---

Prior research on ambidexterity has typically focused on the macro levels, like the firm (Cao, Gedajlovic and Zhang, 2009; He and Wong, 2004; Jansen, George, Van den Bosch and Volberda, 2008; Jansen, Tempelaar, Van den Bosch and Volberda, 2009; Li, Vanhaverbeke and Schoenmakers, 2008; Rothaermel and Alexandre, 2009; Uotila, Maula, Keil and Zahara, 2009) or business unit (O'Reilly and Tushman 2004; Adler, Goldoftas and Levine, 1999; Gibson and Birkinshaw, 2004), while empirical studies that examine it at a more micro level are relatively scant (Taylor and Helfat, 2009; De Visser, Weerd-Nederhof, Faems, Song, Van Looy and Visscher, 2009). However, to better reveal the complexity of the ambidexterity phenomenon, rather than prescriptions at the system level, more granular analyses may be useful: in fact we believe that using a more grained level of analysis really makes it possible to disclose the "how" question of such a complex phenomenon. This is in line with some considerations by Gupta, Smith and Shalley (2006) and Raish and Birkinshaw (2008). Raish and Birkinshaw (2008) point out in fact that "a firm's innovation stream [ ] consists of various initiatives. The exploitation and exploration requirements may differ significantly from initiative to initiative. Furthermore, even within each initiative, some components may be produced by exploiting existing capabilities, whereas developing others may rely on the exploration of new capabilities". Similarly, Gupta, Smith and Shally (2006) suggest that it could be interesting to analyze ambidexterity at different stages of the innovative process.

Following these suggestions, attention has therefore been focused on the first phase of innovation process, the "Search Phase", and analysis is carried out on how ambidexterity is realized and maintained within this phase.

Additionally, in order to better unravel the complexity embedded in ambidexterity capability and provide a micro-foundation of such a multifaceted phenomenon, a "Practice-based" approach was used which will be described in Chapter 4. The literature review results suggest that almost all researchers, with few exception, agree in defining ambidexterity as a *Capability*. According to the definition of capabilities, these result from the ways organizations operate, in their structures and resources, in specific actions carried out by people, in specific places and at specific times, in culture and in the mind-set of senior managers (Becker, Lazaric, Nelson and Winter, 2005; Becker and Lazaric, 2009). According to Orlikowski (2002) "capabilities are constituted in the everyday practices" (p. 249) of the innovation activities, they emerge "from the ongoing and situated actions of organizational members as they engage the world, they are grounded in what [ ] people do every day to get their work done". It is therefore noticeable that practices and routines play a central role in generating and sustaining capabilities. Capabilities are the result of people's everyday actions and are inseparable from practices (Orlikowski, 2000; Seo and Creed, 2002; Nicolini, Gherardi and Yanow, 2003) and in turn "Practice is an entry to how things get done in organizations" (Antonacopoulou and Pesqueux, 2010, p. 11). Understanding searching in practice may additionally get us closer to an understanding of organizational life as "continually contingently reproduced by human agents - that's what gives it fixity and that's what also produces change" (Giddens and Pierson 1998, p. 90).

These are the reasons why we find it useful to adopt a “practice-based” approach for studying how firms succeed in generating and maintaining ambidexterity capability.

### 3.2.2 The search phase of innovation process

---

According to Bessant (2005) and Hansen and Birkinshaw (2007), the innovation process can be depicted as a sequential process that is common to more or less all organizations. This process involves three linked phases as depicted in Figure 7.

Searching and identifying ideas and knowledge is the starting point of almost all innovation processes (Van den Bosch, Saatcioglu and Fay, 2006; Crawford and Di Benedetto, 2003; Backman, Borjesson and Setterberg, 2007). In this phase, firms are constantly seeking new ideas and knowledge, both internally and externally, with which to improve or to renew existing competences. In the subsequent stage, selection, firms have to evaluate all the ideas and knowledge generated within the search phase and select those that will be taken further while in the last phase, implementation, firms have to implement the ideas and the knowledge which they have selected and use them in order to make innovation happen.



**Figure 7 - The innovation process<sup>3</sup>**

The activities and decisions that occur within the search phase are the starting point for all innovation processes and, therefore, determine the direction of any new product path: a better understanding of such activities and decisions could thus lead to competitive

---

<sup>3</sup> Adapted from Hansen and Birkinshaw, 2007 and Bessant, 2005

advantage. It is on the search phase that attention is focused in this work. Successfully managing the search phase is a critical matter for firms that want to survive in the market and be competitive. Firms have to search for knowledge that deepens and improves their existing core knowledge and simultaneously broadens their knowledge base by identifying new possibilities (Argyris and Schon, 1978; March, 1991; Leonard-Barton, 1995; Hamel and Prahalad, 1994): this represents a strategic dilemma. On the one hand, it is argued that an organization that engages excessively in improving existing knowledge undergoes problems such as organizational inertia (Hannan and Freeman, 1977), competency traps (Levitt and March, 1988), the conversion of core capabilities into core rigidities (Leonard-Barton, 1992) and obsolescence (Levinthal and March, 1993). On the other hand, engaging too much in the search for completely new and unfamiliar knowledge could lead to many undeveloped ideas, neglecting to improve and adapt existing routines (March, 1991) and may prevent the organization benefiting from economies of scale (Chesbrough and Rosenbloom, 2002). What emerges is a tension between “improving the existing” and “facing the not previously experienced”. In other words, the search phase is permeated by the widely debated tension between “exploitation” and “exploration” activities.

Within such phase, exploration and exploitation are described in terms of the proximity of the sought-for knowledge (Sidhu, Volberda and Commandeur, 2004; Atuahene-Gima, 2005; Lavie and Rosenkopf, 2006; Sidhu, Commandeur and Volberda, 2007; Mom, Van Den Bosch and Volberda, 2007): exploitation activities correspond to the search for familiar, mature, current or proximate knowledge – *Local Search* - while exploration activities correspond to the search that builds on a firm’s existing knowledge and capabilities with the aim of generate unfamiliar, distant and remote knowledge – *Distant Search*.

### 3.3 Research Questions

Based on the discussion carried out in the previous paragraphs, it is now possible to better delineate the research objectives and research questions. Therefore the research questions are:

1. *Are there any differences, in terms of search practices, between firms that show ambidexterity capability in the search phase of the innovation process and firms that do not show such a capability? What are these differences?*
2. *How can firms succeed in realizing ambidexterity capability in the search phase?*
3. *How does the achievement of ambidexterity capability change while co-evolving with the external environment?*
- 4.

## 4 RESEARCH METHODOLOGY

Methodology is that fundamental element that confers rigor to the analysis and accuracy to the results. The production of knowledge, in fact, substantially depends on the methodology with which it is made and the manner in which the methodology is applied to the context to be studied. A careful consideration of the methodological approach in fact will ensure that we will be able to bring forward learning points for other researchers and provide managerial usefulness of the results (Easterby-Smith, Thorpe, Lowe, 2002). This chapter discusses therefore the appropriate methodological approaches for the scope of our research, that is: given our research questions, which research methods would be most appropriate to apply?

### 4.1 For each question, its methodology

Research methods could be classified into five different types:

1. Experiments,
2. Survey,
3. Archival analysis,
4. Histories,
5. Case research.

In this section we examine the differences between these research methods and look at how three conditions can assist in distinguishing between different research methods. Then, we consider the abilities of each methodology, as an evaluative tool, to help us to find an answer for the research questions identified in chapter 3.

There exist three main conditions that allow us to classify the different methodologies and to delineate the differences between them (Yin, 2009). Many social scientists believe that case studies are only appropriate for the exploratory phase of an investigation, that surveys and histories are appropriate for the descriptive phase, and that experiments are the only way of doing explanatory or causal inquiries: they argue therefore that the different research methods should be arrayed hierarchically. Yin however calls for a different view of the use of research methods: he in fact demonstrates that each method can be used all for all three purposes (exploratory, descriptive or explanatory) and proposes three conditions that must be considered when choosing the most appropriate methodology. These dimensions are:

- the type of research question posed,

- the extent of control an investigator has over actual behavioral events,
- the focus on contemporary events.

Table 15 below summarizes the distinctive traits of each of the five research methodologies identified by Yin. The first and most important condition for differentiating among various research methods is to identify the type of research question being asked. In general, “what” questions may be either exploratory (in which any of the methods could be used) or about occurrence (in which surveys or the analysis would be favored). On the other hand, “how” and “why” questions are likely to favor the use of case studies, experiments, or histories.

<b>METHODS</b>	<b>The type of research question posed</b>	<b>Control investigator has over behavioural events</b>	<b>Focus on contemporary events as opposed to historical events</b>
<i>Experiment</i>	<i>How? Why?</i>	<i>High</i>	<i>Contemporary</i>
<i>Survey</i>	<i>Who? What? Where? How many? How much?</i>	<i>Little</i>	<i>Contemporary</i>
<i>Archival analysis</i>	<i>Who? What? Where? How many? How much?</i>	<i>Little</i>	<i>Contemporary and/or historical</i>
<i>Histories</i>	<i>How? Why?</i>	<i>Little</i>	<i>Historical</i>
<i>Case research</i>	<i>How? Why?</i>	<i>Little</i>	<i>Contemporary</i>

**Table 15 - Three conditions for the choice of research methods (adapted from Yin, 2009)**

Coming back to our research questions, the problem statement is respectively:

- a “WHAT” form of question for research question number 1 (“Are there any differences, in terms of search practices, between firms that show ambidexterity capability in the search phase of the innovation process and firms that do not show such a capability? What are these differences?”)
- a “HOW” form of question for research questions 2 and 3 (“How can firms succeed in realizing ambidexterity capability in the search phase?” and “How does the achievement of ambidexterity capability change while co-evolving with the external environment?”)

As a result, according to table 15, the research methods of survey and archival data can both fit the first type of question and the research methods of history, case study, and experiments can all fit the second and third types of question (Table 16).

METHODS	RESEARCH QUESTIONS FORM	MOST ADEQUATE METHODOLOGIES
<i>Research question 1</i>	<i>WHAT ?</i>	<ul style="list-style-type: none"> <li>• <i>Survey</i></li> <li>• <i>Archival data</i></li> </ul>
<i>Research question 2</i>	<i>HOW ?</i>	<ul style="list-style-type: none"> <li>• <i>History</i></li> <li>• <i>Case study</i></li> <li>• <i>Experiments</i></li> </ul>
<i>Research question 3</i>	<i>HOW ?</i>	<ul style="list-style-type: none"> <li>• <i>History</i></li> <li>• <i>Case study</i></li> <li>• <i>Experiments</i></li> </ul>

**Table 16 – Selectable methodologies on the base of the research question form**

In order to make a choice between these options, we turn to the two other columns in Table 15.

With the first research question our objective is to verify if any difference among the firms that present different level of ambidexterity exists when looking at the practices put in place by firms in order to search for local and distant knowledge and what these differences are.

The focus in this research is about a contemporary phenomenon, namely the searching practices adopted by the firms. Survey, contrary to archival data (that refers to a form of the observational method, whereby the researcher examines the accumulated documents, or archives such as diaries, novels, magazines, newspapers) is particularly useful when a researcher wants to collect data on phenomena that cannot be directly observed.

A survey methodology was thus selected to address the first research aim as

- it seeks to answer a “what” question
- about a contemporary phenomenon - search practices and ambidexterity capability of existing organizations
- in which the investigator has no control over events – the research takes place within the organizations’ context in the midst of their day-to-day activities.

With regards of the research questions 2 and 3, as previously stated, history, case study, and experiments can all fit. Histories are the preferred strategy when there is virtually no access or control. This methodology deals with the “dead” past and is particularly useful when no relevant persons are alive to report and the investigator must rely on various documents and cultural and physical artifacts as the main sources of evidence. Histories can of course also deal with contemporary events, but then this strategy begins to overlap with that of a case study. In regard to experiments, Yin (2003) notes that they are selected when an investigator can manipulate behavior directly, precisely, and systematically. This can occur in a laboratory setting in which an experiment may focus on one or two isolated variables, or it can be done in a field setting where it is often referred to as a “social experiment”, in which e.g. investigators treat groups of people in different ways. The case study, instead, is the preferred research method in examining contemporary events when the relevant behaviors

cannot be manipulated. The case study uses many of the same techniques as a history but it adds two sources of evidence not usually included in a history such as the direct observations of the events being studied and interviews of the persons involved in the events. Further, Yin explains that the case study's unique strength is its ability to deal with a full variety of evidence ranging from e.g. documents, artifacts, interviews, and observations. As we conclude upon the different methods presented, we find that the case study approach looks like the most appropriate choice for the following reasons:

- the research seeks to answer a "How" question;
- the focus in this research is about a contemporary phenomenon;
- this methodology provides us with little or no control over events as the research takes place within the organizations' context in the midst of their day-to-day activities.

Given these considerations we thus divided the analysis into two parts:

- PART 1: Research question 1, survey methodology implemented (Chapter 5)
- PART 2: Research questions 2 and 3, case study methodology implemented (Chapter 6)

Both survey methodology and case study methodology adopt "practices for search" as unit of analysis, implementing however two different approaches (Figure 8):

- treating practices as a black box (PART 1)
- examining the different aspects of practices by opening the black-box (PART 2)



**Figure 8** – Different approaches adopted in this dissertation for studying practices

The “black-box” approach is the most suitable for understanding practices’ role in organizations and for generating useful information without unpacking their internal structure. This approach is a safe approximation when research questions concerns a description, prediction or comparison concerning the practice as a whole. This is the case of research question 1 that will be addressed in PART 1 of the empirical analysis where our intent is to link search practices with ambidexterity capability.

When the objective is to understand how firms succeed in building ambidexterity capability, however, the “black box” perspective can lead to a narrow understanding. For explanation of the dynamics that convey to Ambidexterity Capability, we need in fact to look inside the practices and examine their internal structure. The internal structure of practices appear in fact more variable and potentially contested than it does when viewed as a “black box”. In PART 2 thus the intent is to look inside the practices and examine their internal structure.

## 4.2 PART 1 - Survey methodology description

PART 1 of the empirical research has the objective of answering the research question:

*“Are there any differences, in terms of search practices, between firms that show ambidexterity capability in the search phase of the innovation process and firms that do not show such a capability? What are these differences?”*

A survey methodology has been identified to be the most adequate. There exist however two major types of survey research (Kerlinger, 1986) which have different objectives:

- exploratory survey research
- explanatory survey research.

Exploratory survey research’s main objective is to gain preliminary insight on a topic. It in fact takes place during the early stages of research into a phenomenon. There is usually no model in exploratory research, the concepts of interest need to be better understood and measured and it provides the basis for more in-depth survey. Resulting data can for example be refined to identify new possibilities and dimensions of interest. Exploratory survey methodology includes descriptive survey that Dublin (1978) has described as an indispensable starting point for studying a phenomenon. For example, a descriptive survey might be designed with the purpose of documenting the use of different searching practices by high and medium-tech firms. Its primary aim is not theory development, even though through the facts described it can provide useful suggestions for both theory building and for theory refinement (Dublin, 1978; Malhorta and Grover, 1998).

The second type of survey research, “explanatory research”, is conversely devoted to finding causal relationships among a set of variables. It does so from theory-based expectations on how and why variables should be related: its strength is in explaining hypothesize, and test for positive or negative relationships between the variables of interest. It thus takes place when knowledge of a phenomenon has been previously articulated in a theoretical form

using well-defined concepts, models and propositions. Results are interpreted and in turn contribute to theory development.

Exploratory survey methodology can help identify concepts and the basis for their measurement, and it is very appropriate when research on a topic is still in the early stages, while explanatory survey methodology is more useful as the research on a particular theme matures so that variables can be effectively measured and relationships between them tested. Since little research has been done till now to address search practices issue, an exploratory survey methodology is therefore adopted as recommended by Malhotra and Grover (1998).

The study is conducted in two phases. First a series of semi-structured interviews with managers and academic experts are conducted in order to gain a comprehensive depiction of search practices used by firms (phase I). The results of this preliminary phase are then used to develop a mail survey instrument (phase II). In Paragraphs 4.2.1 and 4.2.2 the two phases are described.

#### **4.2.1 Phase I: Preliminary interviews with managers**

---

The first phase was conducted in collaboration with the “Innovation Lab”<sup>4</sup>, an international laboratory, launched in 2006 by the “Advanced Institute of Management Research” (AIM) and coordinated by Professor John Bessant. The uniqueness of the Innovation Lab lies in the strong international network of academics working together with practitioners from multiple leading companies of different sizes as well as from different Countries and industries. The laboratory is in fact structured in the form of an international network, which involves over 250 companies and many universities in different Countries such as Germany, Denmark, UK, France, Australia, Benelux, Sweden, Norway, Finland, Italy and Suisse.

The network is initiated with the aim of fostering a growing, interactive community of researchers and practitioners that creates and shares state-of-the-art knowledge about innovation management, through the creation of an open international community that promotes development and exchange of know-how on innovation topic.

*“The underlying model is one of cooperative experience sharing supported by a mixture of qualitative and quantitative research carried through by academic partners in the participating countries. Case studies of the member firms are constructed via a common interview framework and the results feedback at both national level and in international workshops, providing a check on face validity and an opportunity to explore and expand on issues raised” (Bessant, 2008).*

---

<sup>4</sup> More information on the laboratory and its activities are available at the website [www.innovation-lab.org](http://www.innovation-lab.org)

Till now the network has collected more than 80 case studies on organizational practices used by firms within the three phases of the innovation process described in paragraph 3.3.1 (search, select and implement) with a focus mainly on discontinuous/radical innovation challenges. The numerous case studies conducted by the researchers participating to the “Innovation Lab” have resulted in the identification of a set of practices that firms should use within the search phase, ranging from well-known to newer approaches (Bessant and Von Stamm, 2007).

Building on these results, the international team has thus developed a questionnaire for the assessment of practices adopted by firms when dealing with the challenges of the search phase. The “Innovation Lab” results and the questionnaire developed within the laboratory represent the starting point for the development of the “*Search Practices Questionnaire*”, used in this research. The questionnaire developed within the laboratory in particular has been modified and adapted to the specific objectives of our research with the support of both a review of existing literature and several interviews conducted with Italian managers who joined the international network.

The following paragraph provides a description of the survey instrument development

#### **4.2.2 Phase II: “Search Practices Questionnaire” development**

---

As stated in the previous paragraph, the questionnaire developed within the “Innovation Lab” represents the starting point for the development of the “Search Practices Questionnaire” used in PART 1 of our empirical research. The objective is to verify if there are some differences between firms that show Ambidexterity capability in the search phase of the innovation process and firms that do not show such a capability in terms of search practices implemented. In order to reach this objective, it is therefore necessary to develop a tool that allows us, on the one hand, to profile the searching practices of Italian medium-high tech firms and, on the other hand, to identify those firms that have developed ambidexterity capability in the search phase.

Building on these consideration, the questionnaire should be structured into three separate parts:

- SECTION 1: the first part of the survey gathers demographic data from the respondent companies such as the company name, company size, market position, industry, R&D expenses , etc.
- SECTION 2: the second part collects information relating to the use of a number of practices for search identified thanks both to the case studies developed within the “Innovation Lab” and a review of the literature
- SECTION 3: the third part includes some previously validated scales that allow us to measure if a firm has developed ambidexterity capability or not.

#### 4.2.2.1 Searching practices assessment

---

The second part of the questionnaire represents the core of the survey and is based on a framework that assesses comprehensively a firm's level of experience with a number of search practices that echo, in part, the contents of the questionnaire developed by the Innovation Lab, albeit with some modifications and expansion.

The innovation Lab questionnaire is in fact aimed at detecting the use that firms make of the different search practices in relation to the generation of only radical, completely new ideas and knowledge.

However, as we stated in chapter 3, to survive in the market and be competitive firms have to both search for knowledge that deepen and improve their existing core knowledge and simultaneously search for knowledge and ideas that broaden their knowledge base: they have both to carry out search practices with the purpose of generating familiar, mature, current or proximate knowledge that builds on a firm's existing knowledge – *Local Search* - and to carry out search practices with the purpose of generating unfamiliar, distant and remote knowledge – *Distant Search*. The Innovation Lab questionnaire only consider this second purpose of search practices while neglecting the former.

Additionally, as literature outlines many of the practices in the questionnaires can be adopted by firms with this dual purpose: their use within the firm can in fact be also addressed to support the generation of both "Local" and "Distant" knowledge. We therefore modify the Innovation Lab questionnaire in order cover both these dimensions: "Local search" and "Distant search".

Twenty three practices for search are included in the questionnaire. We stress that this list is neither conclusive nor exhaustive. It is in fact important to underline that we do not pretend to provide with these practices an exhaustive list of all possible practices that companies can implement in the search for ideas and knowledge: surely there will be many other practices or different nuances of practices not covered in our list. Our intent is in fact to build a list as varied and as wide as possible, consistently with the need to build a quick and immediate questionnaire to be easily filled up by the firms.

For each practice the respondents are asked we asked to indicate, on a 1–5 Likert scale (1 = strongly disagree; 5 = strongly agree), the extent to which their firm makes use of such a practice in order 1) to improve the existing knowledge base and/or 2) to generate completely new knowledge. So, apart some practices that are for their nature directed to the generation of local or distant knowledge, for the majority of practices two questions are posed: one concerning the use of the practice in order to generate local knowledge and the other concerning the use of the practice in order to generate distant knowledge.

In Table 17 that follows we list a number of sources for each of the 23 practices.

	<b>PRACTICE</b>	<b>SOURCES</b>	<b>PURPOSES</b>
<b>1</b>	To bring together people for different knowledge sets, backgrounds or functions.	<i>Hargadon and Sutton (2000)</i> <i>O'Connor and McDermott (2004)</i> <i>Gassmann (2001)</i> <i>Leonard and Straus (1997)</i>	<i>Distant and Local knowledge generation</i>
<b>2</b>	To encourages diversity	<i>Hargadon and Sutton (2000)</i> <i>O'Connor and McDermott (2004)</i> <i>Gassmann (2001)</i>	<i>Distant knowledge generation</i>
<b>3</b>	To encourage innovation teams to expand their resource network by tapping into the knowledge of any employee in the firm.	<i>Hargadon and Sutton (2000)</i> <i>Kelley (2005)</i> <i>O'Connor and McDermott (2004)</i>	<i>Distant and Local knowledge generation</i>
<b>4</b>	To have professional figure in charge of connecting innovation teams with other people company-wide when knowledge or insight is needed	<i>Leifer, McDermott, O'Connor, Peters, Rice and Veryzer (2000)</i>	<i>Distant and Local knowledge generation</i>
<b>5</b>	To implement an open and collaborative research environment	<i>Chesbrough (2003)</i> <i>O'Connor (2006)</i> <i>Phillips, Lamming, Bessant and Noke (2006)</i>	<i>Distant knowledge generation</i>
<b>6</b>	To make use of focus group, interviews, survey on line, brainstorming	<i>Chan and Mauborgne (2001)</i> <i>Ulwick (2002)</i> <i>Ulwick (2003)</i> <i>Ulwick (2005)</i>	<i>Distant and Local knowledge generation</i>
<b>7</b>	To actively involve lead users	<i>Thomke and Von Hippel (2002)</i> <i>Von Hippel (2005)</i> <i>Von Hippel (2001)</i> <i>Von Hippel and Katz (2002).</i> <i>Lettl, Herstatt, Gemünden (2006) Lüthje and Herstatt (2004)</i> <i>Jeppesen and Molin (2003)</i>	<i>Distant and Local knowledge generation</i>
<b>8</b>	To use prototypes as means of learning and refining an idea	<i>Lynn, Morone and Paulson (1996)</i> <i>Thomke (2003)</i>	<i>Distant and Local knowledge generation</i>
<b>9</b>	To set up teams to actively search out new ideas that will take the business in new strategic directions.	<i>Leifer, McDermott, O'Connor, Peters, Rice and Veryzer (2000)</i>	<i>Distant knowledge generation</i>
<b>10</b>	To have a dedicated group of people that explores new ways to apply our existing technology to new industries and new customers.	<i>Chan and Mauborgne (2005)</i> <i>Chan and Mauborgne (2001)</i>	<i>Distant knowledge generation</i>
<b>11</b>	To have people officially charged with scouting for new ideas, finding new sources of potential radical ideas and looking for trends and developments that might have implications for the organisation's future	<i>Christensen and Raynor (2003)</i> <i>Kim and Mauborgne (2001)</i> <i>Ulwick (2005)</i>	<i>Distant knowledge generation</i>
<b>12</b>	To search for multiple applications and to conduct several market experiments to discover promising markets for technologies that are very new and different	<i>Hargadon and Sutton (2000)</i> <i>O'Connor (1998)</i> <i>Thomke (2001)</i> <i>Tidd, Bessant and Pavitt (2005)</i> <i>Leifer, McDermott, O'Connor, Peters, Rice and Veryzer (2000)</i>	<i>Distant knowledge generation</i>

<b>13</b>	To use an open innovation system in which technology-related challenges are posted online by R&D staff so that a community of registered scientists anywhere in the world can propose their solutions	<i>Chesbrough (2003)</i> <i>George, Works and Watson-Hemphill (2005)</i>	<i>Distant knowledge generation</i>
<b>14</b>	To have a website (blog, wiki, corporate social network) where outsiders can submit their suggestions and ideas for markets, products and/or services	<i>George, Works and Watson-Hemphill (2005)</i>	<i>Distant and Local knowledge generation</i>
<b>15</b>	To have one company-wide centralized idea management system in place to which all employees can submit ideas for evaluation and receive quick feedback	<i>Van Dijk and Den Van (2002)</i> <i>Hargadon and Sutton (2000)</i> <i>Gorski and Heinekamp (2002)</i> <i>Flynn, Dooley, O'Sullivan and Cormican (2003)</i>	<i>Distant and Local knowledge generation</i>
<b>16</b>	To mobilizes the mainstream resources to systematically collect information, ideas and opinions from external sources	<i>Tennenhouse (2004)</i> <i>Chesbrough (2003)</i> <i>O'Connor (2006)</i> <i>Linder, Jarvenpaa and Davenport (2003)</i> <i>Rothaermel (2001)</i> <i>Swink (2006)</i>	<i>Distant and Local knowledge generation</i>
<b>17</b>	To encourage people to go to events, conferences, courses, etc.	<i>Chesbrough (2003)</i> <i>O'Connor (2006)</i> <i>Prahalad and Venkatram (2004)</i> <i>Hamel (2006)</i>	<i>Distant and Local knowledge generation</i>
<b>18</b>	To encourage people to come forward with ideas, even if they have only a vague idea of the potential market applications for the idea	<i>Andriopoulos and Gotsi (2005)</i> <i>Snyder and Duarte (2003)</i> <i>Birkinshaw and Gibson (2004)</i> <i>Bessant, Lamming, Noke, and Phillips (2005)</i> <i>Bessant (2003)</i>	<i>Distant knowledge generation</i>
<b>19</b>	Clearly communicate throughout the whole organization that radical innovation is necessary for the long-term survival of the organization.	<i>O'Connor (2006)</i> <i>Phillips, Lamming, Bessant and Noke (2006)</i> <i>Snyder and Duarte (2003)</i>	<i>Distant knowledge generation</i>
<b>20</b>	To support employees that have innovative ideas by giving them the opportunity to manage such ideas into dedicated units	<i>Amabile, Hardley, and Kramer (2002)</i> <i>McLaughlin, Bessant and Smart (2005)</i> <i>Snyder and Duarte (2003)</i> <i>Andriopoulos and Gotsi (2005)</i> <i>Hargadon and Sutton (2000)</i>	<i>Distant knowledge generation</i>
<b>21</b>	To develop an innovation culture within the organization	<i>O'Connor (2006)</i> <i>Phillips, Lamming, Bessant and Noke (2006)</i> <i>Birkinshaw and Gibson (2004)</i> <i>Andriopoulos and Gotsi (2005)</i> <i>Martins and Terblanche (2003)</i>	<i>Distant knowledge generation</i>
<b>22</b>	To connect to the final customers	<i>Leonard and Rayport (1997)</i> <i>Leonard (2002)</i> <i>Hancock, Roland and Wojcik (2005)</i> <i>Ulwick (2002)</i> <i>Ulwick (2003)</i> <i>Ulwick (2005)</i>	<i>Local knowledge generation</i>
<b>23</b>	To deeply look at how people actually use products	<i>Leonard and Rayport (1997)</i> <i>Leonard (2002)</i> <i>Ulwick (2002)</i> <i>Ulwick (2003)</i> <i>Ulwick (2005)</i>	<i>Local knowledge generation</i>

**Table 17 – Some main sources for each practice**

#### 4.2.2.1.1 Questions formulation

---

A critical task in the realization of the questionnaire is the choice of language to be used in the formulation of questions, the so-called “wording” phase. It is essential, in fact, that the questionnaire is understandable, since a lack of understanding or misunderstanding of the questions would lead to unreliable answers, or worse, influenced by external factors. In addition, the stage of formulation of the questions becomes more important when using items that are made from scratch: this is our case. To avoid these problems, in formulating the questions the following rules, identified by Oppenheim (1992), were followed:

- Avoid any ambiguity: we try to formulate the questions so that they have the same meaning for all respondents. Additionally, given that the questionnaire should be completed by Italian managers, the questions are formulated in Italian. Where necessary, supplementary notes are given to assist in the interpretation.
- Avoid questions that implicitly constrain the answers.
- Avoid emotional questions.
- Avoid questions that pilot the answers: the questions are also reviewed by a group of fellow researchers and HR managers to avoid the lack of objectivity of the questions.
- Decompose multiple applications to avoid the overlap of responses: this aspect is taken particularly into consideration in the formulation of the items in which we try to ask questions that contain a single concept.
- Sizing questions: questions and statements must be maintained under 20 words, keeping his attention.
- Avoid questions that require to remember remote experiences: all the questions are formulated considering the current organizational situation.

#### 4.2.2.2 Ambidexterity measure

---

The third part of the questionnaire includes a number of questions that allow us to measure if a firm has succeeded in developing ambidexterity capability in the search phase or not.

Ambidexterity is defined as *the ability of a complex and adaptive system to manage and attain conflicting activities by achieving high levels of both in a simultaneous way*. In the context of the search phase of innovation process ambidexterity is a capability of those firms that excel both in generating completely new knowledge, broadening their knowledge base and identifying new possibilities, and simultaneously in improving their existing core knowledge.

To measure ambidexterity we follow prior studies (Gibson and Birkinshaw, 2004; He and Wong, 2004) and use a two-step approach to develop a measure.

First, we need distinct measures for capturing, on the one hand, the extent to which firms depart from existing knowledge and, on the other hand, the extent to which firms build on and improve existing knowledge.

Through an analysis of the literature, we have therefore identified two already tested scales suitable for our purpose: “Exploration Competence” and “Exploitation Competence” (Nonaka and Takeuchi, 1995; Zahra, Ireland and Hitt, 2000; Atuahene-Gima, 2005). Exploration competence and Exploitation Competence are measured by four and five items respectively, as showed in Table 18.

CONSTRUCTS	OPERATIONAL MEASURES OF CONSTRUCT
<i>Over the last three years, to what extent has your firm:</i>	
<b>Exploration competence</b>	1. <i>Acquired manufacturing technologies and skills entirely new to the firm?</i>
	2. <i>Learned product development skills and processes entirely new to the industry?</i>
	3. <i>Acquired entirely new managerial and organizational skills that are important for innovation (such as forecasting technological and customer trends; identifying emerging markets and technologies)?</i>
	4. <i>Strengthened innovation skills in areas where it had no prior experience?</i>
<b>Exploitation competence</b>	1. <i>Upgraded current knowledge and skills for familiar products and technologies?</i>
	2. <i>Enhanced skills in exploiting mature technologies that improve productivity of current innovation operations?</i>
	3. <i>Enhanced competencies in searching for solutions to customer problems that are near to existing solutions rather than completely new solutions?</i>
	4. <i>Upgraded skills in product development processes in which the firm already possesses significant experience?</i>
	5. <i>Strengthened knowledge and skills on mature technologies?</i>

**Table 18 – “Exploration competence” and “Exploitation competence” measures adopted for measuring ambidexterity capability within the search phase**

To collect data for these measures, we therefore ask the respondents to indicate, on a 1–5 Likert scale, the extent to which the nine different statements were true regarding competence development in their firm over the past three years.

Second, to develop a measure for ambidexterity capability, we follow previous research and computed the multiplicative interaction between “Exploration Competence” and “Exploitation Competence”. The computation of the multiplicative interaction reflects the arguments that “Exploration Competence” and “Exploitation Competence” are orthogonal (Gibson and Birkinshaw, 2004; Gupta, Smith and Shalley, 2006). As outlined in paragraph 2.1.4.2, in a recent work, Cao, Gedajlovic and Zhang (2009) put in evidence a significant ambiguity in the conceptualization of the construct concerning the extent to which ambidexterity involves a firm’s effort to simply balance opposite poles of the tension or to match the magnitude of the opposite poles of the tension (Cao, Gedajlovic and Zhang, 2009). Adopting one perspective or the other implicates important consequences for the operationalization of the construct. Corresponding to the “balance” view, ambidexterity should be in fact operationalized as the absolute difference of “exploration competence” and “exploitation competence” (He and Wong, 2004) while, corresponding to the “combined” view, ambidexterity should be operationalized as the product (Gibson and

Birkinshaw 2004, He and Wong 2004) of “exploration competence” and “exploitation competence”. As previously stated, in measuring ambidexterity capability, we follow this second perspective.

---

#### **4.2.2.3 Pilot testing**

---

As part of our research strategy, we introduce our survey to a number of experts to discuss our objectives, and the rationale of the underlying methodology, and procedure in order to achieve their approval before going on.

The survey was thus pre-tested with two groups of subjects: colleagues and target respondents. The two tests were conducted independently and lead to improvement and update of the survey instrument. In particular we asked colleagues and target respondents whether the compiling instruction and the questions were clear, whether there were any problems in understanding what kind of answers were expected and whether the planned administration procedure would be effective (Forza, 2002).

This pre-testing ensured that the survey questions were clear and convenient to answer and that the relevance of survey participation was evident.

---

#### **4.2.3 The sample**

---

Sampling is the process of selecting a sufficient number of respondents from the population that the researcher wishes to investigate. “By studying the sample and understanding the characteristics of the sample subjects, the researcher will be able to generalize the properties or characteristics to the population elements” (Forza, 2002).

In order to meet our research aim that is to profile the searching practices of Italian medium-high tech firms and to compare ambidextrous and non-ambidextrous firms on the use of such practices, we drawn our population frame from the industry classification ATECO (2007). To this purpose, medium and high Tech companies were selected from the database AIDA (2009) according to the international OECD science classification<sup>5</sup>. The target

---

<sup>5</sup> Firms are considered "high-tech" if at least one of the following "qualitative", and at least one of the following "quantitative" requirements are matched (source: “Osservatorio imprese high-tech Toscana”):

QUALITATIVE REQUIREMENTS:

- The firm makes use, even occasionally, of internal R&D activity in order to identify new technologies or develop new products.
- The firm, in the three years preceding the survey, has at least one Italian, European or U.S. patent application, or a PCT procedure.

population frame thus consisted of Italian with more than 50 employees and covering the specific two-digit ATECO (2007) codes 20, 21, 25, 26, 27, 28, 29, 30, 32.

The sample design can follow two different sampling approaches (Forza, 2002):

- *Probabilistic sampling*, useful to ensure representativeness of the sample and to generalize the results. Probabilistic sampling includes “simple random sampling”, “proportional stratified random sampling” and “disproportionate stratified random sampling” (see Babbie (1990) for more details);
- *Non-probabilistic sampling*, that is almost totally random and provides information for a given sample size. Non probabilistic sampling includes “area sampling”, “double sampling”, “convenience sampling”, “judgement sampling” e “quota sampling” (see Babbie (1990) for more details).

In the research we chose to use a simple random sampling approach.

Another important issue that should be addressed concerns the sample size. The sample size indicates the minimum required number of observations necessary to conduct reliable analysis: it is in fact an important element since it is closely connected with the significance of the results, the statistical power of the survey and the magnitude of the relationship (*effect size*) (Table 19). Table 19 shows that the mandatory sample size increases while increasing the statistical power, decreasing the significance level ( $\alpha$ ) and decreasing the size of the effect researched (Forza, 2002).

Given that a study with low statistical power is not capable of understanding large-scale results, while a study with high statistical power wasted resources to obtain conclusions with little value, we consider 0.8 as an acceptable value of statistical power (Verma and Goodable, 1995). Additionally, we would like to reach a medium effect size and a significance level of at least 0.05. As a consequence, our sample should consist of at least 44 observations.

We have therefore randomly selected five hundreds of high-tech firms previously identified in the AIDA database, to which submit the questionnaire.

- 
- The firm, in the three years preceding the survey, has participated to at least one European project, as main contractor or as a partner.
  - at the time of the interview, the firm cooperates on research projects with at least one local public or private research institution.
  - The firm has undertaken activities in order to participate in national or regional programs for financing innovative actions in specific industries (such as FAR, FIT, MAP, regional funds and awards).
  - The firm is a spin-off of a public research organization (that is within the founding members there are researchers, professors or public research institutions who have carried out research activities within the laboratories of these institutions), or is housed in an incubator/science and technology park.

#### QUANTITATIVE REQUIREMENTS:

- Average percentage of employees in R&D over the last three years is equal to or greater than ten percentage points.
- Average percentage of expenditure on R&D over the last three years is equal to or greater than ten percentage points.
- Percentage of graduates employed in technical-scientific is equal to or greater than fifty percent.

		Statistical power = 0.6		Statistical power = 0.8	
		$\alpha = 0.05$	$\alpha = 0.01$	$\alpha = 0.05$	$\alpha = 0.01$
<b>Effect size</b>	Large effect (strong association)	12	18	17	24
	Medium effect (medium association)	30	45	44	62
	Small effect (small association)	179	274	271	385

**Table 19** – Effect size, statistical power and sample size (Forza, 2002)

## 4.2.4 Data collection

After having defined the sample we moved to the data collection that took place between October 2009 and April 2010. Data collection has been conducted in collaboration with a team of researchers of the University of Pisa. The sample has in fact been divided into two equal parts: the Pisa team has been thus responsible for collecting data of 250 firms while the team of Padova has been responsible for the remaining 250.

### 4.2.4.1 Data collection method

Data collection may occur with a wide variety of tools: interviews or questionnaires are the main instruments used. Each instrument of data collection has advantages and disadvantages that are summarized in Table 20 (Forza, 2002). The choice of the most adequate data collection tool is in particular determined by the specific needs presented by the research and constrained by time, money and resources available.

<b>DATA COLLECTION TOOL</b>	<b>ADVANTAGES</b>	<b>DISADVANTAGES</b>
<p><b>Structured face-to-face interviews</b> The interviewer solicits information directly from a respondent in personal interviews.</p>	<ul style="list-style-type: none"> <li>- Flexibility in sequencing the questions</li> <li>- More details and explanations</li> <li>- Highly complex questionnaire can be administered</li> <li>- Improved ability to contact hard-to-reach populations</li> <li>- Higher response rate</li> <li>- Increased confidence that data collection instructions are followed</li> </ul>	<ul style="list-style-type: none"> <li>- Higher cost</li> <li>- Interviewer bias</li> <li>- Respondent's reluctance to cooperate</li> <li>- Greater stress for both respondents and interviewers</li> <li>- Less anonymity</li> </ul>
<p><b>Telephone interviews</b> Information are collected through the use of telephone interviews.</p>	<ul style="list-style-type: none"> <li>- Rapid data collection</li> <li>- Lower cost</li> <li>- Anonymity</li> <li>- Large-scale accessibility</li> <li>- Increased confidence that data collection instructions are followed</li> </ul>	<ul style="list-style-type: none"> <li>- Less control over the interview situation</li> <li>- Less credibility</li> <li>- Lack of visual materials</li> </ul>
<p><b>Questionnaires sent by mail</b> The questionnaires are sent by mail, completed by the respondents and sent back.</p>	<ul style="list-style-type: none"> <li>- Cost saving</li> <li>- Questionnaires can be completed at the respondent's convenience</li> <li>- No time constraints</li> <li>- Questionnaires can be prepared to give an authoritative impression</li> <li>- Anonymity ensured</li> <li>- Interviewer's bias reduced</li> </ul>	<ul style="list-style-type: none"> <li>- Lower response rate</li> <li>- Longer period time involved</li> <li>- Affected by self-selection</li> <li>- Lack of interviewer involvement</li> <li>- No open-ended questions</li> </ul>

**Table 20 – Advantages and disadvantages of data collection tools (Forza, 2002)**

Building on these considerations, we have find on-line questionnaire to be the most useful data collection instrument: it is cost and time saving, it can be completed at the respondents' convenience thus not presenting time constraints and ensure the anonymity of the respondents.

An on-line questionnaire has therefore been created and mailed to the respondents through Survey-Monkey.com. To avoid the low response rate associated with this tool, we accompanied the questionnaire with a presentation letter that put in evidence the advantages associated with the questionnaire filling. A series of recall have also been planned in order to solicit respondents.

Appendix B contains the presentation letter and an extract of the questionnaire, comprehending only the questions that have been used for the statistical analysis.

#### 4.2.4.2 Data collection procedure

Data collection followed a common procedure (Figure 9).

- a) SCOUTING PHASE. First we searched on the website of each company of the sample the names of Research and Development managers, senior managers with responsibility for product developing or, if these were not available, the name of owners or managing directors. Choosing respondents based on their roles ensures that we have the best information on our measures.
  - b) CALL PHASE. We then telephoned each company asking to speak with the managers previously identified. In case no name was available, we asked directly the switchboard. Once we have been in contact with such managers, we have briefly introduced the research, using a shared framework encompassing the research object, the “Innovation Lab” and the benefits that the company would stretch from participating in the project.
  - c) SEND PHASE. Where we noticed some interest towards the research, we asked the authorization to send an e-mail with more explanation on the contents of the project and a private link to the on-line questionnaire. The authorization by the company was quick followed by the send of the cover letter and the link to the questionnaire.
- RECALL PHASE. After one month from the first call, we checked for the progress in completing the send questionnaire by the selected respondents (survey-monkey keeps track on this so that it is possible to verify if a respondent has started compiling the questionnaire and the percentage of the questionnaire that has already been compiled). We therefore carried out a further round of telephone reminders to those firms for which the questionnaire was not yet completed. The objective was to reach 100 compiled questionnaires.



Figure 9 – Data collection procedure

## 4.2.5 Analysis procedure

The data collected are imported in SPSS 18, the software used for conducting the analysis. Table 21 present a summary of the main analysis and corresponding statistical functions that have been conducted on the data.

ANALYSIS	STATISTICAL FUNCTIONS IMPLEMENTED	APPLIED TO
Preliminary analysis of the data	Frequencies (for nominal variables), mean, median, mode, measures of dispersion, measures of shape, skewness and kurtosis	The whole questionnaire
Factor Analysis	Exploratory Factor Analysis (EFA)	“Local Search” practices and “Distant Search” practices
	Confirmatory Factor Analysis (CFA)	“Exploration competence” and “Exploitation competence”
Content validity	Pre-testing the instrument	“Local Search” practices and “Distant Search” practices
	Use of previously validated scales	“Exploration competence” and “Exploitation competence”
Construct reliability	Cronbach’s Alpha	“Local search” and “Distant search” dimensions (factors identified with EFA), “Exploration competence” and “Exploitation competence”
Convergent validity	Factor loadings	“Local search” and “Distant search” dimensions (factors identified with EFA), “Exploration competence” and “Exploitation competence”
Discriminant validity	Inter-factors correlations	“Local search” and “Distant search” dimensions (factors identified with EFA), “Exploration competence” and “Exploitation competence”
Firm classification into “ambidextrous” and “non-ambidextrous”	Hierarchical cluster analysis	“Exploration competence” and “Exploitation competence”
Comparison between “ambidextrous” and “non-ambidextrous”	Mann-Whitney U-Test	“Local search” and “Distant search” dimensions (factors identified with EFA)

**Table 21 – Analysis conducted on the data collected**

#### 4.2.5.1 Preliminary data analysis

---

To acquire knowledge of the characteristics and properties of the collected data, some preliminary analysis are performed before performing measurement quality assessment and conducting cluster analysis.

“Carrying out such analysis gives preliminary indications of how well the coding and entering of the data have been done, how good the scale are, and whether there is a suspicious of poor content validity or systematic bias” (Forza, 2002, p. 181).

The main statistical function used for the preliminary analysis are:

- *Frequency*: generally obtained for nominal variables, it refers to the number of times various subcategories of certain phenomenon occur. The calculation of frequencies allows to verify that the variables' values are within the range of expected values, to verify the presence of missing data and the distribution of responses for a specific variable.
- *Mean, Median and Mode*: they characterize the central tendency of a set of observations, it indicate the average value around which the data are distributed.
- *Standard Deviation and Variance*: they measure the dispersion of data and concisely indicate the variability that exists in a set of observations.
- *Skewness, Kurtosis*: they describe the departures from the symmetry of a distribution and its relative flatness respectively. Skewness measures how the sample observations are distributed if confronted with a normal distribution. Kurtosis is a how the observations are grouped into the extremes (tails) of the distribution. In SPSS a perfectly normal distribution has skewness and kurtosis values equal to zero. Skewness values that are positive indicate a tail to the right and skewness values that are negative indicate a tail to the left. Values between -1 and +1 indicate an approximate bell shaped curve and values from -1 to -3 and from +1 to +3 indicate that the distribution is tending away from a bell shape. Any values above +3 or below -3 are a good indication that the variable is not normally distributed. A kurtosis value above 1 indicate that the distribution tends to be pointed and a value below 1 indicate that the distribution tend to be flat. As for skewness, a kurtosis value between -1 and +1 indicate normality and values from -1 to -3 and from +1 to +3 indicate a tendency away from normality. Any values above +3 or below -3 are a good indication of non-normality. (Peat and Barton, 2005)

#### 4.2.5.2 Factor analysis

Factor analysis is a common statistical method used to find a small set of unobserved variables (also called latent factors, or latent variables) which can account for the covariance among a larger set of observed variables (also called items or manifest variables) (Fabrigar, Wegener, MacCallum and Strahan, 1999).

It is possible to distinguish between two categories of factor analysis depending on whether the objective is to explore patterns in the data or to test explicitly stated hypotheses on the factor model. Exploratory factor analysis (EFA) corresponds to the former task while Confirmatory factor analysis (CFA), being theory-driven, relates to the second task. Although both exploratory and confirmatory approaches hunt for accounting for as much variance as possible in a set of observed variables with a smaller set of factors, EFA is particularly appropriate for scale development or when there is little theoretical basis for specifying a priori the number and patterns of common factors (Hurley, Scandura, Schriesheim, Brannick, Seers, Vandenberg and Williams, 1997) (Table 22).

EFA is therefore adequate for understanding latent constructs within search practices items, while CFA is more adequate for verify the two already tested scales of “exploration competence” and “exploitation competence”.

EXPLORATORY FACTOR ANALYSIS	CONFIRMATORY FACTOR ANALYSIS
Heuristic-weak literature base	Strong theory and/or strong empirical base
Determine the number of factor	Number of factors fixed a priori
Determine whether the factors are correlated or uncorrelated	Factor fixed a priori as correlated or uncorrelated
Variables free to load on all factors	Variables fixed to load on a specific factor or factors

**Table 22** – Differences between exploratory and confirmatory factor Analysis (Stevens, 1999)

There are many decisions confronting users of factor analysis:

- (a) the factor extraction model used,
- (b) the number of factors retained,
- (c) the method used to rotate factors (assuming more than one factor is retained).

#### 4.2.5.2.1 Factor extraction model

A variety of factor extraction models exists. SPSS, the software we used for our analysis, supplies seven models such as principal component analysis, unweighted least squares, generalized least squares, maximum likelihood, principal axis factoring, alpha factoring, and image factoring (Costello and Osborne, 2005). These models can be categorized as either common factor models or components models (Gorsuch, 1983).

Common factor (i.e. maximum likelihood and principal axis factoring) and component models (i.e. Principal Components Analysis) differ in how they conceptualize sources of variance in measured variables. “Common factor models assume the factors are imperfectly reflected by the measured variables and differentiate between variance in measures due to the common factors (factors that influence more than one measure) and variance due to unique factors (factors that influence only one measure). PCA makes no such distinction, and the components therefore contain a mixture of common and unique variance” (Conway and Huffcutt, 2003, p. 150). Consequently, if a researcher’s purpose is to understand the latent structure of a set of variables, then use of a common factor model such as principal axis or maximum likelihood factoring may represent a high-quality decision while, if a researcher’s purpose is pure reduction of variables without interpreting the resulting variables in terms of latent constructs, then use of PCA should represent a high-quality decision.

However, several researchers (Goldberg and Digman, 1994; Velicer and Jackson, 1990) claim that even if the research goal involves the understanding the latent structure of a set of variables, PCA is a very good substitute for common factor analysis and gives almost identical results. Additionally, Ford, MacCallum and Tait (1986) and Fabrigar, Wegener, MacCallum and Strahan (1999) in their works find that there is a trend toward increasing use of PCA over common factor analysis.

We therefore have chosen Principal Components Analysis model for conducting the factor analysis on our data.

#### 4.2.5.2.2 Number of factors retained

A second important decision is the criterion for the number of factors to retain. Available options include: Kaiser’s (1956) “eigenvalues greater than one” rule, scree test and retaining the number of factors that gives a high proportion of variance accounted for or that gives the most interpretable solution (Conway and Huffcutt, 2003)

One of the most commonly used methods is the Kaiser criterion (K1), which retains factors with eigenvalues greater than 1 (Kaiser, 1960). In essence this is like saying that, unless a factor extracts at least as much as the equivalent of one original variable, we drop it. This rule is the default retention criterion for a number of commonly used statistical packages. There is however broad consensus in the literature that this is among the least accurate methods for selecting the number of factors to retain (Velicer and Jackson, 1990).

Another widely used and accepted method is the Scree Test. It is a graphical method proposed by Cattell (1966). The scree test involves examining the graph of the eigenvalues and looking for the natural bend or break point in the data where the curve flattens out. The number of data-points above the “break” is usually the number of factors to retain, although it can be unclear if there are data points clustered together near the bend.

A third factor retention method is to retaining the number of factors that gives a proportion of variance accounted for greater than a certain threshold  $p$  (usually 60 %).

In conducting our analysis we follow the recommendation by both Ford, MacCallum and Tait (1986) and Fabrigar, Wegener, MacCallum and Strahan (1999) to use a combination of techniques. This therefore have run multiple factor analyses, examined several solutions with more or fewer factors, and have chosen the one that is most interpretable and makes the best "sense".

#### **4.2.5.2.3 Method used to rotate factors**

---

Given a number of factors greater than one, the factors are usually rotated to find a more interpretable solution. The objective of rotation is to gain a “simple structure” of the data (Thurstone, 1947; Fabrigar, Wegener, MacCallum and Strahan, 1999): this means that each factor has a subset of variables with high loadings, and the rest with low loadings, and that each variable has high loadings on only some of the factors and low loadings on the rest.

Rotation methods can be classified into two groups: orthogonal methods (varimax, quartimax, and equamax) and oblique methods (direct oblimin, quartimin, and promax). Orthogonal rotations produce factors that are uncorrelated while oblique methods allow the factors to correlate.

Since we expect some correlation among factors resulting from factor analysis on search practices, direct oblimin rotation is applied to exploratory factor analysis on these data. As regards “exploration competence” and “exploitation competence”, they are clearly defined as orthogonal variables (Gupta, Smith and Shalley, 2006). When conducting Confirmatory Factor Analysis on these scales, varimax rotation has therefore been selected.

A set of decision rules is established and used in interpreting the results of the factor analysis. In particular, an item is retained using the following criteria:

- 1) only if it loads primarily on one factor,
- 2) only if its loading this factor is greater than or equal to 0.6 and lower than 0.4 on the other factors,
- 3) when loading on multiple factors, the difference between the higher loading and all the other loadings (related to different factors) should be greater than or equal to 0.25

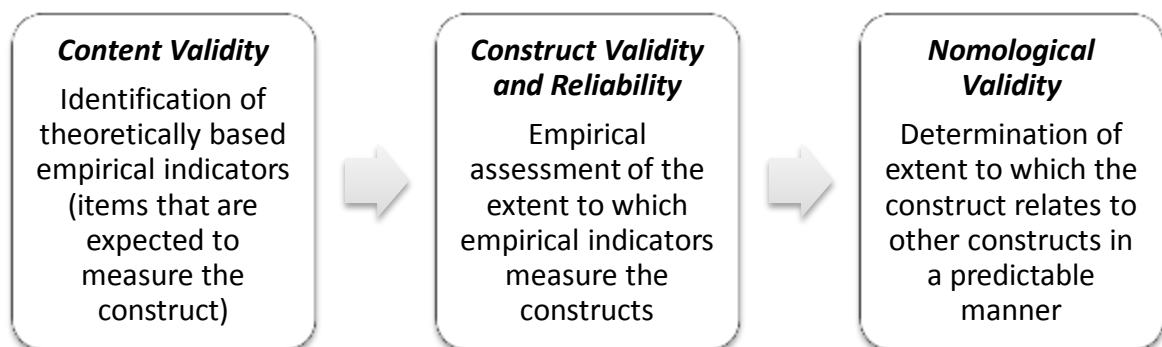
### 4.2.5.3 Validity and Reliability test

---

Validity and Reliability tests are used to evaluate the goodness of the measures used in the questionnaire. Validity in particular refers to whether a study is able to scientifically answer the questions it is intended to answer while reliability is concerned with stability and the repeatability of a measure, it is the degree to which an instrument measures the same way each time it is used under the same condition with the same subjects (Carmines and Zelle, 1979; Forza, 2002).

Construct validation is a multifaceted process that consists of three basic steps (Figure 10):

- content Validity
- construct Validity and Reliability
- nomological Validity



**Figure 10** - Construct validation process (O’Leary-Kelly and Vokurkar, 1998).

Our analysis focuses on the first two steps of the process: content and Construct Validity and Reliability.

The *content validity* of an instrument aims to demonstrate that the empirical indicators are logically, as well as theoretically, connected to the construct (Nunnally, 1978; Pedhazur and Schmelkin, 1991). The content validity test is not numerical, but subjective and judgmental (Emory, 1980). It is usually assumed to be established grounding constructs and measurements in the existing literature and pre-testing the measurement instrument before the collection of data further validated it. In order to guarantee content validity experts and managers have been involved in the revision of the items in order to obtain their comment and suggestion for improvement. As regards the ambidexterity construct, content validity is

ensured by adopting previously validated scales: “exploration competence” and “exploitation competence” (Atuahene-Gima, 2005).

*Construct validity* refers to whether the operational definition of a variable actually reflect the true theoretical meaning of a concept. Testing of construct validity means to assess both convergent validity and discriminant validity. Convergent validity measures the similarity or convergence between the individual items measuring the same construct. Discriminant validity measures the extent to which the individual items of a construct are unique and do not measure any other constructs. Both convergent and discriminant validity can be tested through confirmatory factor analysis (Flynn, Sakakibara, Schroeder, Bates and Flynn, 1990). Convergent validity involves measuring a construct with independent measurement techniques and demonstrating a high correlation among the measures. Discriminant validity is exactly the opposite; it involves demonstrating a lack or a very low correlation among different constructs (Kinnear and Taylor, 1996). Testing for Convergent and Discriminant validity means testing for the unidimensionality of the constructs: this means determining whether or not a set of indicators significantly reflect one, and only one construct (Gerbing and Anderson, 1988).

Convergent validity can be evaluated by examining the indicator loadings for statistical significance (Kenny and Kashy, 1992). To have convergent validity, the resulting factorial structure should be clear and well defined thus indicating that a significant relationship between each item and its respective factor: the factor loadings of each construct should be significantly high (Dunn, Seaker and Waller, 1994).

For evidence of discriminant validity both analyses the factor loadings and the inter-factor correlations are conducted. In particular, each item should present high loading only on one specific factor and significantly lower loadings on all the other factors. By looking at the Correlation Coefficient among the factors, discriminant validity is established verifying that correlations for all possible pairs of latent constructs is significant difference from 1, with a recommended level of 0.65 (Tabachnick and Fidell, 1996, p. 86).

To assess unidimensionality a Confirmatory Factor Analysis (CFA) is conducted. First, by looking at the output of the Exploratory Factor Analysis, the items that do not meet the retention criteria indicated in paragraph 4.2.5.3 are discarded. Then, on the remaining items a Confirmatory Factor Analysis is carried out by fixing the number of the factors to extract. Construct validity is therefore established by assessing the overall model fit of the general model by AMOS. As recommended, multiple fit criteria are used (Bollen and Long, 1993): chi-square ( $\chi^2$ ) value is reported as the index of absolute fit, which assesses the extent to which the covariances estimated in the model match the covariances in the measured variables (Kline, 1998). Additionally, we calculate: the non-normed fit index (NNFI; Bentler and Bonett, 1980), the comparative fit index that checks for non-normal distributions (CFI) (Bentler, 1990), the root mean square error of approximation (RMSEA: Steiger, 1990) and the  $\chi^2$ /degree of freedom. The first two indices, NNFI and CFI, have a theoretical upper value of 1.00 and values near 0.90 are considered evidence of a good fitting model (Medsker, Williams and Holahan, 1994). For RMSEA, evidence of good fit is considered to be values less than 0.05: values from 0.05 to 0.08 are indicative of moderate fit and values greater than 0.10 are taken to be evidence of a poorly fitting model (Browne and Cudeck, 1993). For the  $\chi^2$ /degree of freedom values less than 3 are indices of good fit (Table 23).

<i>Indexes</i>	<i>Recommended values for GOOD FIT</i>	<i>Recommended values for VERY GOOD FIT</i>	<i>Sources</i>
RMSEA	< .08	< 0.05	<i>Byrne, 1998</i>
NFI	> 0.8	> 0.9	<i>Byrne, 1998; Zhang, Vonderembse and Lim, 2002</i>
N-NFI or TLI	> 0.8	> 0.9	<i>Byrne, 1998; Zhang, Vonderembse and Lim, 2002</i>
CFI	> 0.8	> 0.9	<i>Byrne, 1998; Zhang, Vonderembse and Lim, 2002</i>
IFI	> 0.8	> 0.9	<i>Byrne, 1998; Zhang, Vonderembse and Lim, 2002</i>
$\chi^2/df$	>1 and <5	>1 and <3	<i>Bollen (1989); Carmines and McIver (1981); Hair, Anderson, R.E., Tatham and Black (1995); Jöreskog, 1969; Bentler (1990)</i>

**Table 23 - Recommended value for fit indices**

Finally, *reliability* is tested using the internal consistency method that is estimated using Cronbach's alpha (Cronbach, 1951; Nunnally, 1978; Hull and Nie, 1981). Typically, reliability coefficients of 0.70 or higher are considered adequate (Cronbach, 1951; Nunnally, 1978). With alpha value greater or equal to 0.8 the measure is very reliable. Nunnally (1978) further states that permissible alpha values can be slightly lower (0.60) for newer scales. The constructs reported in this analysis can be certainly considered as news in the field.

For factors made up by only two items, Pearson Correlation should be calculated instead of Cronbach's alpha: in this case reliability is verified if items are highly correlated ( $p < 0.05$  or  $p < 0.01$ ).

#### 4.2.5.4 Cluster analysis and Mann-Whitney U-Test

In order to respond to the first research question, "does it exist any difference among the firms that present different level of ambidexterity in the early phase of the innovation process in terms of practices put in place by firms when searching for local and distant ideas?", it is necessary to first identify those firms that show Ambidexterity Capability in the search phase, that are firms that possess high competences in both exploration and exploitation of knowledge.

To this end we perform a cluster analysis to sort firms into groups. There are numerous ways in which clusters can be formed: SPSS for example has three different procedures: hierarchical cluster analysis, k-means cluster, and two-step cluster. With large data file (even 1,000 cases is large for clustering) or a mixture of continuous and categorical variables, the most adequate procedure is two-step. If the data set is small hierarchical clustering is the most suitable while k-means clustering better fits with moderately sized data set and when the number of clusters that should results in known.

Given the dimension of our dataset, we consider Hierarchical Cluster Analysis to be the best choice: this procedure is additionally considered to be one of the most straightforward methods.

To form clusters using a hierarchical cluster analysis, it is necessary to select:

- A criterion for determining similarity or distance between cases
- A criterion for determining which clusters are merged at successive steps
- The number of clusters you need to represent your data

Given our objective, “exploration competence” and “exploitation competence” are the variables that are used for establishing clusters. The criterion used for determined which clusters are merged at successive steps is Euclidean Distance. With regard to the number of clusters, at least 2 clusters have to been retained.

The second step of our analysis is about the cluster comparison in order to detect differences in term of search practices. Choosing the right test to compare measurements is a bit tricky. It is possible to choose between two families of tests: parametric and nonparametric as depicted in Table 24.

<b>Goal</b> \ <b>Type of data</b>	<b>Measurement (from Gaussian Population)</b>	<b>Rank, Score, or Measurement (from Non-Gaussian Population)</b>	<b>Binomial (Two Possible Outcomes)</b>	<b>Survival Time</b>
<b>Describe one group</b>	Mean, SD	Median, interquartile range	Proportion	Kaplan Meier survival curve
<b>Compare one group to a hypothetical value</b>	One-sample <i>t</i> test	Wilcoxon test	Chi-square or Binomial test	
<b>Compare two unpaired groups</b>	Unpaired <i>t</i> test	Mann-Whitney U test	Fisher's test (chi-square for large samples)	Log-rank test or Mantel-Haenzel
<b>Compare two paired groups</b>	Paired <i>t</i> test	Wilcoxon test	McNemar's test	Conditional proportional hazards regression
<b>Compare three or more unmatched groups</b>	One-way ANOVA	Kruskal-Wallis test	Chi-square test	Cox proportional hazard regression
<b>Compare three or more matched groups</b>	Repeated-measures ANOVA	Friedman test	Cochrane Q	Conditional proportional hazards regression
<b>Quantify association between two variables</b>	Pearson correlation	Spearman correlation	Contingency coefficients	
<b>Predict value from another measured variable</b>	Simple linear regression or Nonlinear regression	Nonparametric regression	Simple logistic regression	Cox proportional hazard regression

<b>Predict value from several measured or binomial variables</b>	Multiple linear regression	Multiple logistic regression	Cox proportional hazard regression
	or Multiple nonlinear regression		

**Table 24 – Criteria for selecting a statistical test**

Referring to the criteria of table the statistical tests that should be chosen are the Mann-Whitney U test (in case of two clusters retained) and the Kruskal-Wallis test (in case of more than two clusters retained).

### 4.3 PART 2 – Case study methodology description

Since the second part of our empirical research focuses on "how" -type questions (*"How can firms succeed in realizing ambidexterity capability in the search phase?"* and *"How does the achievement of ambidexterity capability change, while co-evolving with the external environment?"*) and, as noted above, addressed a process not yet carefully researched, a case study was the logical methodology (Yin 2009).

A case study is a history of a past or current phenomenon, drawn from multiple sources of evidence. It can include data from direct observation and systematic interviewing as well as from public and private archives. In fact, any fact relevant to the stream of events describing the phenomenon is a potential datum in a case study, since context is important (Stone 1978).

#### 4.3.1 What type of case study?

Yin (2003) speaks of three types of case studies that present different objectives and characteristics:

- exploratory
- descriptive
- explanatory.

Table 25 summarizes the objectives and the characteristics of each typology. As the focus of this study is the development of a new framework, it was appropriate that an emphasis was placed on the inductive, exploratory cases: we commence with no prior theory or hypothesis as "preordained theoretical perspectives or propositions may bias and limit the findings"

(Eisenhardt, 1989, p. 536). Additionally the greater use of interpretive, inductive perspectives could help to avoid both the premature adoption of limiting frameworks, as well as allowing a deeper understanding of the phenomenon under research. However prior knowledge will inevitably influence the researcher.

Having determined that the case study should be exploratory in nature, we note in particular two important ramifications of conducting an exploratory case study. First, once an exploratory case study is completed subsequent research is expected. The findings should not be looked upon as conclusive but to clarify and define a concept where little prior knowledge exists. Second, it then becomes important for researchers to provide useful learning points which future research can leverage upon. We intend to do so throughout the thesis and we conclude by presenting a perspective on how we can advance research within the field.

	<b>OBJECTIVES</b>	<b>CHARACTERISTICS</b>
<i>Exploratory case study</i>	<ul style="list-style-type: none"> <li>- to assist in giving a better understanding of a concept as well as to identify important factors that should tested in future studies (Glaser and Strauss, 1967).</li> <li>- to clarify and define the nature of a problem (concept) but it will not provide conclusive evidence and subsequent research is expected (Yin, 2003)</li> <li>- to define the questions and hypotheses of a subsequent or to determine the feasibility of the desired research procedure (Yin, 2003).</li> <li>- there are no propositions in exploratory studies and the focus should be on stating purpose(s) instead as well as the criteria by which an explorative case study will be judged successful (Yin, 2003).</li> </ul>	<p>The exploratory case study has contributed to giving case studies a bad reputation (Yin, 2003). Yin (2003) mentions that research may follow intuitive paths often perceived by others as sloppy. However, this goal may be justifiable to discover theory by directly observing a social phenomenon in its raw form (Glaser and Strauss, 1967)</p>
<i>Descriptive case study</i>	<ul style="list-style-type: none"> <li>- to present a complete description of a phenomenon within its context (Yin, 2003).</li> </ul>	<p>Yin (2003) notes that descriptive theory is not an expression of cause-effect relationship, which is the focus of an explanatory case study. Instead, a descriptive case study covers the scope and depth of the object (case) being studied. This raised a question as Yin (2003) mentions. Where should your description start, and where should it end? What should your description include, and what might it exclude? Yin (2003) states that the criteria used to answer these questions would represent your “theory” of what needs to be described.</p>

- To present data bearing on cause-effect relationships to explain how events happened (Yin, 2003).

Yin (2003) focuses on two main themes within explanatory (causal) case studies, namely factor theories and explanatory theories.

Factor theories is a paradigm that assembles a list of independent variables and determines those that are most highly correlated with the dependent variable. Those independent variables are then considered causally related to the dependent variable. Yin (2003) notes that to conduct the analysis and account for such complexities, researchers may use statistical techniques such as factor analysis, regression analysis, and analysis of variance. Yin (2003) notes that the use of factor theories has its counterpart in case study research although such application is not desired.

However, he adds if factor theories and not causally linked explanatory theories are the state of knowledge on a given topic, a case study researcher may need to consider using this approach. In contrast the use of explanatory theories is more suitable for designing and doing causal case studies. In fact, Yin (2003) states that the more complex and multivariate the explanatory theory, the better. The case study can then take advantage of pattern-matching techniques. The problem is, however, that such viable explanatory theories do not exist for many topics covered by case studies.

**Table 25 - Main objectives and characteristics of the three types of case studies**

We now turn to discuss our choice of a single case, which is an important feature in a case design.

### 4.3.2 A single case study design

Once the research methodology, the type of data to be collected and the tactics employed to ensure high quality had been selected, the criteria by which the type and number of cases to be studied had to be developed. This section outlines and justifies the selection of the single case design adopted in this research.

There are no rules outlining the “correct” number of cases to choose in case study research. Eisenhardt (1989) recommends continuing to add cases until “theoretical saturation” is reached but, while theoretical saturation is the ideal, in practice, the researcher has to take into consideration some limitations such as time and money.

In our case, only one exploratory case is carried out. Arguably, it would be better to include more firms in the research based on the logic of replication and robustness but this is not possible due to time and resource constraints. Nevertheless, Yin (2003) also mentions a number of justifications for selecting a limited number of cases:

1. Critical case: clear set of propositions
2. Extreme/Unique case

3. Representative/Typical case
4. Revelatory case: previously inaccessible phenomena
5. Longitudinal case: Same things at different point in time or assumes that conditions changes over time.
6. As a pilot case for multiple case for multiple case studies/ other form of studies.

Of these justifications, we can eliminate n° 1 as we do not have a clear set of propositions from the beginning due to the exploratory nature, and we cannot at this stage say that the selected firm (SAES Getters S.p.A.) represents a critical case as there are other firms that could equally been used for this case study. Neither we can say that our case is unique as described by n° 2 or revelatory as stipulated by n° 4.

We feel that the best alternatives to describe our justification for a single case study are number 3, number 5 and also number 6. The case study we select is in fact a good example of a firm that has succeeded in building ambidexterity in the search phase and in maintaining it through time (justification n° 3). Additionally, given the objective of our study, a longitudinal approach should been selected, as discussed in the next paragraph (justification n° 5). Finally, our case study should be considered as a pilot case for future studies (justification n° 6).

---

#### **4.3.2.1 A longitudinal approach**

One of the aims of our research is to analyze how ambidexterity co-evolve with the competitive environment: this intrinsically calls for an empirical co-evolution research, longitudinal methods of analyses and time series data. Although the relevance and need for longitudinal research in strategic management and organization adaptation research is widely recognized (Miller and Friesen, 1982; Huber and Van de Ven 1995; Henderson and Mitchell, 1997; Barnett and Burgelman 1996), such research is far from becoming the norm.

Following Kimberly (1976, p. 329) we define longitudinal research as those techniques, methodologies and activities which permit the observation, description and/or classification of organizational phenomena in such a way that any sequence of changes in organizational variables and process can be identified and empirically documented.

The strength of adopting a longitudinal approach is that it provides a basis for real insights into how organizations make decisions, adapt to their environments, enact new environments, and restructure themselves. "There is a wealth of detail on sequences of decisions and events and this affords much knowledge on the time priority of change in variables of strategy, structure, environment, decision making methods and executive personality" (Miller and Friesen, 1982, p.1016). Longitudinal case study makes it possible to put a light on the reason why things change within a time horizon by showing the dynamic interrelationships among many of the attributes of the firm and its setting.

---

#### **4.3.2.2 *Selecting an appropriate organization***

---

The firm analyzed is a high-tech Italian company, located in Milan, named SAES Getters. SAES Getters S.p.A. (SAES) is a publicly traded scientific and industrial applications company. The firm was established 62 years ago and has now grown to serve a global market with average revenues (2004-2008 period) of 154.2 million euro annually.

SAES specializes in the development of getter technology and operates in sectors including information displays and lighting, complex high-vacuum systems and vacuum thermal insulation, drawing on technologies ranging from large vacuum power tubes to miniaturized devices such as microelectronic and micromechanical systems. The firm also leads the market in the ultra-pure gas purification systems for the semiconductor industry and other high-tech industries. More recently, SAES entered the medical business through a variety of products based on shape-memory alloys and, in particular, on NiTiNOL.

There are several reasons that guided us in the company selection.

First, it belongs to a knowledge-intensive industry, where rapid technological changes, coupled with intense competition, compress product lifecycles. The industry is in fact characterized by high dynamics, velocity and demand for continuous innovation.

Second, the case firm is renowned for their excellence in both exploitation and exploration within an intensely competitive industry, it is highly and consistently profitable, while simultaneously receiving numerous awards and top rankings for cutting-edge innovation: it represents a good model of ambidexterity in the innovation process.

Finally, it represents a good example of a firm that has realized and maintained ambidexterity capability in the search phase of the innovation process by successfully withstood the transition from a stable competitive environment to a turbulent one.

---

#### **4.3.2.3 *The unit of analysis***

---

The research is conducted by using the practice level of analysis. Using a practice-based approach, as discussed in chapter 3, could help in better unraveling the complexity embedded on ambidexterity capability by providing a micro-foundation of such a multifaceted phenomenon. Accordingly to Orlikowski (2002) capabilities, and therefore ambidexterity, are constituted in the everyday practices, they emerge “from the ongoing and situated actions of organizational members as they engage the world ... they are grounded in what [] people do every day to get their work done”.

Practices as a result plays a central role in generating and sustaining capabilities: “Practice is an entry to how things get done in organizations” (Antonacopoulou, 2010, p. 11).

Additionally, adopting a practice-based approach for studying ambidexterity is an analytical lens that help understand how practices are influenced by organization and how they constitute them in turn (Giddens, 1984; Orlikowski, 2000). Understanding searching in practice may in fact get us closer to an understanding of organizational life as “continually contingently reproduced by human agents - that’s what gives it fixity and that’s what also produces change” (Giddens and Pierson 1998, p. 90).

### 4.3.3 Quality of case study research

In this section, we identify the validity issues that are dealt throughout this study. We give a general assessment of what threats we see ahead, and deal with them as they become relevant for our research. Maxwell (2005) gives a broad definition of validity: he defines validity as “the correctness of a description, conclusion, explanation, interpretation, or other sort of account” (p. 106)

Any research faces threats to validity (Caffyn, 1998), and this is especially true for case study research (Yin, 2009). This occurs also in our case study, even if it is exploratory in nature.

This section thus discusses the criteria by which the quality of case study research can be judged: construct validity, external validity, internal validity and reliability (Table 22). While internal validity, the establishing of a causal relationship whereby certain conditions are shown to lead to other conditions, and external validity, the establishing of the domain to which a study’s findings can be generalized, are important for explanatory (causal) case studies, they are not important for exploratory case studies (Yin, 2009). Internal validity is in fact only relevant to the extent a researcher intend to make assertions on cause and effect relationships for the study: however, this is not a requirement in explorative case studies. Additionally, we are doing an explorative single case study, so we do not need to produce generalizable results: as a result, external validity is not an issue for this present study.

	CASE STUDY TACTICS	PHASE OF RESEARCH
<b>Construct Validity</b>	Use multiple sources of evidence	Data collection
	Establish chains of evidence	Data collection
	Have key informants review draft case study reports	Composition
<b>Internal Validity</b>	NOT APPLICABLE WITH SINGLE CASE STUDY	
<b>External Validity</b>	NOT IMPORTANT WITH EXPLORATORY CASE STUDY	
<b>Reliability</b>	Case study protocol	Data collection
	Develop case study data base	Data collection

**Table 26 – Case study research quality test and tactics (adapted from Yin, 2009)**

---

#### **4.3.3.1 Construct validity**

---

Construct validity, which we define as the correct establishment of operational measures for the concepts being studied (Yin, 2003a) is by far the most important validity issue for this study.

The threats to construct validity are either failure to incorporate all the dimension of the concept into operation or to incorporate the wrong concepts, namely those that are irrelevant to the construct under investigation (Caffyn, 1998). In our case, it means how well we have translated ambidexterity, local and distant search, practices and competitive environment turbulence into concrete language that people can understand (Aiman-Smith, Goodrich, Roberts, and Scinta, 2005). This is important to us because we are trying to translate rather complex concepts into as simple a language as possible.

Three tactics are used to increase construct validity in this research.

Firstly, triangulation of the data is achieved by the use of multiple sources of evidence. These sources included case study research protocols, documents collected during the case studies, multiple interviewees during each case and the use of workshops involving multiple participants.

Secondly, a chain of evidence is established that involves all the collected data being systematically documented and stored with appropriate referencing.

Finally, all collected data are presented back to the respondent for confirmation and all case study reports are reviewed by key informants. This allows any inconsistencies or ambiguities to be detected thus increasing the construct validity of the research.

---

#### **4.3.3.2 Reliability**

---

Reliability is concerned with the minimizing of errors and biases in the study so that a later investigator following the same procedures would arrive at the same findings and conclusions when conducting the same case study (Yin 2009). Thus it is achieved when the researchers can demonstrate that the operations of a study - such as the data collection procedures - can be repeated with the same results.

Carefully documenting the research procedures ensures that another researcher might do the same study and come to the same conclusions and is therefore one way to enhance reliability in a case study.

Given the exploratory nature of our study, we therefore put special care in using a case study protocol to deal with the documentation problem and to develop a case study database.

---

#### 4.3.4 Search instruments

---

The validity and reliability of case research data deeply depend on the design of the research protocol (Yin, 2009) that contains the research instrument, the procedures and the general rules that should be followed. Additionally it indicates who and from where different sets of information are to be sought. The core of the protocol is the set of questions to be used in interviews. It outlines the subjects to be covered during an interview, states the questions to be asked and indicates the specific data required. In conducting our research we follow a funnel model. We start with open-ended questions first, addressed in particular to verify that the company presents ambidexterity capability, that is we investigate if the firm has succeeded in solving the tensions arising in the search phase of innovation process. As the interview progressed the questions became more specific and detailed. In order to be sure that all topics have been covered, the interviews were guided by two investigation frameworks:

- A framework that underline the different dimensions of practices
- A framework for describing the dimensions of the competitive environment

The investigation frameworks are described below.

---

##### 4.3.4.1 Investigation framework 1: the dimensions of practices

---

Both in the survey methodology described in PART 1 and case study methodology “practices for search” are adopted as unit of analysis. However, while in the survey practices are considered as a “black-box”, with case study our intent is to open this “black-box” in order to examine the different aspects that constitute a practice. Opening the black-box in our opinion could be very useful for the reason that it allows to identify the key dimensions on which it is possible to intervene in order to create the grounds on which ambidexterity is realized and maintained over time. For explanation of the dynamics that convey to Ambidexterity Capability, we need in fact to look inside the practices and examine their internal structure. The internal structure of practices appear in fact more variable and potentially contested than it does when viewed as a “black box”.

To this purpose, we find the framework proposed by Antonacopoulou (2007; 2008) to be extremely suitable. Antonacopoulou in fact describes practices on micro-level by identifying seven dimensions, called the “7 Ps” that are (Figure 11):

- Procedures
- Practitioners
- Purposes
- Places
- Principles

- Past and Present.

The first dimension concerns the *procedures* at the basis of practices. This dimension matches with the first conceptualization of practice supply by Bourdieu (1990) that equates practices to action and what people do: in other words, Bourdieu makes practice corresponds to *praxis*.

According to Antonacopoulou (2007), however, “we cannot afford to limit our understanding of practice only as ‘praxis’ (action/activity). Building on Whittington (2006) who adopts a wider view of practice, that acknowledge the role of the *practitioner* in enacting practices.

Practices is not only what practitioners do, but also how they do what they do (Antonacopoulou,2007, p. 5). It is therefore necessary to know the *principles*, the values and assumptions at the basis of the practices. The judgments practitioners exercise in relation to a practice in very important for the reason that they reveal some of the underlying Principles and core values that govern a practice. Another important dimension, closely connected to how practices are performed, is what Aristotle calls as “telos” that is the *purpose*, the objective to which a practice is oriented (Bernstein, 1971)

Finally, space and time are other two dimensions that need to be accounted for. Procedures are in fact contextually specific and they are reflective of the cultural and social conditions that shape the space a practice occupies in the Place in which it is performed. No space exists however, without the socio-historical dimensions that define the time boundaries, in terms of the Past and Present regarding the ways a practice is performed.



**Figure 11** - The dimensions of practice (the 7 Ps)

We therefore elaborate the history of the search practices (Past and Present) explaining the different applications of the search practices (Purposes). We also outline the evolution of search practices by focusing on organizational mechanisms, actions, locations and actors involved (Procedures, Place, Principle and Practitioners).

These dimensions build the basis for analysing how ambidexterity capability is realized and maintained over time. Taken together, the 7 Ps of practice, could in fact reveal different aspects of a dynamic phenomenon like change and “act as a compass shaping multiple directions possible as a process unfolds across time and space” (Antonacopoulou, 2007, p. 8).

---

#### ***4.3.4.2 Investigation framework 2: the dimensions of competitive environment***

---

One of the object of the study is to investigate ambidexterity co-evolution with the competitive environment. To this purpose we need some dimensions that allow to characterize the competitive environment. Strategic management literature characterizes the competitive environment in several ways and through multiple dimensions (e.g. Miller and Friesen, 1983; Dess and Beard, 1984; Sharfman and Dean, 1991; Sutcliffe and Huber, 1998). In our analysis we follow Sharfman and Dean (1991) and describe the competitive environment in terms of: “Dynamism”, “Complexity” and “Competitive Threat”. Table 27 summarizes these dimensions.

*Dynamism* reflects the level of certainty or predictability that is evident in the industry, with a dynamic or variable environment being characterized by uncertainty or low predictability (Dess and Beard 1984). According to Cruz-González, Navas-López, López-Sáez and Delgado-Verde (2010) the potential sources of environmental dynamism provided by literature could be classified in three main types: supply-side factors, market-side factors, and macroeconomic factors. The first group technology-side factors, comprehends progresses in new products development; reduction of products lifecycles (Nelson, 1991; Leonard-Barton, 1992; Brown and Eisenhardt, 1997; Danneels, 2002; Benner and Tushman, 2003; Teece, 2007; Uotila, Maula, Keil and Zahara, 2009) and technological instability (Nelson, 1991; Leonard-Barton, 1992; Amit and Schoemaker, 1993; Lane and Lubatkin, 1998; Zollo and Winter, 2002; Benner and Tushman, 2003; Lavie, 2006; Jansen, Van den Bosch and Volberda, 2006; Teece, 2007; Uotila, Maula, Keil and Zahara, 2009). Literature argues that firm adaptation to this factor requires not only technological opportunity identification, but also the firm’s ability to integrate new technology in its productive process and to exploit it efficiently (O’Reilly and Tushman, 2008). The second group is composed by those factors emerging from demand-side stimuli: it encompasses factors related to new product or services demand, as consequence of changes in consumer’s preferences or demand patterns, which would create new business opportunities for firms being able to interpret the signals emanating from users (Amit and Schoemaker, 1993; Winter, 2000; Danneels, 2002; Helfat and Peteraf, 2003). Analogously, these changes would suppose a serious threat to those companies that continue producing the same products or providing the same services in the same way and to the same group of customers (Danneels, 2008). Finally, we

find another group of factors, related to those aspects that may vary the conditions under which firms carry on their competitive activity. We refer to those factors affecting macroeconomic conditions such as changes in economic (regulation, deregulation) and fiscal trends; changes in government policy regarding industrial sector, globalization, crisis and economic shocks (Amit and Schoemaker, 1993; Suárez and Oliva, 2005; Sirmon, Hitt and Irelland, 2007; Wang and Ahmed, 2007). As in the two previous categories, these changes can mean new opportunities or, conversely, become serious threats to the future of the firm.

*Complexity* concerns the number of environmental elements that challenge an organization such as the level of complex knowledge to be understood from the environment. According to Dess and Bear (1984) one source of complexity can be geographical concentration. As Sharfman and Dean (1991) outline, greater concentration indicates lower complexity because greater proximity of firms facilitate inter-firms communication, rendering information processes easier. Complexity is also the result of product diversity (number of distinct product categories) (Thompson, 1967) or technical intricacy (percentage of scientists and engineers in the work force) (Mintzberg, 1979). A higher number of products categories and considerable number of scientists and engineers would increase the level of complexity. In terms of knowledge, complexity thus refers to the number of different kind of knowledge that needs to be combined for the development of products (Fuentes-Fuentes, Albacete-Saez and Lloreis-Montes, 2004).

*Competitive Threat* relates to the level of competition faced by an organization and is intimately related to the rivalry and competitive intensity in the environment (Miller and Friesen, 1983). It corresponds with the extent of environmental hostility that a firm faces due to the intensity, vigor and multifacetedness of competition. Increased competitive threat results from increased competition, entry of new competitors, convergence of industries, and reduced trust among competitors within industries (D'Aveni, 1994; Hambrick, 1998).

DIMENSIONS	MEASURED BY:
<b><i>Dynamism</i></b>	Supply-side dynamism:
	- <i>progresses in new product development and reduction of product lifecycles</i>
	- <i>technological instability</i>
	Market-side dynamism:
	- <i>changes in consumer needs and preferences</i>
	- <i>fluctuations in product demand</i>
	Macroeconomic dynamism:
	- <i>changes in economic and fiscal trends</i>
	- <i>globalization</i>
	- <i>crisis, economic shocks and changes in economic cycles</i>
<b><i>Complexity</i></b>	- <i>geographical concentration of firms</i>
	- <i>number of distinct product categories</i>
	- <i>technical intricacy</i>
<b><i>Competitive threats</i></b>	- <i>competitive intensity</i>
	- <i>hostility</i>

**Table 27 - The competitive environment dimensions**

#### 4.3.4.3 Data collection

---

Data collection is the most important aspect of the research methodology. The validity and reliability of the research depends upon the way data is collected and how this collected information is analyzed. A useful approach is to use multiple data collection methods and respondents in order to triangulate the data and increasing, as a consequence, their reliability. This view is supported by Patton (2002) who advocates the use of triangulation by suggesting that triangulation strengthens a study by combining methods (Table 28).

Firstly, secondary data for the case study are collected through detailed analysis of publicly and privately available data of the firm. Publicly available data includes detailed analysis of annual reports, news articles, business journals, academic presentations and previous studies carried out by researchers on related topics. The second phase of data collection includes analysis of the survey questionnaire developed for answering the first research questions. Finally, interviews are arranged and conducted for the final phase of data collection. This study adopts a combined approach, using a “guide approach” within a standardized open-ended interview format.

The guide approach on the one hand arms the researcher with key questions to explore in the course of the interview. This method of data collection is therefore described by May (1991) as, an interview “organized around areas of particular interest while still allowing considerable flexibility in scope and depth”.

The standardized open-ended format, on the other hand, allows the flexibility in probing and determining when it is appropriate to explore certain issues in greater depth, or even to pose questions about emerging new ideas that were not originally anticipated by the researcher.

A key issue when conducting interviews is to seek out the persons who are best informed about the data being researched. This person is often known as the principal informant. A good practice is to firstly contact “someone senior enough to be able to open doors where necessary, to know who best to interview to gather the data required and to provide senior support for the research being conducted” (Voss, Tsiriktsis and Frohlich, 2002).

In our case, this key figure has been identified easily: in fact we have had the fortune to attend SAES’ presentation focused on innovation theme, made by the Corporate R&D director. Such presentation featured numerous references to the topic of tensions management, and implicitly to Ambidexterity. We have therefore expressed to the R&D Director our interest to develop a case study finding his enthusiasm for a first meeting. More than fifteen interviews, conducted between December 2008 and November 2010, have then followed this preliminary meeting, for an amount of more than fifty hours of recorded discussion. These sessions involved also the Knowledge Manager, who, thanks to his role, is one of the best informed about the data being researched.

As soon as possible after the case visit, we transcribed all the recorded interviews and returned them to the interviewees for verification. This is an important activity for the reason that it allows the researcher to obtain agreement that the story had been accurately

(and completely) presented. This process of interaction provided an opportunity to validate our findings. Thus, we improved the validity of our case studies continuously (Yin, 2009).

Responses from the interviews are then used to develop a case study database that included tables to record data accordingly to the investigation frameworks described in paragraph 4.3.4.1 and 4.3.4.2. These tables are helpful in guaranteeing that the data collected were based on the research questions.

<b>Primary sources of data</b>	<ul style="list-style-type: none"> <li>Semi-structured interviews (October 2008 – September 2010)</li> </ul>									
	<table border="1"> <thead> <tr> <th>Informants</th> <th># interviews</th> <th>Σ Hours</th> </tr> </thead> <tbody> <tr> <td> <ul style="list-style-type: none"> <li>Corporate Research and Development Manager</li> </ul> </td> <td>5</td> <td>30</td> </tr> <tr> <td> <ul style="list-style-type: none"> <li>Knowledge Manager</li> </ul> </td> <td>9</td> <td>25</td> </tr> </tbody> </table>	Informants	# interviews	Σ Hours	<ul style="list-style-type: none"> <li>Corporate Research and Development Manager</li> </ul>	5	30	<ul style="list-style-type: none"> <li>Knowledge Manager</li> </ul>	9	25
Informants	# interviews	Σ Hours								
<ul style="list-style-type: none"> <li>Corporate Research and Development Manager</li> </ul>	5	30								
<ul style="list-style-type: none"> <li>Knowledge Manager</li> </ul>	9	25								
	<ul style="list-style-type: none"> <li>Search questionnaire</li> <li>Personal research notes</li> <li>Ongoing discussions</li> <li>Internal documents</li> <li>Balance sheets</li> <li>The Company's Web site</li> </ul>									
<b>Secondary sources of data</b>	<ul style="list-style-type: none"> <li>Sector description</li> <li>Press releases</li> <li>Previous case studies conducted on the firm</li> </ul>									
<b>Company events</b>	<ul style="list-style-type: none"> <li>DILab workshops</li> <li>Company presentation at the Enterprise 2.0 conference</li> <li>Company presentation at the "Club R&amp;D" meeting</li> </ul>									

**Table 28 – Sources of evidence for the case study research**



## **5 SURVEY RESULTS - Search practices and Ambidexterity, a black box approach.**

The main objective of this chapter is to answer the first research question that is to verify if significant statistical differences regarding search practices exist between firms that are ambidextrous in the search phase of innovation process and firms that aren't.

The chapter thus presents the results of statistical analysis conducted on data collected through the survey described in Chapter 4. Specifically, after a preliminary analysis of data, the results of exploratory and confirmatory factor analysis, of cluster analysis and of the Mann-Whitney U Test are presented. Discussions of the results are finally provided.

### **5.1 The data for the analysis**

Of the 500 surveys mailed, 104 responses have been received, resulting in a response rate of 22.4% which is a good response rate if confronted with others using quite complex survey instruments (He and Wong, 2004, 19,8% response rate; Lubatkin, Simsek, Ling and Veiga, 2006, 19% response rate; Jansen, Tempelaar, van den Bosch and Volberda, 2009, 11,3% response rate).

Of the total, 16 questionnaires are discarded due to incomplete information, resulting in an effective response rate of 17.6% (88 usable questionnaires).

In order to test for non-respondent bias we have conducted several telephone calls with those firms that have not answered yet and concluded that the main reasons for replay's failure was the length of the survey (12 web pages) and a lack of time (the questionnaire takes about 50 minutes to complete).

In relation to the considerations made in Chapter 4 on the sample size and statistical power of the test, for significance set at 0.05 a sample of 88 respondents provides a statistical power of 0.8 and produces an average effect of the sample dimension on the results as showed in Table 29. This means that our sample size has a medium impact on the results that may be different if the sample is larger.

		Statistical power = 0.6		Statistical power = 0.8	
		$\alpha = 0.05$	$\alpha = 0.01$	$\alpha = 0.05$	$\alpha = 0.01$
Effect size	Large effect (strong association)	12	18	17	24
	Medium effect (medium association)	30	45	44	62
	Small effect (small association)	179	274	271	385

**Table 29** - Effect size, statistical power and sample size (Forza, 2002)

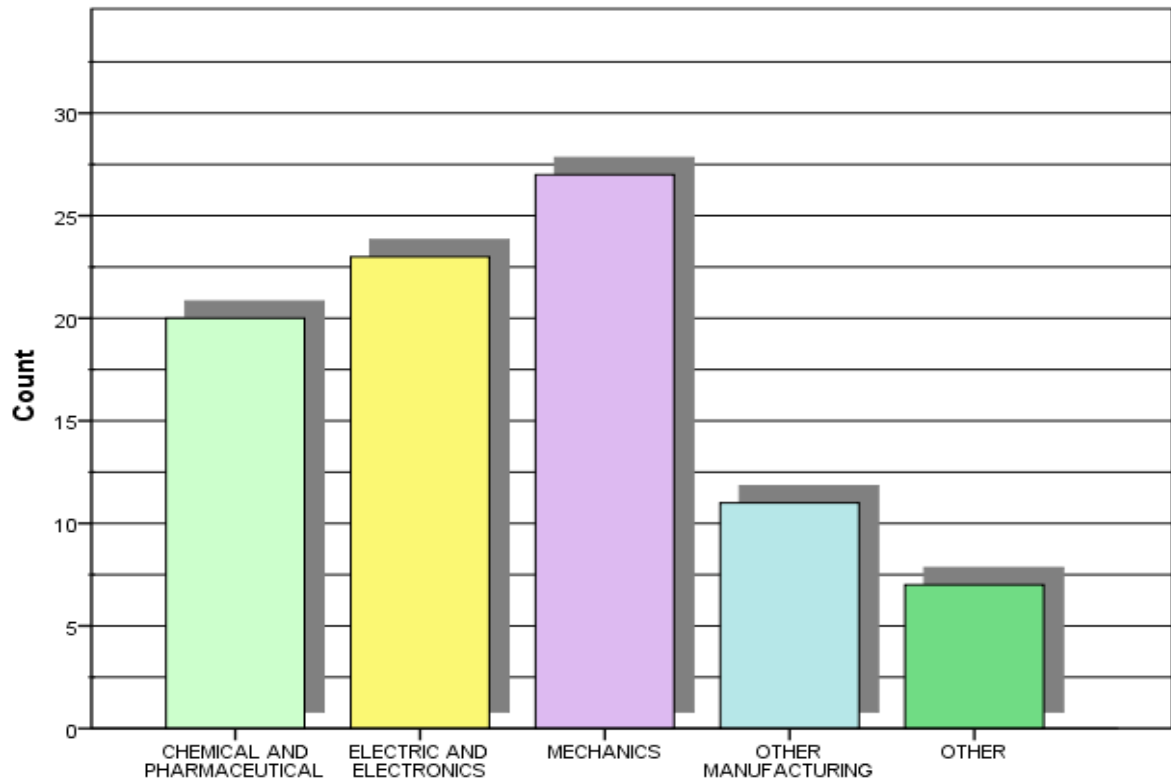
## 5.2 Preliminary analysis

The purpose of the preliminary analysis of the data is to provide some information on the composition of the sample analyzed (Forza, 2002).

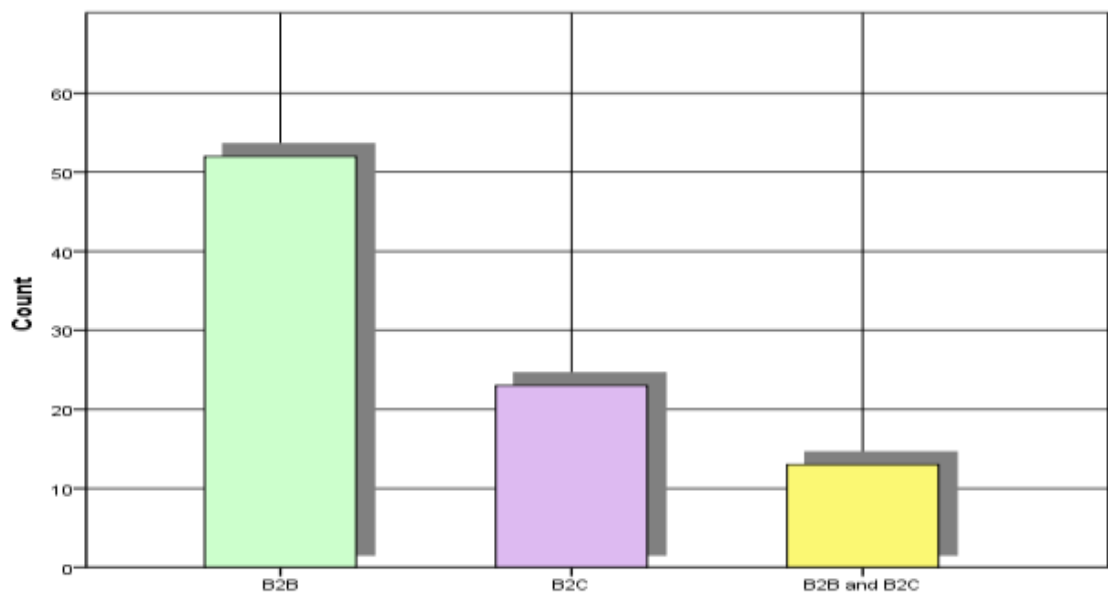
A first information is about the industry to which firms belong. Companies responding to the questionnaire can in fact be spread across various industries, identified at first through ATECO codes. ATECO is an alpha-numeric classification with varying degrees of detail: the letters indicate the macro-economic sector, while the numbers (ranging from two to six digits) represent, with varying degrees of detail, joints and breakdowns of individual sectors. Although the companies have been grouped on the basis of the first two digits of the numerical division, the final result is not satisfactory because it conveys an excessive layering. Also we have noticed that in many cases the industries do not exactly represent the activity of the corresponding firms: this is due to the fact that are not constantly updated. We have therefore supported the analysis of the ATECO codes, with an in-depth analysis on the activities undertaken by the firms, by finding information from the website of each firm. The outcome of this classification is shown in Figure 12

All firms belong to high tech industries: 27 firms (30.7 %) belong to the mechanics industry, 23 firms (26.1 %) to the electrics and electronics industry, 20 firms (22.7 %) to chemical and pharmaceutical industries and 11 firms (12.5 %) to other high tech manufacturing. The group called "other" groups together those industries with a small number of firms such as software and ICT.

We have then grouped the firms according to the type of business approach/es that characterizes them. The sample consists in fact of both business to business firms - B2B, organizations that sell their products or services to other companies and not directly to consumers (59.1 %), business to consumer firms - B2C, firms selling their products or services directly to consumers (26.1 %) and firms that present both approaches (14.8 %). As can be seen from the Figure 13 in majority of cases, firms present a B2B business approach.



**Figure 12** –Distribution of firms in the different industries



**Figure 13** – Distribution of firms according to their business approach

Another fundamental task in this preliminary analysis is to characterize the location (i.e., to find a typical or central value that best describes the data) and variability of a data set.

For univariate data, a common measure of location is the mean value while, for evaluating the variability, variance and standard deviation are between the most common numerical measures. A further characterization of the data includes *Skewness*, the measure of the asymmetry of a distribution, and *kurtosis*, the measure of the relative flatness of a distribution. These measures allow to verify if data distribution follows a “normal” distribution. Tables 30, 31 and 32 summarize the descriptive statistics for “distant search”, “local search”, “exploration competence” and “exploitation competence” items respectively. The descriptive tables shows that the skewness and kurtosis values are all between -1 and +1 suggesting that the distribution of all the items are within the limits of a normal distribution as suggested in chapter 4.

	Mean	Std. Deviation	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
Our organisation has organizational practices that allow bringing together people for different knowledge sets, backgrounds or functions.	3.2955	1.05219	-0.380	0.257	-0.681	0.508
Our organisation deliberately encourages diversity in terms of mind-sets and thinking	3.1932	1.07059	0.006	0.257	-0.668	0.508
In our organization, innovation teams are encouraged to expand their resource network by tapping into the knowledge of any employee in our firm.	3.1818	1.08856	-0.262	0.257	-0.700	0.508
In our organization, we have "network ambassadors" who can help innovation teams connect with other people company-wide when knowledge or insight is needed	2.7159	1.25898	0.204	0.257	-1.000	0.508
We have implemented an open and collaborative research environment with other companies	3.4828	1.16001	-0.621	0.258	-0.500	0.511
We make use of focus group, interviews, survey on line, brainstorming in order to gather market ideas	2.7011	1.15250	0.192	0.258	-0.863	0.511
We actively involve lead users	3.3977	1,03435	-0.485	0.257	-0.341	0.508
We frequently use prototypes as means of learning and refining an idea	4.0465	0.93188	-0.898	0.260	0.512	0.514
Our organisation sets up teams to actively search out new ideas that will take our business in new strategic directions.	3.4659	1.18369	-0.470	0.257	-0.813	0.508
We have a dedicated group of people that explores new ways to apply our existing technology to new industries and new customers.	3.4545	1.24945	-0.419	0.257	-0.983	0.508
We have people officially charged with scouting for new ideas, finding new sources of potential radical ideas and looking for trends and developments that might have implications for organisation's future	3.26437	1.252530	-0.264	0.258	-1.001	0.511
When we have a very new and different technology, we search for multiple applications and conduct several market experiments to discover promising markets	3.79310	1.101140	-0.914	0.258	0.219	0.511

We use an open innovation system in which technology-related challenges are posted online by our R&D staff so that a community of registered scientists anywhere in the world can propose their solutions..	2.1724	1.03662	0.670	0.258	-0.136	0.511
We have a website (blog, wiki, corporate social network) where outsiders can submit their suggestions and ideas for markets, products and/or services..	2.1279	1.22519	0.890	0.260	-0.224	0.514
We have one company-wide centralized idea management system in place to which all employees can submit ideas for evaluation and receive quick feedback.	2.7045	1.26998	0.302	0.257	-0.985	0.508
Our organisation mobilises its mainstream resources to systematically collect information, ideas and opinions from external sources	3.3523	0.91022	-0.110	0.257	-0.489	0.508
We actively encourage people to go to events/conferences/courses, etc.	3.5698	1.09050	-0.573	0.260	-0.291	0.514
We encourage people to come forward with ideas, even if they have only a vague idea of the potential market applications for the idea.	3.4659	1.14419	-0.621	0.257	-0.463	0.508
Radical innovation is clearly communicated throughout our organization as necessary for the long-term survival of our organization.	3.4205	1.15193	-0.424	0.257	-0.570	0.508
Our organization support those employees that have innovative ideas by giving them the opportunity to manage such ideas into dedicated units	3.0909	1.05739	-0.125	0.257	-0.607	0.508
Our top management works to develop an innovation culture within the organization	3.7614	1.05039	-0.904	0.257	0.484	0.508

**Table 30 – Descriptive statistics for “Distant Search” practices**

	Mean	Std. Deviation	Variance	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
In our organization, innovation teams are encouraged to expand their resource network by tapping into the knowledge of any employee in our firm.	3.2614	1.09853	1.207	-0.381	0.257	-0.431	0.508
In our organization, we have "network ambassadors" who can help innovation teams connect with other people company-wide when knowledge or insight is needed	2.8636	1.27019	1.613	-0.048	0.257	-9.997	0.508
Our organisation has organizational practices that allow bringing together people for different knowledge sets, backgrounds or functions	3.4713	1.03248	1.066	-0.278	0.258	-0.639	0.511
We actively encourage people to go to events/conferences/courses, etc.	3.4941	1.15081	1.324	-0.633	0.261	-0.395	0.517
We frequently use prototypes as means of learning and refining an idea	3.7326	1.03383	1.069	-0.812	0.260	0.228	0.514
We make an effort to connect to our final customers in order to obtain regular feedback on their demands	3.5455	1.18330	1.400	-0.409	0.257	-0.842	0.508
We actively involve lead users	3.5682	1.03719	1,076	-0.376	0.257	-0.546	0.508
We make use of focus group, interviste dirette o telefoniche, survey on line, brainstorming in order to gather market ideas	3.2045	1.19538	1.429	-0.365	0.257	-0.742	0.508

Our organisation looks deeply at how people actually use our products	3.6932	0.86247	0.744	-0.786	0.257	1.056	0.508
Our organisation mobilises its mainstream resources to systematically collect information, ideas and opinions from external sources	3.5455	0.90857	0.825	-0.561	0.257	0.221	0.508
We have a website (blog, wiki, corporate social network) where outsiders can submit their suggestions and ideas for markets, products and/or services.	2.1744	1.25737	1.581	0.934	0.260	-0.115	0.514
We have one company-wide centralized idea management system in place to which all employees can submit ideas for evaluation and receive quick feedback.	2.7273	1.22922	1.511	0.274	0.257	-0.808	0.508

**Table 31 - Descriptive statistics for “Local Search” practices**

	Mean	Std. Deviation	Variance	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
Acquired manufacturing technologies and skills entirely new to the firm	3.0575	1.06046	1.125	-0.236	0.258	-0.460	0.511
Learned product development skills and processes entirely new to the industry	3.3218	0.90854	0.825	-0.404	0.258	0.108	0.511
Acquired entirely new managerial and organizational skills that are important for innovation (such as forecasting technological and customer trends; identifying emerging markets and technologies)	2.7586	0.93964	0.883	0.161	0.258	-0.533	0.511
Strengthened innovation skills in areas where it had no prior experience	2.8837	0,95077	0.904	-0.099	0.260	-0.568	0.514
Upgraded current knowledge and skills for familiar products and technologies	3.3977	0.80999	0.656	0.074	0.257	-0.438	0.508
Enhanced skills in exploiting mature technologies that improve productivity of current innovation operations	3.2093	0.95937	0.920	-0.435	0.260	-0.367	0.514
Enhanced competencies in searching for solutions to customer problems that are near to existing solutions rather than completely new solutions	3.4091	0.82541	0.681	-0.142	0.257	-0.583	0.508
Upgraded skills in product development processes in which the firm already possesses significant experience	3.3678	0.76424	0.584	-0.100	0.258	0.444	0.511
Strengthened knowledge and skills on mature technologies	3.1034	0.84955	0.722	-0.201	0.258	0.131	0.511

**Table 32 - Descriptive statistics for “Exploration competence” and “Exploitation competence”**

## 5.3 Factor analysis

Before answering our first research question - *does it exist any difference among the firms that present different level of ambidexterity in the early phase of the innovation process in terms of practices put in place by firms when searching for local and distant ideas?* – factor analysis has been conducted on the different items that constitute the questionnaire.

In particular, exploratory factor analysis (EFA) is carried out for understanding latent constructs within search practices items: our intent is in fact to explore if patterns exists within the data in order to reduce multiple items to a lesser number of underlying dimensions (factors). An advantage of exploratory factor analysis is that it can generate hypotheses about underlying dimensions, which can then be tested in future studies using confirmatory factor analysis. More precisely, two exploratory factor analysis are conducted: one for “Local search” and the other for “Distant search”.

Confirmatory factor analysis (CFA) is instead used for verifying the two already tested scales of “Exploration competence” and “Exploitation competence”.

In the paragraphs that follow we present the results of the two exploratory factor analysis and of the confirmatory factor analysis, each accompanied by validity and reliability tests described in paragraph 4.2.5.3.

### 5.3.1 Local and Distant Search dimensions: results of Exploratory Factor Analysis

To ensure that the characteristics of the data set are suitable for carrying out factor analysis, before performing the analysis, all items are checked for normality and are found to be sufficiently normally distributed for further analyses (see the previous paragraph). Additionally, the Kaiser–Meyer–Olkin (KMO) measure of sampling adequacy and the Bartlett Test of Sphericity (BTS) are conducted on the data, through SPSS 18 software package.

Bartlett’s test of Sphericity is a statistic test used for examining the hypothesis that the variables are uncorrelated in the population. In other words, the population correlation matrix is an identity matrix: each variable correlates perfectly with itself ( $r = 1$ ) but has no correlation with the other variables ( $r = 0$ ). For a large sample Bartlett’s test approximates a chi-square distribution. Very small values of significance (below 0.05) indicate a high probability that there are significant relationships between the variables, whereas higher values (0.1 or above) indicate the data is inappropriate for factor analysis.

The Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy provides an index (between 0 and 1) of the proportion of variance among the variables that might be common variance (i.e., that might be indicative of underlying or latent common factors). A KMO near 1.0 supports a factor analysis while anything less than 0.5 is probably not amenable to useful factor analysis. More specifically, anything in the 0.90s is “marvelous”, in the 0.80s “meritorious”, in the 0.70s “middling”, in the 0.60s “mediocre”, in the 0.50s “miserable” and below 0.5 “unacceptable” (Dziuban and Shirkey 1974, p. 359).

This preliminary analysis confirms that the data distribution satisfies the psychometric criteria for the factor analysis to be performed (Tables 33 and 34).

Keiser Meyer Olkin measure of sampling adequacy		0.854
Bartlett's test of Sphericity	Approx. Chi-Square	810.019
	df	210
	Sig.	0.000

**Table 33 - KMO and Bartlett's tests for "Distant Search"**

Keiser Meyer Olkin measure of sampling adequacy		0.742
Bartlett's test of Sphericity	Approx. Chi-Square	238.038
	df	66
	Sig.	0.000

**Table 34 - KMO and Bartlett's tests for "Local Search"**

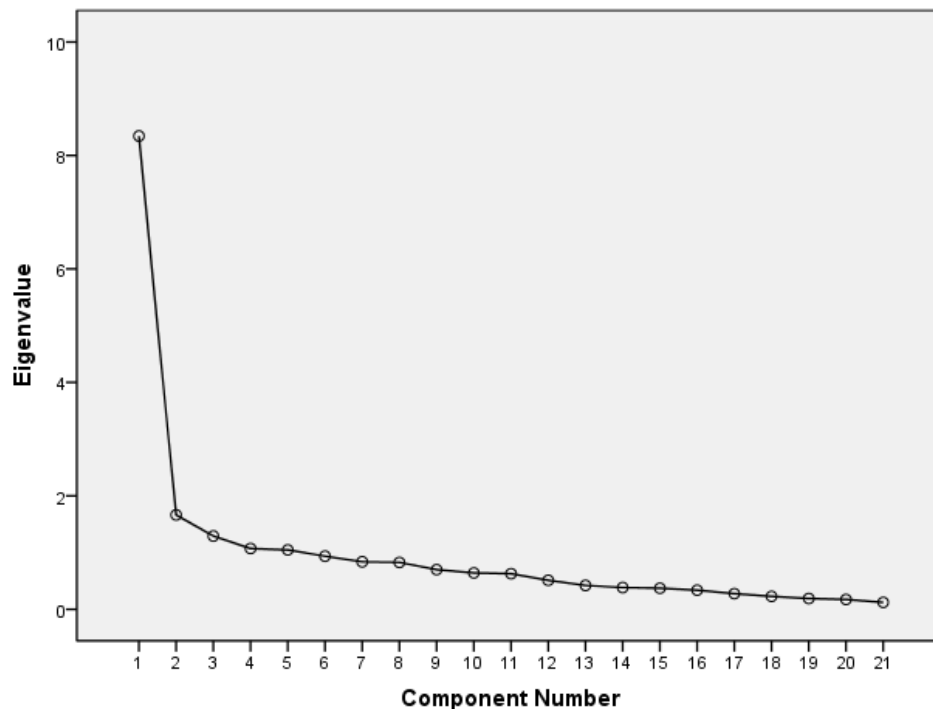
To reveal any latent variables within the search practices included into the "Search Questionnaire", we follow the guidelines depicted in Chapter 4: principal component analysis (PCA) as the factor extraction method, oblique rotation ("Direct Oblimin" is employed because of the possibility that the extracted factors may be correlated). Both for distant and local search, the analysis on the data has been run several times, setting the number of factors extracted at different values (five and six for distant search; four and five for local search) as suggested by Costello and Osborne (2005). Parallel analysis that combine scree plots observation, Kaiser criterion, variance accounted for greater than 60% are all conducted in order to decide the number of meaningful factors that might be in the data set (Costello and Osborne, 2005).

The solution that presents the item loading table with the "cleanest" factor structure is selected as the best fit to the data. In the following we present only the best factor structures obtained.

### **5.3.1.1 Emerging dimensions for Distant Search**

The first exploratory factor analysis is conducted on the data pertaining firms' use of search practices that have the purpose of generating distant knowledge and ideas.

By looking at the eigenvalues (Table 14), the Kaiser criterion would suggest that five factors should be retained. However, the sixth factor has an eigenvalue of 0.966. Nevertheless the Kaiser criterion is recognized to be an arbitrary rule, since it makes little sense for a factor with an eigenvalue of 0.966 to be excluded: Jolliffe (1972) in fact recommends that all factors with eigenvalues greater than 0.7 should be retained. Additionally, if we look at the scree plot it is difficult to clearly say that the curve flattens out after the fifth factor and not after the sixth. Figure 14 shows the trend of the eigenvalues obtained and Table 35 shows the values of the percentage of variance (absolute and cumulative) and the weights of non-rotated factors. It is possible to notice that the first factor accounts for a large proportion of the variance at 39.7%, and a 6-factor solution accounts for over 68% of the total variance. More importantly, by comparing the five-factor solution with the six-factor solution, we argue that the six-factor one is more readily interpretable.



**Figure 14 – Scree plot for “Distant Search” (EFA)**

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total
1	8.342	39.726	39.726	8.342	39.726	39.726	4.462
2	1.664	7.924	47.649	1.664	7.924	47.649	2.522

3	1.292	6.153	53.803	1.292	6.153	53.803	4.014
4	1.071	5.101	58.904	1.071	5.101	58.904	3.013
5	1.047	4.986	63.889	1.047	4.986	63.889	3.763
6	0.966	4.600	68.489	0.966	4.600	68.489	4.491
7	0.827	3.938	72.427				
8	0.807	3.842	76.270				
9	0.699	3.330	79.599				
10	0.642	3.057	82.656				
11	0.628	2.992	85.648				
12	0.511	2.431	88.079				
13	0.421	2.005	90.084				
14	0.384	1.826	91.911				
15	0.370	1.764	93.674				
16	0.337	1.606	95.281				
17	0.276	1.314	96.595				
18	0.228	1.084	97.679				
19	0.191	0.907	98.586				
20	0.174	0.829	99.415				
21	0.123	0.585	100.000				

**Table 35** - Amount of variance explained by each factor based on eigenvalues.

Table 36 shows the factor loadings for each variable for the pattern matrix of the six-factor solution. This matrix contains the saturation coefficients between each item and different factors. The higher this value the greater the correlation between the item and the specific factor. From this matrix it is possible to deduce which are the items that saturate the different factors extracted. Having rotated factors allows us to easily interpret the factorial solution. Each factor has a subset of items with high loadings, and the rest with low loadings: in other words, each item has high loadings on only one of the factors and low loadings on the rest. To identify (and interpret) the factors we sort the matrix of factor loadings in ascending order so that items with high loadings on the same factor appear together. The “strong” factor loadings ( $\geq 0.5$  in absolute value) are thus shown in bold.

On the basis of the decision rules established in interpreting the results of the factor analysis, one item is retained: 1) only if it loads primarily on one factor, 2) only if its loading on this factor is greater than or equal to 0.6 and lower than 0.4 on the other factors, or 3) when loading on multiple factors, the difference between the higher loading and all the other loadings should be greater than or equal to 0.25.

The items in Table 36 that are highlighted in gray should therefore be discarded.

	<i>Items Loadings</i>					
	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>
Our organisation has organizational practices that allow bringing together people for different knowledge sets, backgrounds or functions.	<b>0.653</b>	0.184	-0.216	0.218	0.073	-0.071
Our organisation deliberately encourages diversity in terms of mind-sets and thinking	<b>0.626</b>	0.073	-0.082	0.097	-0.130	0.381
In our organization, innovation teams are encouraged to expand their resource network by tapping into the knowledge of any employee in our firm.	<b>0.570</b>	0.120	-,009	0.043	0.185	0.300
In our organization, we have "network ambassadors" who can help innovation teams connect with other people company-wide when knowledge or insight is needed	<b>0.537</b>	0.183	-,066	0.177	0.328	-0.055
We have implemented an open and collaborative research environment with other companies	0.443	0.146	-0.149	-0.041	0.356	0.121
We make use of focus group, interviews, survey on line, brainstorming in order to gather market ideas	-0.028	<b>0.818</b>	-0.070	0.257	-0.179	-0.213
We actively involve lead users	0.002	<b>0.784</b>	0.254	-0.225	0.065	0.147
We frequently use prototypes as means of learning and refining an idea	0.124	0.454	-0.195	-0.094	0.150	0.164
Our organisation sets up teams to actively search out new ideas that will take our business in new strategic directions.	0.126	-0.063	<b>-0.749</b>	0.075	-0.129	0.251
We have a dedicated group of people that explores new ways to apply our existing technology to new industries and new customers.	0.120	0.146	<b>-0.666</b>	0.029	0.268	-0.076
We have people officially charged with scouting for new ideas, finding new sources of potential radical ideas and looking for trends and developments that might have implications for organisation's future	-0.192	0.136	<b>-0.601</b>	0.142	0.208	0.236
When we have a very new and different technology, we search for multiple applications and conduct several market experiments to discover promising markets	0.303	-0.037	<b>-0.555</b>	0.080	0.067	0.044
We use an open innovation system in which technology-related challenges are posted online by our R&D staff so that a community of registered scientists anywhere in the world can propose their solutions..	0.049	-0.001	-0.202	<b>0.748</b>	-0.083	-0.039
We have a website (blog, wiki, corporate social network) where outsiders can submit their suggestions and ideas for markets, products and/or services..	0.013	0.010	0.252	<b>0.738</b>	0.114	0.144
We have one company-wide centralized idea management system in place to which all employees can submit ideas for evaluation and receive quick feedback.	0.062	-0.049	0.021	<b>0.576</b>	0.236	0.242
Our organisation mobilises its mainstream resources to systematically collect information, ideas and opinions from external sources	0.265	-0.035	0.140	-0.022	<b>0.751</b>	-0.064
We actively encourage people to go to events/conferences/courses, etc.	-0.198	0.050	-0.262	0.225	<b>0.672</b>	0.077
We encourage people to come forward with ideas, even if they have only a vague idea of the potential market applications for the idea.	0.081	-0.002	-0.071	0.190	-0.080	<b>0.764</b>
Radical innovation is clearly communicated throughout our organization as necessary for the long-term survival of our organization.	0.019	0.106	-0.020	0.066	0.302	<b>0.665</b>

Our organization support those employees that have innovative ideas by giving them the opportunity to manage such ideas into dedicated units	0.302	0.047	-0.077	0.109	0.019	<b>0.528</b>
Our top management works to develop an innovation culture within the organization	-0.047	0.230	-0.214	0.028	0.433	0.462

**Table 36 - Exploratory factor analysis results for “Distant search”<sup>6</sup>**

Factors are now labelled and the meaning of each factor is explained.

*Factor 1* of the six-factor solution has high loadings (high loading is defined as greater than 0.50) for the four items relating to people connection through the creation of an internal network. Hence, this factor may be labelled as “**Internal Networking (D)**”. In fact all of the four items are examples of practices through which individuals with different backgrounds and skills are linked together in order to leverage on different skills and experience sets, to gain a knowledge and experience exchange and to learn new perspectives. In addition these practices favour the gathering and dissemination of knowledge in the organization, making knowledge accessible to everyone.

*Factor 2*, has heavy loadings with two variables mainly relating to the involvement of users as sources of innovative ideas. Customers are viewed as active players in the innovation process whose ideas can provide the starting point for new directions and help create new markets, products and services. This involvement can occur through conventional market research, interviews or by involving the lead users, active players in the innovation process. The practices included in this factor are therefore centred on customers’ ideas and insights that can provide the starting point for new directions and help create new markets, products and services. Hence this factor may be called “**Listening to the Customer (D)**”.

*Factor 3* concerns the exploration of new markets by specialized functions and dedicated groups of people whose role is to actively search for new ideas and knowledge to trigger the innovation process. The 4 items relate to the practices that organizations use when trying to open up new markets. These practices include sending out “idea hunters” whose role is to actively search for new ideas to trigger the innovation process and having a dedicated group of people that explores new ways to apply existing technology to new industries and new customers. We label this factor “**Market Sentinels (D)**”.

*Factor 4* clearly relates to the “**Knowledge Collector (D)**”. The 3 items in fact comprise systems for capturing and collecting ideas both inside and outside the organization: company-wide centralized idea management systems to which all employees can submit ideas for evaluation and receive quick feedback, forums, blogs, wikis, etc., where external actors can submit their ideas or suggest solutions for problems posted by R&D.

*Factor 5* comprises of 2 items which depict an open environment where the organization is put in connection with external resources in order to co-develop technologies and products.

---

<sup>6</sup> Extraction Method: Principal Component Analysis; Rotation Method: Oblimin with Kaiser Normalization; Rotation converged in 47 iterations.

We labelled this factor “**Openness to External Sources (D)**”. It groups together practices such as attending conferences and events which not only allow the firm to keep up-to-date with the developments in particular field of expertise but also provide a useful opportunity to exchange ideas, establish relationships with external stakeholders, and encourage the various functions to systematically collect ideas and opinions from outside sources such as universities, research centres, etc.

Finally, *Factor 6* can be interpreted as “**Organizational Support (D)**” and includes various ways of mobilizing high involvement innovation across the organisation. The 3 items in fact encompass the development of a culture that sustains innovation and the communication throughout the whole organization of the important role of innovation for long-term survival. Creating such a culture is not simple and requires a set of mechanisms to put forward bright ideas, including having a dedicated support unit to assist teams involved in innovative activities, the creation of an “entrepreneurial” environment that sustains, using strong incentive schemes, those employees who put forward innovative ideas.

For each firm we have then computed the average value of the items grouped together in the same factor. Firms pertaining to different industries or adopting different business approaches are then confronted on the basis of the values assumed by “distant search” dimensions.

Figures 15 and 16 in particular clearly show that the “idea collector” dimension presents the lowest values of use in all the industries while openness to external sources is widely recognized as being one of the most widely used practice, together with having dedicated people in charge of searching for new knowledge. Higher values are recorded for the industries included in the group “other”: namely ICT and software industries. We think that this fact should be attributed to the low number of firms belonging to this group (only six firms): having few firms in fact reduces the likelihood that they counterbalance each other regarding the use of the different practices. A similar argument can be made for the “other manufacturing” group.

When considering the differences between firms that show diverse business approaches, there are no significant differences between the three groups, except for “listening to the customers” dimension which presents the highest values within the Business-to-Consumer group.

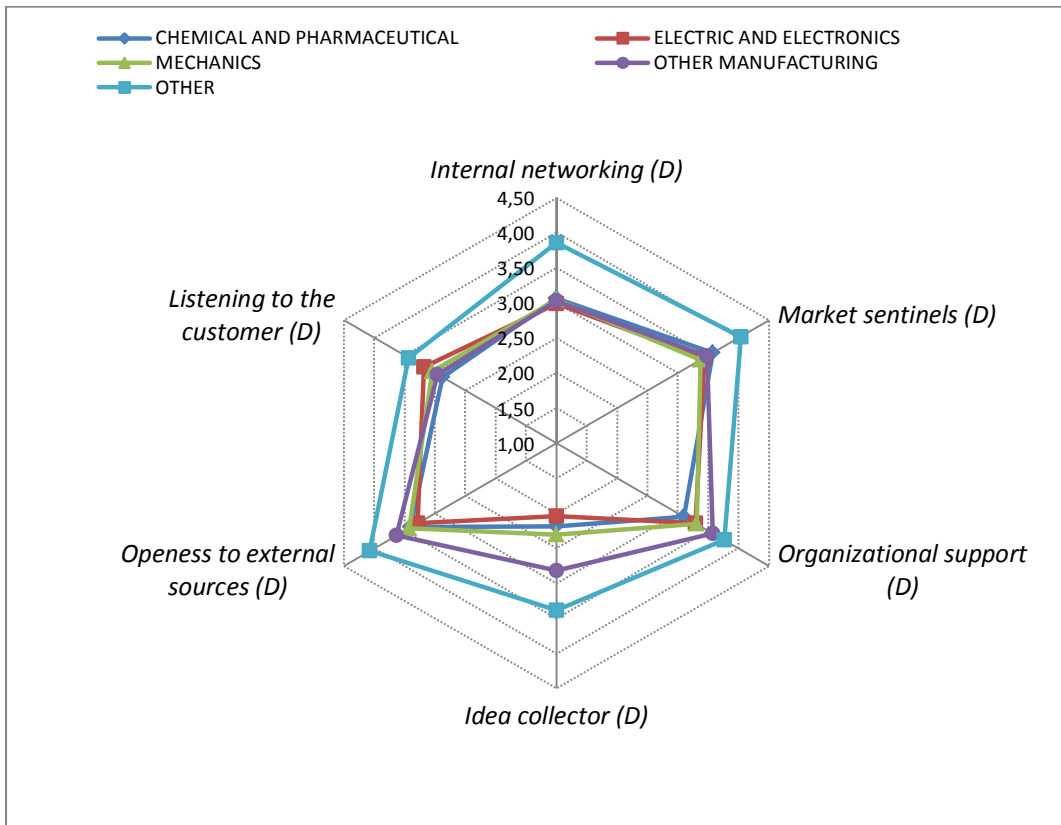


Figure 15 – “Distant search” dimensions mean value by industry

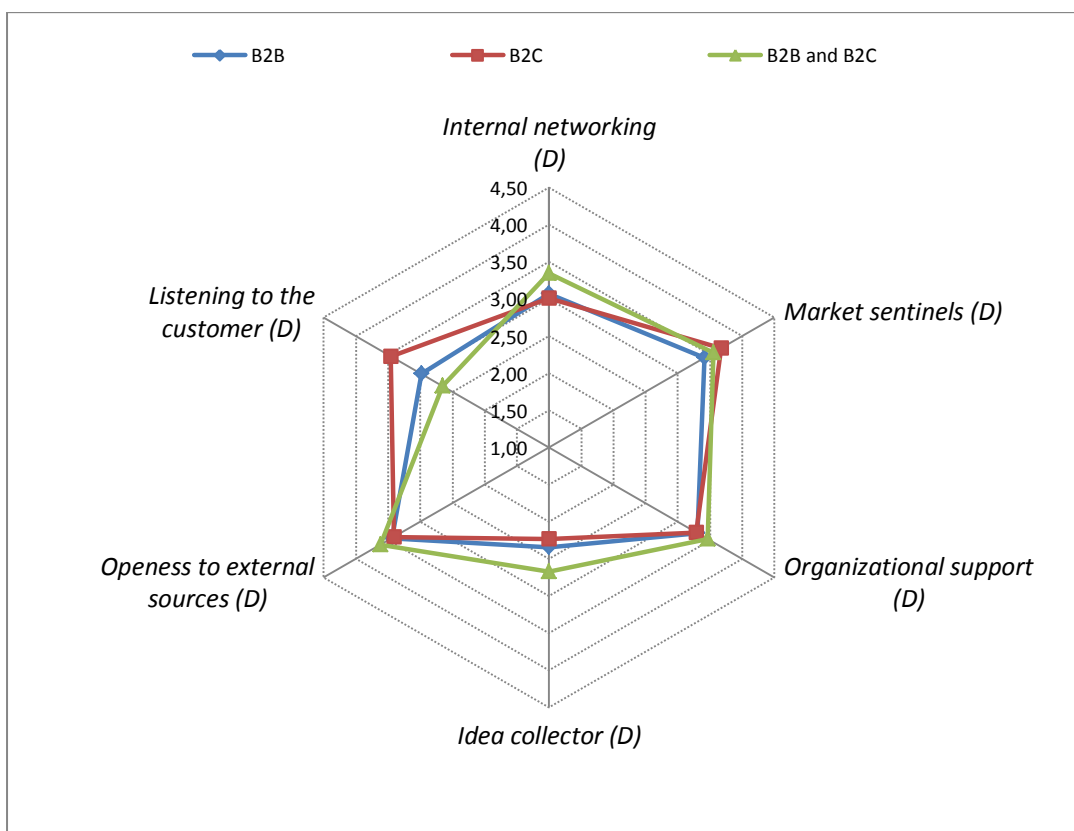


Figure 16 - “Distant search” dimensions mean value by business approach

### 5.3.1.1.1 Validity and Reliability tests of the six-factors for Distant Search

Validity and Reliability tests are very important because they allow to evaluate the goodness of the measures used in the questionnaire (for additional information please refer to paragraph 4.2.5.3). In this paragraph construct validity (convergent and discriminant validity), unidimensionality and reliability of the six-factors solution for Distant Search are evaluated.

*Convergent validity* is evaluated by examining the indicator loadings for statistical significance (Kenny and Kashy, 1992). To have convergent validity, the resulting factorial structure should be clear and well defined thus indicating that a significant relationship between each item and its respective factor: the factor loadings of each construct should be significantly high (Dunn, Seaker and Waller, 1994). Table 36 shows that the factorial structure for Distant search practices is clear and well defined. Results for our factor analysis additionally indicate that the relationship between each item and its respective factor is significant ( $p < 0.001$ ).

For evidence of *discriminant validity* both analyses the factor loadings and the inter-factor correlations are conducted. In particular, each item should present high loading only on one specific factor and significantly lower loadings on all the other factors. All the items in fact, apart the three items highlighted in gray (“We have implemented an open and collaborative research environment”, “We frequently use prototypes as means of learning and refining an idea” and “Our top management works to develop an innovation culture within the organization”), present high loadings only on one specific factor and significantly lower loadings on all the other factors. We have therefore calculated the mean value of all the items loading in the same factor in order to obtain a single value for each factor. These values have been used to calculate the correlation coefficients for all possible pairs of latent constructs (Table 37). By looking at the Correlation Coefficient among the factors, it is additionally possible to verify that correlations for all possible pairs of latent constructs are significant difference from 1, and above the recommended level of 0.65 (Tabachnick and Fidell, 1996, p. 86). Additionally, as can be seen in Table 37, factors are all significantly and moderately inter-correlated, suggesting that they measure distinct, but related, constructs.

	<i>Internal Networking (D)</i>	<i>Market sentinels (D)</i>	<i>Organizational support (D)</i>	<i>Knowledge collector (D)</i>	<i>Openness to external sources (D)</i>	<i>Listening to the customer (D)</i>
<i>Internal Networking (D)</i>	1	0.604**	0.643**	0.475**	0.531**	0.306**
<i>Market sentinels (D)</i>	0.604**	1	0.614**	0.463**	0.521**	0.232*
<i>Organizational support (D)</i>	0.643**	0.614**	1	0.571**	0.517**	0.237*
<i>Knowledge collector (D)</i>	0.475**	0.463**	0.571**	1	0.423**	0.115

<b>Openness to external sources (D)</b>	0.531**	0.512**	0.517**	0.423**	1	0.160
<b>Listening to the customer (D)</b>	0.306**	0.232*	0.237*	0.115	0.160	1

**Table 37 - Correlations between the six “Distant Search” factors<sup>7</sup>**

Assessing *unidimensionality* means determining whether or not a set of indicators significantly reflect one, and only one construct (Gerbing and Anderson, 1988). To this purpose, a confirmatory factor analysis (CFA) is performed<sup>8</sup>. First, by looking at the output of the Exploratory Factor Analysis, the items that do not meet the retention criteria indicated in paragraph 4.2.5.3 are discarded. Then, on the remaining items a Confirmatory Factor Analysis is carried out by fixing the number of the factors to extract. Construct validity is therefore established by assessing the overall model fit with AMOS<sup>9</sup> (Pedhazur and Schmelkin, 1991; O’Leary-Kelly and Vokurkar, 1998). Multiple fit indexes are calculated. Table 38 summarizes the recommended ranges for some of the main fit indexes and the value assumed of such indexes with our data. An excellent fit is provided as displayed in the table. In particular, the RMSEA value for the six-factor solution indicated reasonable fit. In addition, the null hypothesis for the test of close fit is retained ( $p=0.126$ ).

<b>Indexes</b>	<b>Values</b>	<b>Recommended values for GOOD FIT</b>	<b>Recommended values for VERY GOOD FIT</b>
$\chi^2$	138	-	-
d.f.	120	-	-
p	0.126	-	-
RMSEA	0.041	< .08	< 0.05
NFI	0.814	> 0.8	> 0.9
N-NFI or TLI	0.955	> 0.8	> 0.9
CFI	0.969	> 0.8	> 0.9
IFI	0.971	> 0.8	> 0.9
$\chi^2/df$	1.149	>1 and <5	>1 and <3

**Table 38 – Fit indices value for “Distant Search”**

<sup>7</sup> Pearson’s correlation coefficient, Eta and Phi statistics were used (\*  $p < 0.05$ ; \*\*  $p < 0.01$ )

<sup>8</sup> It is important to underline that CFA in this case is performed only with the aim of obtaining some indications about the model fit and not to assess the generalizability of our results. If the intent is to verify the generalizability of the results obtained with the exploratory factor analysis, CFA should in fact be conducted on data coming from a different sample.

<sup>9</sup> AMOS is part of the SPSS Software for Powerful Structural Equation Modeling and Path Analysis. It is used to create realistic models in addition to using standard multivariate methods or regression analysis.

Finally, to investigate *reliability*, Cronbach's alpha coefficient is calculated. Accordingly to Nunnally (1978), 0.60 is considered as the minimum acceptable criterion of instrument internal reliability, being our measures new developed measures while with alpha value greater or equal to 0.8 the measure should be considered very reliable. Tables 39 to 44 reassume items statistics (mean and variance), inter-items correlations and reliability test for all the "Distant Search" factors.

The coefficient alpha for all the factors obtained through exploratory factor analysis on "Distant Search" practices exceeded the criterion for acceptable instrument internal reliability of 0.60. For factors made up by only two items, Pearson Correlation is calculated: in this case reliability is verified if items are highly correlated ( $p < 0.05$  or  $p < 0.01$ ): this condition is verified both for "Openness to External Sources" and "Listening to the Customer" factors.

	<i>Mean</i>	<i>Standard Deviation</i>	<i>1° item</i>	<i>2° item</i>	<i>3° item</i>	<i>4° item</i>
<i>1° item</i>	3.2955	1.05219	1,000	0.581	0.605	0.481
<i>2° item</i>	3.1932	1.07059	0.581	1.000	0.591	0.613
<i>3° item</i>	3.1818	1.08856	0.605	0.591	1.000	0.642
<i>4° item</i>	2.7159	1.25898	0.481	0.613	0.642	1.000

Cronbach's Alpha = 0.847  
Cronbach's Alpha Based on Standardized Items = 0.850

**Table 39** – Items statistics, inter-items correlations and reliability test for "Internal Networking"

	<i>Mean</i>	<i>Standard Deviation</i>	<i>1° item</i>	<i>2° item</i>	<i>3° item</i>	<i>4° item</i>
<i>1° item</i>	3.43023	1.173639	1.000	0.586	0.571	0.548
<i>2° item</i>	3.41860	1.241111	0.586	1.000	0.550	0.534
<i>3° item</i>	3.24419	1.245567	0.571	0.550	1.000	0.469
<i>4° item</i>	3.77907	1.099745	0.548	0.534	0.469	1.000

Cronbach's Alpha = 0.826  
Cronbach's Alpha Based on Standardized Items = 0.826

**Table 40** – Items statistics, inter-items correlations and reliability test for "Market Sentinel"

	<i>Mean</i>	<i>Standard Deviation</i>	<i>1° item</i>	<i>2° item</i>	<i>3° item</i>
<i>1° item</i>	3.4205	1.15193	1.000	0.563	0.547
<i>2° item</i>	3.0909	1.05739	0.563	1.000	0.525
<i>3° item</i>	3.4659	1.14419	0.547	0.525	1.000

Cronbach's Alpha = 0.782  
Cronbach's Alpha Based on Standardized Items = 0.782

**Table 41** – Items statistics, inter-items correlations and reliability test for "Organizational Support"

	<i>Mean</i>	<i>Standard Deviation</i>	<i>1° item</i>	<i>2° item</i>	<i>3° item</i>
<i>1° item</i>	2.6744	1.25971	1.000	0.446	0.547
<i>2° item</i>	2.1279	1.22519	0.556	1.000	0.372
<i>3° item</i>	2.1628	1.03878	0.408	0.372	1.000

Cronbach's Alpha = 0.671  
Cronbach's Alpha Based on Standardized Items = 0.675

**Table 42** – Items statistics, inter-items correlations and reliability test for “Idea Collector”

	<i>Mean</i>	<i>Standard Deviation</i>	<i>1° item</i>	<i>2° item</i>
<i>1° item</i>	3.3523	0.91022	1.000	0.352
<i>2° item</i>	3.5698	1.09050	0.352	1.000

Pearson Correlation is significant at the 0.01 level (2-tailed).

**Table 43** – Items statistics, inter-items correlations and reliability test for “Openness to External Sources”

	<i>Mean</i>	<i>Standard Deviation</i>	<i>1° item</i>	<i>2° item</i>
<i>1° item</i>	2.7011	1.15250	1.000	0.332
<i>2° item</i>	3.3977	1.03435	0.332	1.000

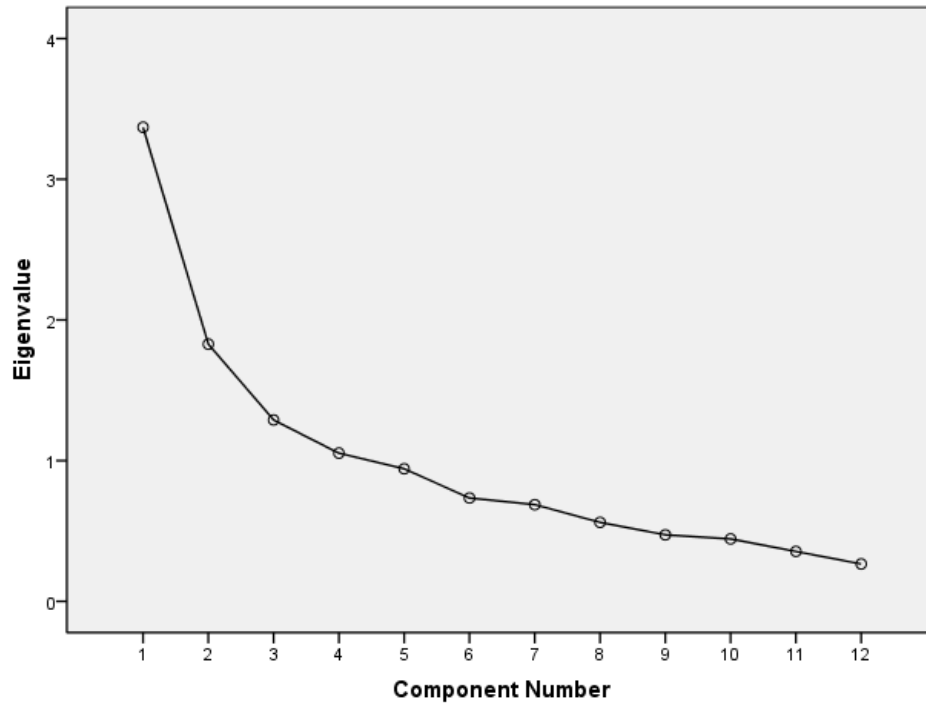
Pearson Correlation is significant at the 0.01 level (2-tailed).

**Table 44** – Items statistics, inter-items correlations and reliability test for “Listening to the Customer”

### 5.3.1.2 Emerging categories for Local Search

The second exploratory factor analysis is conducted on the data pertaining to firms' use of search practices that have the purpose of generating local knowledge and ideas.

Examination of the eigenvalues (Table 45) suggests that retaining factors with an eigenvalue greater than 1 would produce a 4-factor solution. Figure 17 shows the trend of the eigenvalues obtained and Table 45 shows the values of the percentage of variance (absolute and cumulative) and the weights of non-rotated factors: the first factor accounts for a large proportion of the variance at 28%, and a 4-factor solution accounts for about 63% of the total variance. The same is apparent from Figure 17 where the curve flattens out in the fourth component thus confirming that four is a viable number for factors extracted. Additionally a four-factor solution appears to be readily interpretable.



**Figure 17** - Scree plot for “Local Search” (EFA)

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total
1	3.370	28.081	28.081	3.370	28.081	28.081	3.101
2	1.828	15.231	43.312	1.828	15.231	43.312	1.785
3	1.289	10.740	54.053	1.289	10.740	54.053	1.655
4	1.053	8.779	62.831	1.053	8.779	62.831	1.456
5	0.942	7.851	70.682				
6	0.734	6.119	76.801				
7	0.687	5.724	82.526				
8	0.561	4.677	87.203				
9	0.473	3.939	91.142				
10	0.443	3.695	94.837				
11	0.354	2.953	97.791				
12	0.265	2.209	100.000				

**Table 45** - Amount of variance explained by each factor based on eigenvalues.

Table 46 shows the factor loadings for each variable for the pattern matrix of the four-factor solution. From this matrix it is possible to deduce which are the items that saturate the different factors extracted. The “strong” factor loadings ( $\geq 0.5$  in absolute value) are shown in bold. On the basis of the decision rules established in interpreting the results of the factor analysis the items in Table 46 that are highlighted in gray should be discarded (similarly to the previous factor analysis)

	<i>Items Loadings</i>			
	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>
In our organization, innovation teams are encouraged to expand their resource network by tapping into the knowledge of any employee in our firm.	<b>0.840</b>	0.089	0.071	0.062
In our organization, we have "network ambassadors" who can help innovation teams connect with other people company-wide when knowledge or insight is needed	<b>0.799</b>	-0.043	-0.105	0.199
Our organisation has organizational practices that allow bringing together people for different knowledge sets, backgrounds or functions	<b>0.792</b>	0.208	0.047	0.049
We actively encourage people to go to events/conferences/courses, etc.	0.522	-0.316	0.471	0.044
We frequently use prototypes as means of learning and refining an idea	0.439	0.396	0.135	-0.164
We make an effort to connect to our final customers in order to obtain regular feedback on their demands	-0.098	<b>0.769</b>	0.099	0.244
We actively involve lead users	0.151	<b>0.659</b>	-0.111	-0.272
We make use of focus group, interviews, survey on line, brainstorming in order to gather market ideas	0.099	0.495	0.119	-0.158
Our organisation looks deeply at how people actually use our products	-0.212	0.248	<b>0.829</b>	0.093
Our organisation mobilises its mainstream resources to systematically collect information, ideas and opinions from external sources	0.424	-0.212	0.502	-0.227
We have a website (blog, wiki, corporate social network) where outsiders can submit their suggestions and ideas for markets, products and/or services.	-0.056	0.000	0.396	<b>0.734</b>
We have one company-wide centralized idea management system in place to which all employees can submit ideas for evaluation and receive quick feedback.	0.418	-0.014	-0.192	<b>0.721</b>

**Table 46 - Exploratory factor analysis results for “Local Search”<sup>10</sup>**

<sup>10</sup> Extraction Method: Principal Component Analysis; Rotation Method: Oblimin with Kaiser Normalization; Rotation converged in 73 iterations

Factors are now labelled and what is meant by each factor is explained.

*Factor 1* of the four-factor solution may be labelled as “**Internal Networking (L)**”. This factor is very similar to the first factor identified for “distant knowledge generation”. The practices through which individuals with different backgrounds and skills are linked together and exchange their knowledge and experience could in fact favour the improvement of the firm's existing knowledge base and make the knowledge generated accessible to everyone.

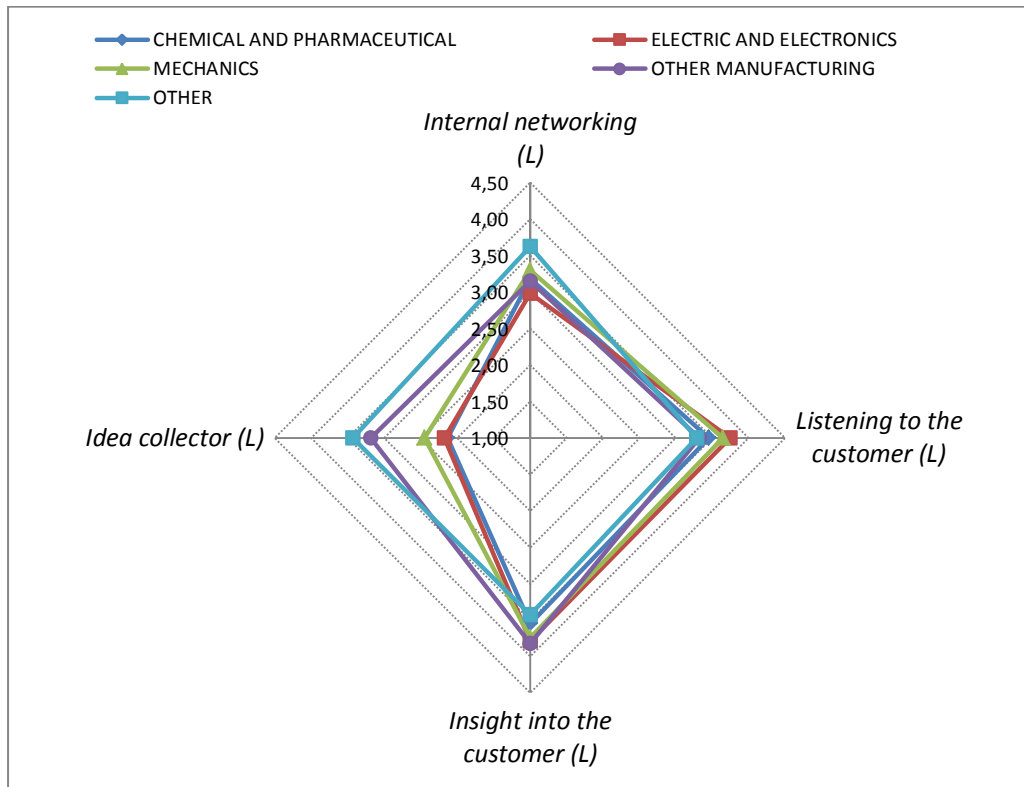
*Factor 2* concerns practices through which the actual users take part in the innovation process by conveying their ideas and insights on existing products. This occurs through a closer connection with final customers in order to obtain regular feedback on their demands and the involvement of lead users in the innovation process. In this case such practices are aimed at generating useful proposals for the improvement of the existing offer. We called this factor “**Listening to the Customer (L)**”, in line with the similar factor identified for “distant search”.

*Factor 3*, “**Insight into the Customer (L)**” is made up of one single item that concerns a technique of getting closer to what people need and want in the context they operate in. Rather than asking consumers and customers what they might like, researchers observe the everyday life of real people, capturing the experiences of people as and when they occur. This leads to the creation of new insights and a deeper understanding of how existing products and services are actually used.

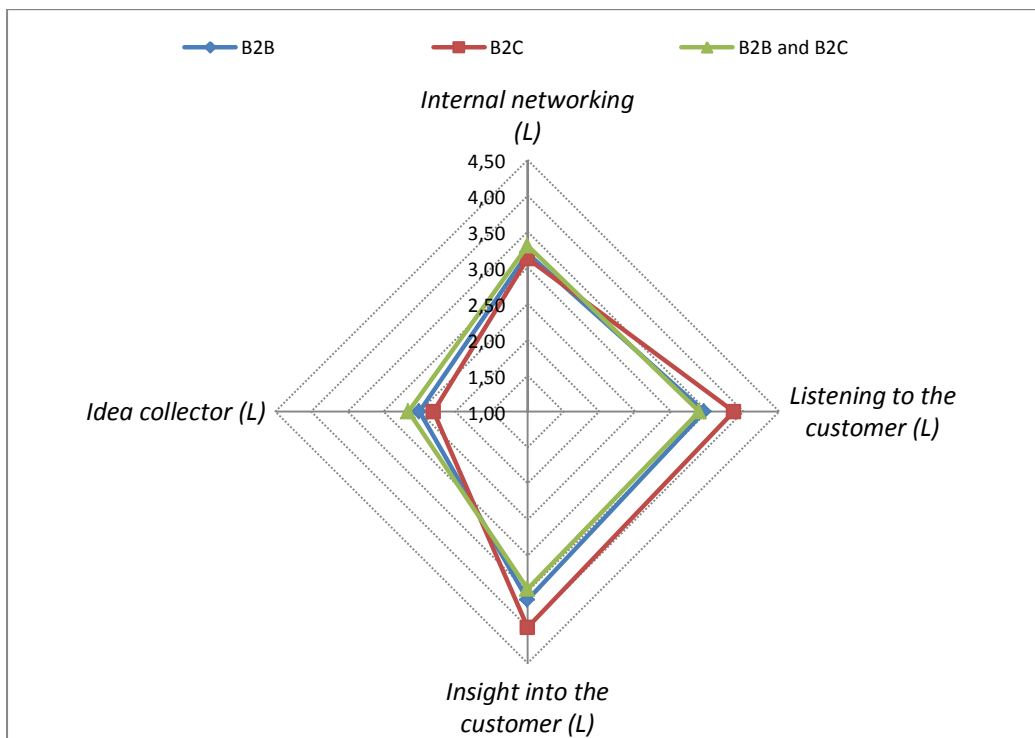
The final factor, *factor 4*, has two items which relate to the “**Knowledge Collector (L)**”. It involves systems for capturing and collecting ideas both inside and outside the organization. Some of the key features of such a system include having a central system in which employees or external actors can submit their ideas or forums, blogs, wikis, etc., where external actors can offer their ideas.

For each firm we have then computed the average value of the items grouped together in the same factor. Firms pertaining to different industries or adopting different business approaches are then confronted on the basis of the values assumed by “local search” dimensions.

Figures 18 and 19 in particular show that also within the local search domain the “idea collector” dimension has the lowest values of use within almost all the industries included in our sample. Only firms that belong to the groups “other” and “other manufacturing” seem to make substantial use of the practices included in the “idea collector” dimension. We echo what has been said in a previous paragraph: we believe that this fact should be attributed to the low number of firms belonging to these groups. When considering the differences between firms that show diverse business approaches, there are no significant differences between the three groups, except for “listening to the customer” and “insight into the customer” dimensions which have the highest values within the Business-to-Consumer group.



**Figure 18 - "Local search" dimensions mean value by industry**



**Figure 19 - "Local search" dimensions mean value by business approach**

### 5.3.1.2.1 Validity and Reliability tests of the four factors for Local Search

As it has been done for “Distant Search” dimensions, in this paragraph construct validity (convergent and discriminant validity), unidimensionality and reliability of the four-factors solution for Distant Search are evaluated.

*Convergent validity* is evaluated by examining the indicator loadings for statistical significance (Kenny and Kashy, 1992). Table 46 shows that the factorial structure for local search practices is clear and well defined. Results for our factor analysis additionally indicate that the relationship between each item and its respective factor is significant ( $p < 0.001$ ).

For evidence of *discriminant validity* both analyses the factor loadings and the inter-factor correlations are conducted. In particular, each item should present high loading only on one specific factor and significantly lower loadings on all the other factors. All the items in fact, apart the four items highlighted in gray (“We actively encourage people to go to events, conferences, courses”, “We frequently use prototypes as means of learning and refining an idea”, “We make use of focus group, interviews, survey on line, brainstorming in order to gather market ideas” and “Our organisation mobilizes its mainstream resources to systematically collect information, ideas and opinions from external sources”), present high loading only on one specific factor and significantly lower loadings on all the other factors. We have therefore calculated the mean value of all the items loading in the same factor in order to obtain a single value for each factor. These values have been used to calculate the correlation coefficients for all possible pairs of latent constructs (Table 47). Table 47, which summarizes Pearson’s Correlation Coefficient among the factors, provides evidence of discriminant validity: correlations for all possible pairs of latent constructs is in fact above the recommended level of 0.65 (Tabachnick and Fidell, 1996). Given that no inter-factor correlation is above the recommended level of 0.65, problems created by a lack of discriminant validity are not likely to bias our data. Additionally, as can be seen in Table 47, factors are all significantly and moderately inter-correlated, suggesting that they measure distinct, but related, constructs.

	<i>Internal Networking (L)</i>	<i>Listening to the Customer (L)</i>	<i>Insight into the Customer (L)</i>	<i>Knowledge Collector (L)</i>
<i>Internal Networking (L)</i>	1	0.144	0.060	0.304**
<i>Listening to the Customer (L)</i>	0.144	1	0.176	-0.042
<i>Insight into the Customer (L)</i>	0.060	0.176	1	0.118
<i>Knowledge Collector (L)</i>	0.304**	-0.042	0.118	1

**Table 47 - Correlations between the four “Local Search” factors<sup>11</sup>**

<sup>11</sup> Pearson’s correlation coefficient, Eta and Phi statistics were used (\*  $p < 0.05$ ; \*\*  $p < 0.01$ )

Assessing unidimensionality means determining whether or not a set of indicators significantly reflect one, and only one construct (Gerbing and Anderson, 1988). To this purpose, confirmatory factor analysis (CFA) is used. First, by looking at the output of the Exploratory Factor Analysis, the items that do not meet the retention criteria indicated in paragraph 4.2.5.3 are discarded. Then, on the remaining items a Confirmatory Factor Analysis is carried out by fixing the number of the factors to extract. Construct validity is therefore established by assessing the overall model fit with AMOS (Pedhazur and Schmelkin, 1991; O’Leary-Kelly and Vokurkar, 1998). Multiple fit indexes are calculated. Table 48 summarizes the recommended ranges for some of the main fit indexes and the value assumed of such indexes with our data. An excellent fit is provided as displayed in the table. In particular, the RMSEA value for the six-factor solution indicated reasonable fit. In addition, the null hypothesis for the test of close fit is retained ( $p=0.35$ ).

<i>Indexes</i>	<i>Values</i>	<i>Recommended values for GOOD FIT</i>	<i>Recommended values for VERY GOOD FIT</i>
$\chi^2$	17.85	-	-
df	15	-	-
p	0.35	-	-
RMSEA	0.035	< .08	< 0.05
NFI	0.9	> 0.8	> 0.9
N-NFI or TLI	0.98	> 0.8	> 0.9
CFI	0.99	> 0.8	> 0.9
IFI	0.99	> 0.8	> 0.9
$\chi^2/df$	1.19	>1 and <5	>1 and <3

**Table 48 – Fit indices value for “Distant Search”**

To investigate *reliability* Cronbach’s alpha coefficient is calculated. The coefficient alpha for all the factors obtained through exploratory factor analysis on “Distant Search” practices exceed the criterion for acceptable instrument internal reliability of 0.60. For factors made up by only two items, Pearson Correlation is calculated: in this case reliability is verified if items are highly correlated ( $p < 0.05$  or  $p < 0.01$ ): this condition is verified both for “Openness to External Sources” and “Listening to the Customer” factors.

Tables 49 to 51 reassume items statistics (mean and variance), inter-items correlations and reliability test for all the “Distant Search” factors.

	<i>Mean</i>	<i>Standard Deviation</i>	<i>1° item</i>	<i>2° item</i>	<i>3° item</i>
<i>1° item</i>	3.2644	1.10453	1.000	0.578	0.654
<i>2° item</i>	2.8621	1.27746	0.578	1.000	0.508
<i>3° item</i>	3.4713	1.03248	0.654	0.508	1.000

Cronbach's Alpha = 0.799

Cronbach's Alpha Based on Standardized Items = 0.806

**Table 49** – Items statistics, inter-items correlations and reliability test for “Internal Networking”

	<i>Mean</i>	<i>Standard Deviation</i>	<i>1° item</i>	<i>2° item</i>
<i>1° item</i>	3.5682	1.03719	1.000	0.241
<i>2° item</i>	3.5455	1.18330	0.241	1.000

Correlation is significant at the 0.05 level (2-tailed)

**Table 50** – Items statistics, inter-items correlations and reliability test for “Listening to the Customer”

	<i>Mean</i>	<i>Standard Deviation</i>	<i>1° item</i>	<i>2° item</i>
<i>1° item</i>	2,7273	1,22922	1.000	0.350**
<i>2° item</i>	2,1744	1,25737	0.350**	1.000

Correlation is significant at the 0.01 level (2-tailed)

**Table 51** – Items statistics, inter-items correlations and reliability test for “Knowledge Collector”

### 5.3.2 Confirmatory Factor analysis (CFA) on “Exploration competence” and “Exploitation competence” scales

In the previous paragraphs we have carried out an Exploratory factor analysis with the aim of exploring the possible underlying factor structure of a set of observed variables (Distant and Local search practices) without imposing a preconceived structure on the outcome.

In this section our intent is however to test the specific hypothesis about the factor structure for a set of variables, that have already been validated in the literature: CFA is therefore the selected technique for verifying the two already tested scales of “exploration competence” and “exploitation competence” depicted in Table 54 (Atuahene-Gima, 2005).

To ensure that the characteristics of the data set are suitable for the factor analysis, the Kaiser–Meyer–Olkin (KMO) measure of sampling adequacy and the Bartlett Test of

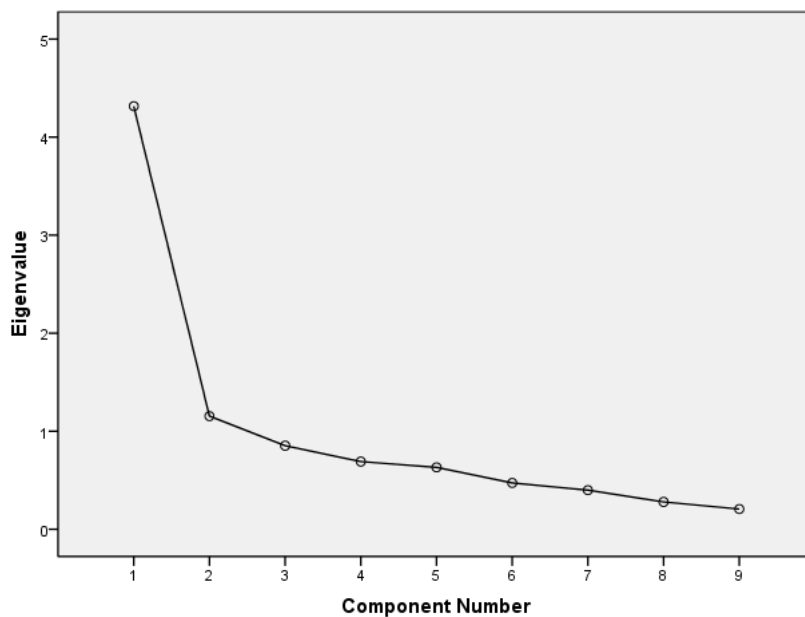
Sphericity (BTS) are conducted on the data, through SPSS software package. This preliminary analysis confirms that the data distribution satisfies the psychometric criteria for performing factor analysis (Table 52).

Keiser Meyer Olkin measure of sampling adequacy		0.788
Bartlett's test of Sphericity	Approx. Chi-Square	301.747
	df	36
	Sig.	0.000

**Table 52 - KMO and Bartlett's tests for "exploration competence" and "exploitation competence"**

We have therefore imposed to two the number of factors to extract. Being "exploration competence" and "exploitation competence", defined as orthogonal variables (Gupta, Smith and Shally, 2006) varimax rotation is used. In Figure 20 and in Tables 53 and 54 the results of the confirmatory factor analysis are shown.

The two factors identified, which both have eigenvalue greater than 1, explain over 60% of cumulative variance: additionally, after the second component the curve of the scree plot also becomes nearly flat, thus meaning that the components after the second does not make any significant contribution to the explanation of the variance of the factors extracted.



**Figure 20 - Scree plot for "Exploration competence" and "Exploitation competence" scales**

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	4.316	47.953	47.953	4.316	47.953	47.953	2.835	31.495	31.495
2	1.154	12.822	60.774	1.154	12.822	60.774	2.635	29.280	60.774
3	0.853	9.473	70.247						
4	0.690	7.667	77.914						
5	0.632	7.019	84.933						
6	0.472	5.247	90.180						
7	0.399	4.432	94.613						
8	0.279	3.096	97.709						
9	0.206	2.291	100.000						

**Table 53 - Amount of variance explained by each factor based on eigenvalues<sup>12</sup>**

CONSTRUCTS	OPERATIONAL MEASURES OF CONSTRUCT	FACTOR LOADINGS	
<i>Over the last three years, to what extent has your firm:</i>			
Exploration competence	1. Acquired manufacturing technologies and skills entirely new to the firm?	<b>0.794</b>	0.057
	2. Learned product development skills and processes entirely new to the industry?	<b>0.723</b>	0.04
	3. Acquired entirely new managerial and organizational skills that are important for innovation (such as forecasting technological and customer trends; identifying emerging markets and technologies)?	<b>0.730</b>	0.284
	4. Strengthened innovation skills in areas where it had no prior experience?	<b>0.827</b>	0.225
Exploitation competence	1. Upgraded current knowledge and skills for familiar products and technologies?	0.500	0.502
	2. Enhanced skills in exploiting mature technologies that improve productivity of current innovation operations?	0.234	<b>0.650</b>
	3. Enhanced competencies in searching for solutions to customer problems that are near to existing solutions rather than completely new solutions?	0.052	<b>0.779</b>
	4. Upgraded skills in product development processes in which the firm already possesses significant experience?	0.242	<b>0.738</b>
	5. Strengthened knowledge and skills on mature technologies?	0.314	<b>0.715</b>

**Table 54 – Confirmatory factor analysis results for “Exploration competence” and “Exploitation competence”<sup>13</sup>**

<sup>12</sup> Extraction Method: Principal Component Analysis; Rotation Method: Varimax with Kaiser Normalization; Rotation converged in 3 iterations

<sup>13</sup> Extraction Method: Principal Component Analysis; Rotation Method: Varimax with Kaiser Normalization; Rotation converged in 3 iterations

If item n. 1 of the "Exploitation Competence" scale is excluded, the factorial structure is clear and readily identifiable. We have therefore carried out a second confirmatory factor analysis by excluding this item. The results are shown in Tables 55 and 56. As it can be seen from Table 55, removing an item, the cumulative percentage of variance increases from 60% to 62%.

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	3.881	48.515	48.515	3.881	48.515	48.515	2.611	32.641	32.641
2	1.154	14.421	62.936	1.154	14.421	62.936	2.424	30.294	62.936
3	0.847	10.585	73.520						
4	0.632	7.896	81.416						
5	0.549	6.860	88.276						
6	0.406	5.081	93.357						
7	0.296	3.697	97.054						
8	0.236	2.946	100.000						

**Table 55** - Amount of variance explained by each factor based on eigenvalues by excluding one item

CONSTRUCTS	OPERATIONAL MEASURES OF CONSTRUCT	FACTOR LOADINGS	
<i>Over the last three years, to what extent has your firm:</i>			
<b>Exploration competence</b>	<i>Acquired manufacturing technologies and skills entirely new to the firm?</i>	<b>0.798</b>	0.062
	<i>Learned product development skills and processes entirely new to the industry?</i>	<b>0.726</b>	0.410
	<i>Acquired entirely new managerial and organizational skills that are important for innovation (such as forecasting technological and customer trends; identifying emerging markets and technologies)?</i>	<b>0.747</b>	0.307
	<i>Strengthened innovation skills in areas where it had no prior experience?</i>	<b>0.819</b>	0.217

<b>Exploitation competence</b>	<i>Enhanced skills in exploiting mature technologies that improve productivity of current innovation operations?</i>	0.237	<b>0.658</b>
	<i>Enhanced competencies in searching for solutions to customer problems that are near to existing solutions rather than completely new solutions?</i>	0.055	<b>0.783</b>
	<i>Upgraded skills in product development processes in which the firm already possesses significant experience?</i>	0.251	<b>0.751</b>
	<i>Strengthened knowledge and skills on mature technologies?</i>	0.309	<b>0.708</b>

**Table 56** - Confirmatory factor analysis results for “Exploration competence” and “Exploitation competence” by excluding one item

#### 5.3.2.1.1 Validity and Reliability tests of the factors “Exploration competence” and “Exploitation competence”

Construct validity (convergent and discriminant validity), unidimensionality and reliability of the two factors “Exploration competence” and “Exploitation competence” are now evaluated.

To assess *convergent validity* of “Exploration competence” and “Exploitation competence” scales, we examine the loadings’ values of each item. Table 56 shows in fact a clearly defined factorial structure. Each item saturates a single factor with a coefficient of saturation above the threshold value 0.65, presenting very low saturation ratios in the other factors: all scale indicators significantly load on their respective latent variables. This indicates that the unidimensionality of each variable is verified: convergent validity is achieved.

For evidence of *discriminant validity*, both analyses the factor loadings and the inter-factor correlations are conducted. As we can see from Table 56, all the items primarily load on only one factor with a loading value significantly greater than the loading values in all the other factors. We have therefore calculated the mean value of all the items loading in the same factor in order to obtain a single value for each factor. These values have been used to calculate the correlation coefficients between the two latent constructs “Exploration competence” and “Exploitation competence” (Table 57). Table 57, which summarizes Pearson’s Correlation Coefficient among the factors, provides evidence of discriminant validity: correlations for all possible pairs of latent constructs are in fact above the recommended level of 0.65 (Tabachnick and Fidell, 1996). Given that no inter-factor correlation is above the recommended level of 0.65, problems created by a lack of discriminant validity are not likely to bias our data.

	<i>Exploration competence</i>	<i>Exploitation competence</i>
<i>Exploration competence</i>	1	0.549**
<i>Exploitation competence</i>	0.549**	1

**Table 57 - Correlations between Exploration and Exploitation competences** <sup>14</sup>

In order to establish *unidimensionality* we assess the overall model fit with AMOS. Multiple fit indexes are calculated. Table 58 summarizes the recommended ranges for some of the main fit indexes and the value assumed of such indexes with our data. In particular, the RMSEA value for the two-factor solution indicated an excellent fit to the data. RMSEA value and the values of all the indexes indicate that this solution is statistically valid as it meets all the requirements.

<i>Indexes</i>	<i>Values</i>	<i>Recommended values for GOOD FIT</i>	<i>Recommended values for VERY GOOD FIT</i>
$\chi^2$	38.38	-	-
df	19	-	-
RMSEA	0.08	< .08	< 0.05
NFI	0.91	> 0.8	> 0.9
N-NFI or TLI	0.93	> 0.8	> 0.9
CFI	0.9	> 0.8	> 0.9
IFI	0.95	> 0.8	> 0.9
$\chi^2/df$	2.02	>1 and <5	>1 and <3

**Table 58 – Fit indices values**

Finally, *reliability* is tested using the internal consistency method that is estimated using Cronbach’s alpha (Cronbach, 1951; Nunnally, 1978; Hull and Nie, 1981). Cronbach’s alpha values of the two factors are well above the cut-off value: for the exploration competence measure is 0.8228, and 0.7610 for exploitation competence (Tables 59 and 60). These results support good psychometric properties for the constructs.

<sup>14</sup> Pearson’s correlation coefficient, Eta and Phi statistics were used (\* p < 0.05; \*\* p < 0.01)

	<i>Mean</i>	<i>Standard Deviation</i>	<i>1° item</i>	<i>2° item</i>	<i>3° item</i>	<i>4° item</i>
<i>1° item</i>	3.0595	1.07939	1	0.573	0.394	0.487
<i>2° item</i>	3.3333	0.92272	0.573	1	0.554	0.584
<i>3° item</i>	2,7500	0.94263	0.394	0.554	1	0.673
<i>4° item</i>	2,8690	0.95413	0.487	0.584	0.673	1

Cronbach's Alpha = 0.823  
Cronbach's Alpha Based on Standardized Items = 0.827

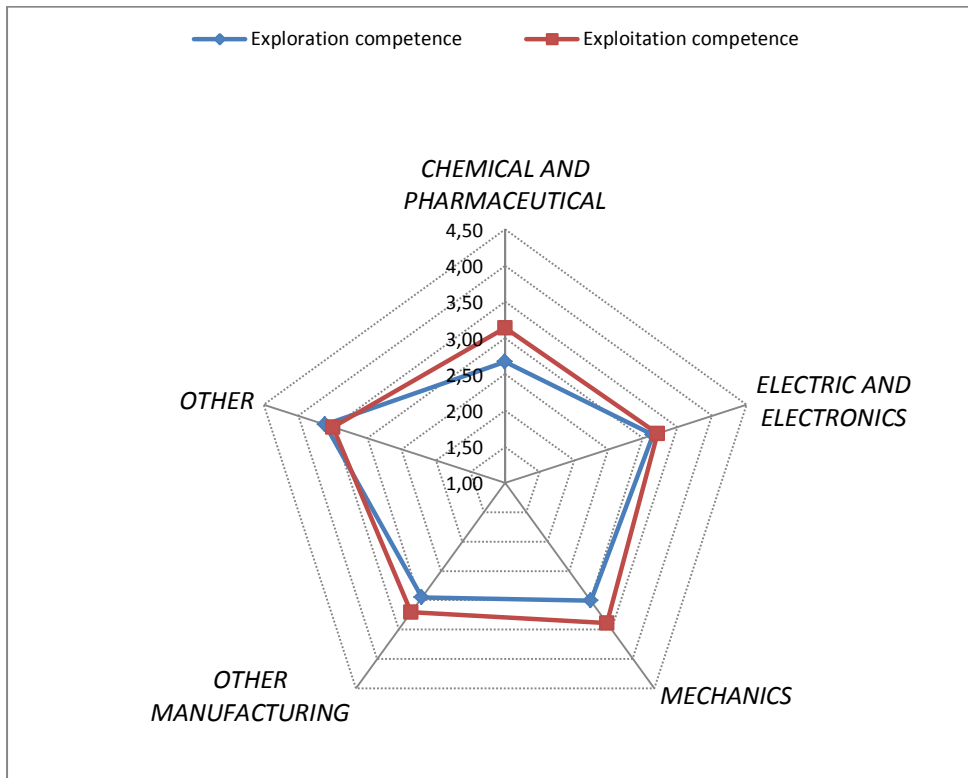
**Table 59** – Items statistics, inter-items correlations and reliability test for “Exploration Competence”

	<i>Mean</i>	<i>Standard Deviation</i>	<i>1° item</i>	<i>2° item</i>	<i>3° item</i>	<i>4° item</i>
<i>1° item</i>	3.2024	0.96667	1	0.284	0.459	0.495
<i>2° item</i>	3.4048	0.83765	0.284	1	0.539	0.453
<i>3° item</i>	3.3810	0.77467	0.459	0.539	1	0.476
<i>4° item</i>	3,1190	0.85595	0.495	0.453	0.476	1

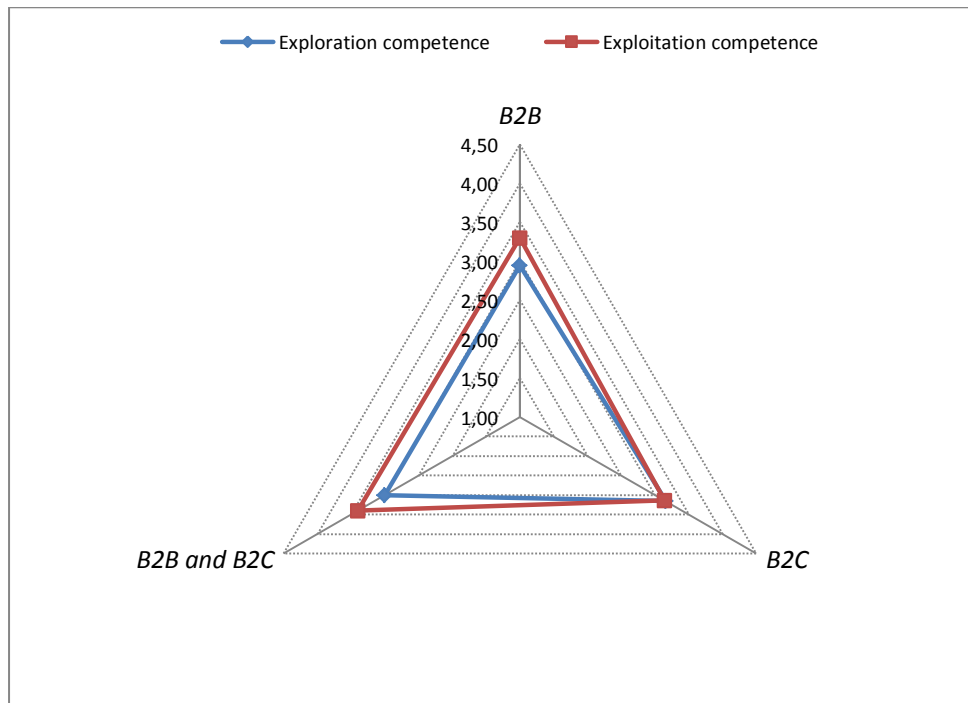
Cronbach's Alpha = 0.761  
Cronbach's Alpha Based on Standardized Items = 0.767

**Table 60** – Items statistics, inter-items correlations and reliability test for “Exploitation Competence”

For each firm we have then computed the average value of the items grouped together in the same factor. Firms pertaining to different industries or adopting different business approaches are then confronted on the basis of the values assumed by “exploration competence” and “exploitation competence” dimensions. Figures 21 and 22 show how “exploration competence” and “exploitation competence” change in values across the different sectors and different business approaches adopted by the firms. What might be noticed is that “exploitation competence” generally has higher values within all sectors and within the groups of firms that differ for the business approach adopted.



**Figure 21** - “Exploration competence” and “Exploitation competence” dimensions mean value by industry



**Figure 22** - “Exploration competence” and “Exploitation competence” dimensions mean value by business approach

#### 5.3.2.1.2 Ambidexterity measure

Following prior studies that consider “exploration competence” and “exploitation competence” as orthogonal (Gibson and Birkinshaw, 2004; He and Wong, 2004), to develop a measure for ambidexterity capability in the search phase, we compute the multiplicative interaction between “exploration competence” and “exploitation competence” as indicated in paragraph (for more information on this topic, please refer to paragraph 4.2.2.2).

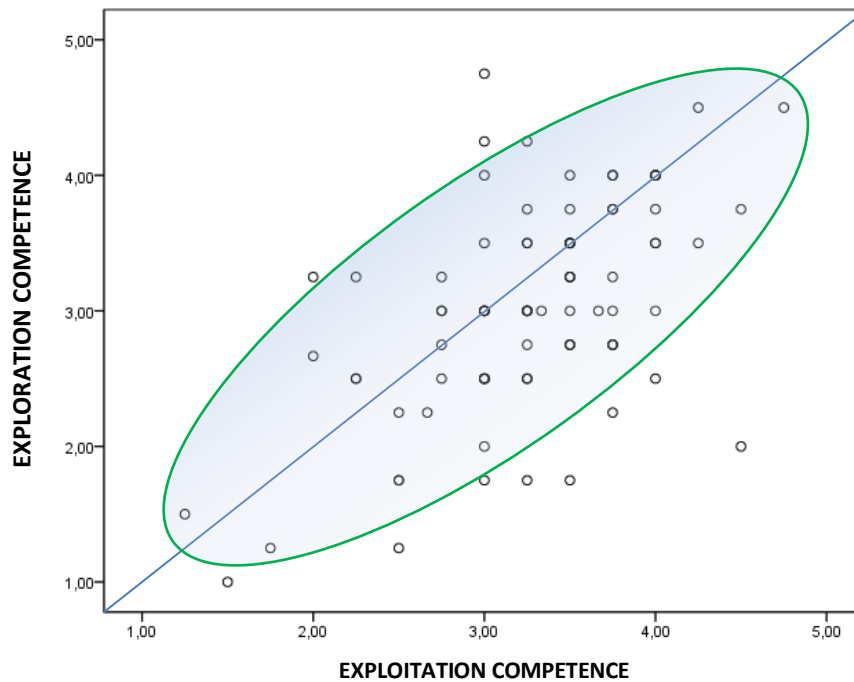
The computation of the multiplicative interaction reflects the orthogonality between the two variables (Gibson and Birkinshaw, 2004; Gupta, Smith and Shalley, 2006).

### 5.4 Clusters identifications and comparison

The analysis previously described allowed us to identify and describe the underlining dimensions of searching activities. Now, in order to answer the first research question, *“does it exist any difference among the firms that present different level of ambidexterity in the early phase of the innovation process in terms of practices put in place by firms when searching for local and distant ideas?”*, we cluster the firms on the basis of their ambidexterity capability in the search phase and perform the Mann Whitney U-Test on the search dimensions identified.

In order to identify firms that have developed ambidexterity capability in the search phase, “Exploitation competence” and “Exploration competence” constructs are used as taxons in a hierarchical cluster analysis (Miller and Roth, 1994; Bendoly et al., 2007).

By looking at the scatterplots chart in Figure 23 it is possible to notice that almost all the firms are located on the main diagonal of the quadrant identified by “exploration competence” and “exploitation competence” axis. Building on this consideration and on the limited number of firms in our sample (88 firms) the clustering algorithm is constrained to a 2-clusters solution.



**Figure 23** – Firms distribution according to “exploration competence” and “exploitation competence”

Hierarchical cluster analysis is therefore conducted – based on “exploration competence” and “exploitation competence” factors – to assign the 88 firms into two relatively heterogeneous clusters. The clusters identified are made up by 54 firms (61%) – Cluster 1 - and 34 firms (39%) - Cluster 2. To further ensure the validity of our clusters, following Miller and Roth (1994), we use discriminant analyses by calculating the percentage of observations correctly classified among the two clusters. Our analysis indicated a 98,9% success classification rate (see Table 61), which further validates our 2-cluster solution (Hair et al., 1998).

	<i>Actual classification</i> <i>Predicted classification</i>	<i>Cluster I</i>	<i>Cluster II</i>	<i>Total cluster</i>
<i>Original</i>	Cluster I	53 (98.1%)	1 (1.9%)	54 (100%)
	Cluster II	0 (0%)	34 (100%)	34 (100%)
<i>Cross-validated</i>	Cluster I	51 (94,4%)	3 (5,6%)	54 (100%)
	Cluster II	0 (0%)	34 (100%)	34 (100%)

**Table 61** - Percent of cluster classifications correctly classified and cross-validation<sup>15</sup>.

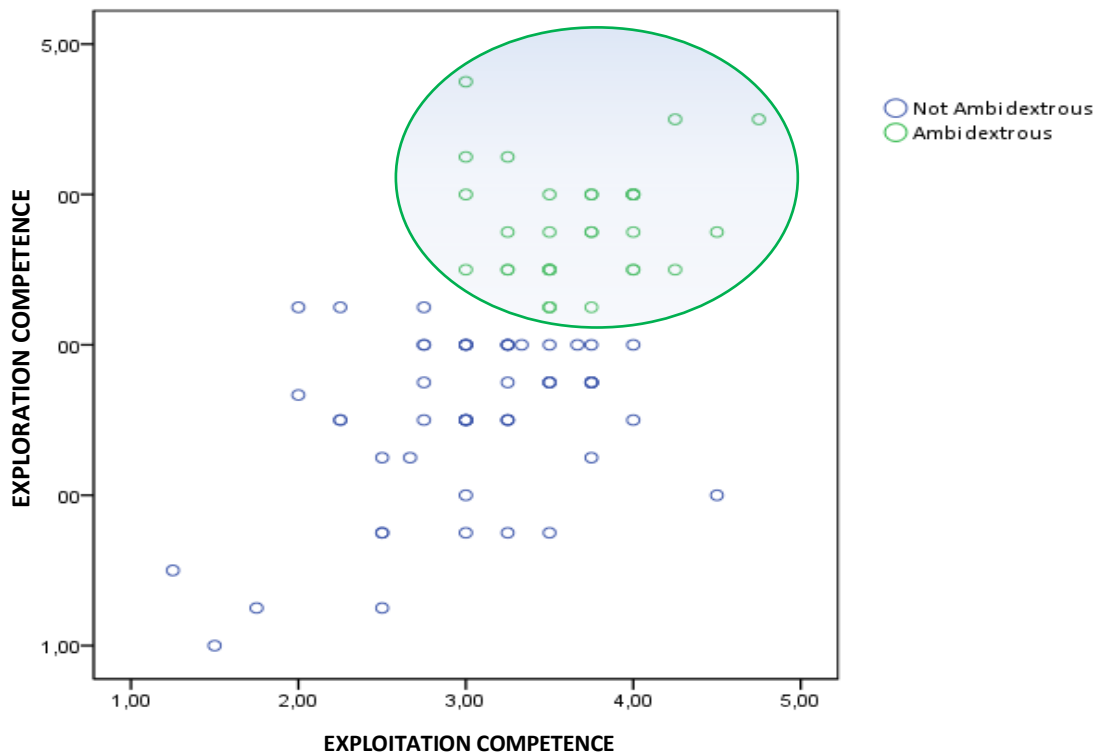
<sup>15</sup> The numbers in parenthesis are the percentages of correctly classified “hits” as predicted by the discriminant analysis to the number of actual observations from the cluster analysis (or cluster totals)

The firms falling into the Cluster 1 show low or medium levels of exploration and exploitation competences and ambidexterity while the firms that fall into Cluster 2 present significantly (p-values < 0.001) higher mean scores on exploration and exploitation competences and ambidexterity (Table 62 and Figure 24).

Cluster 2 hence contains firms that have developed ambidexterity capability in the search phase of innovation process.

	<i>Cluster I (N=54)</i>	<i>Cluster II (N=34)</i>	<i>Mann Whitney U- test</i>	<i>Wilcoxon W</i>	<i>Z</i>	<i>Asymp. Sig. (2-tailed)</i>
<i>Competence Exploration</i>	2.5309	3.7721	6.000	1491.000	-7.864	0.000
<i>Competence Exploitation</i>	3.0262	3.6618	375.500	1860.500	-4.688	0.000
<i>Ambidexterity</i>	7.7874	13.8327	9.000	1494.000	-7.795	0.000

**Table 62** - Cluster analysis results: comparison of competence exploration, competence exploitation and ambidexterity means by cluster.



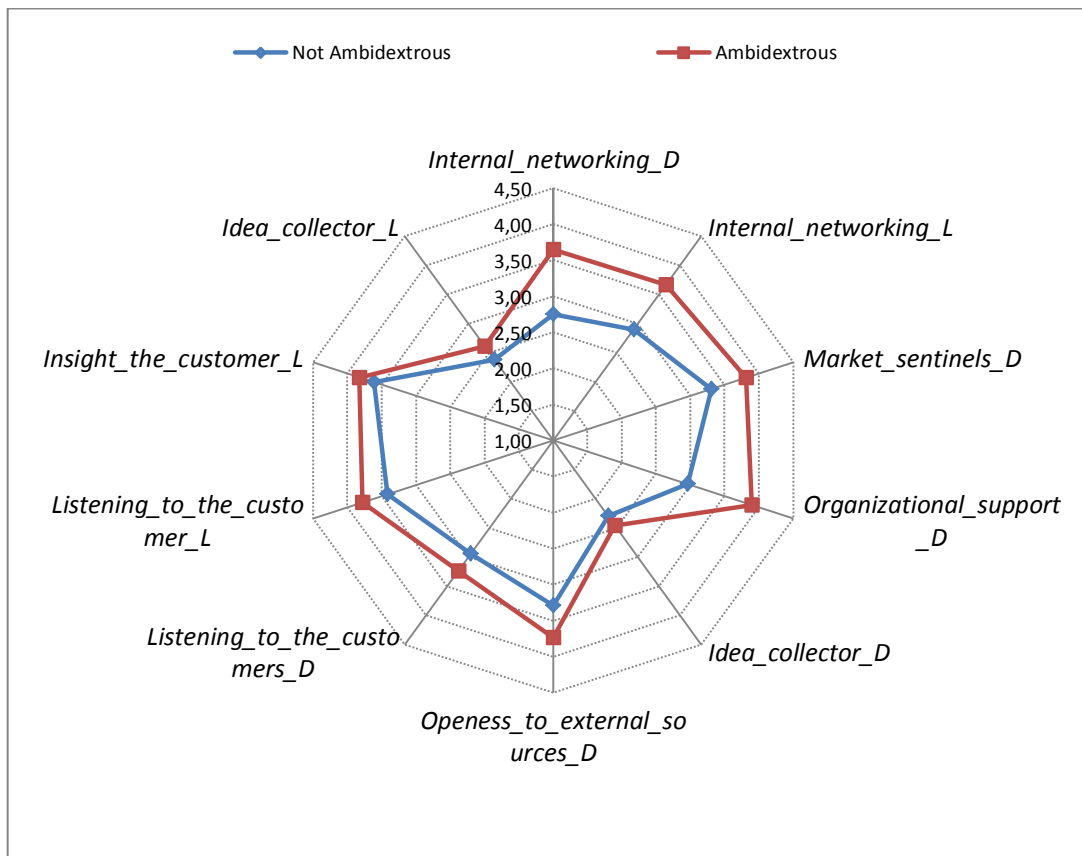
**Figure 24** - Cluster analysis results

We now investigate the variation among the two clusters, concerning the search dimensions previously identified with exploratory factor analysis. The results in Table 63 show that the ambidextrous group (cluster 2) exhibits the highest mean value for all the search dimensions (both distant and local search dimensions). This result is immediately evident when looking at the radar represented in Figure 25, whose rays correspond with the ten search dimensions identified with the exploratory factor analyses.

	<i>Groups</i>	<i>N</i>	<i>Mean</i>	<i>Std. Deviation</i>
<i>Internal networking (D)</i>	1	54	2.7500	0.88088
	2	34	<b>3.6471</b>	0.71805
	Total	88	3.0966	0.92804
<i>Market sentinels (D)</i>	1	54	3.3056	1.03097
	2	34	<b>3.8162</b>	0.81721
	Total	88	3.5028	0.98151
<i>Organizational support (D)</i>	1	54	2.9630	0.96189
	2	34	<b>3.9020</b>	0.50272
	Total	88	3.3258	0.93325
<i>Idea collector (D)</i>	1	54	2.2963	1.01698
	2	34	<b>2.4608</b>	0.84093
	Total	88	2.3598	0.95120
<i>Openness to external sources (D)</i>	1	54	3.2870	0.86658
	2	34	<b>3.7353</b>	0.66555
	Total	88	3.4602	0.82078
<i>Listening at the customer (D)</i>	1	54	2.9444	0.89372
	2	34	<b>3.2353</b>	0.88107
	Total	88	3.0568	0.89517
<i>Internal networking (L)</i>	1	54	2.9012	0.97909
	2	34	<b>3.6667</b>	0.72008
	Total	88	3.1970	0.95977
<i>Listening to the customer (L)</i>	1	54	3.4167	0.79355
	2	34	<b>3.7794</b>	0.96288

	Total	88	3.5568	0.87570
<b>Insight into the customer (L)</b>	1	54	3.6111	0.83365
	2	34	<b>3.8235</b>	0.90355
	Total	88	3.6932	0.86247
<b>Idea collector (L)</b>	1	54	2.3796	1.05926
	2	34	<b>2.6176</b>	1.01548
	Total	88	2.4716	1.04320

**Table 63** - Descriptive statistics



**Figure 25** – Differences among search dimensions between ambidextrous and non-ambidextrous firms in the search phase.

To verify if these differences between firms that present ambidexterity capability and firms that do not present this capability are statistically significant, the Wilcoxon-Mann-Whitney U-test is carried out on the data.

This technique involves testing a null hypothesis ( $H_0$ ) against an alternative hypothesis ( $H_1$ ). The null hypothesis can be described as "the boring case" - i.e. nothing has changed:

$H_0$ : *There is no difference in the search dimensions between firms that present ambidexterity and firms that do not present such a capability.*

The alternative hypothesis is effectively saying the opposite of the null hypothesis - for example, for the last case above the alternative hypothesis would be:

$H_1$ : *There is a difference in the search dimensions between firms that present ambidexterity and firms that do not present such a capability.*

It is a good praxis assuming that the null hypothesis is true, and only change mind if the data obtained in the investigation provides strong enough evidence. The role of the statistical test is in fact to give an objective definition of what constitutes sufficient evidence to reject  $H_0$ .

Table 64 presents the actual significance value of the test. Specifically, the Mann-Whitney procedure calculates a value of a statistic called U. This is done by first putting all the scores together (but keeping note of their group identities) and ordering them. Then U equals the sum of the numbers of scores from the experimental group that are less than each of the control group scores (or the other way round, whichever gives the smaller value of U). The "Test Statistics" Table additionally provides value as well as the asymptotic significance (2-tailed) p-value.

From this data, at the  $\alpha = 0.05$  level of significance, there is enough evidence to conclude that there is a statistically significant difference between firms that present ambidexterity capability and firms that do not present ambidexterity capability concerning the following dimensions of search: "Internal networking (D)" (U = 426, p = 0.000), "Market sentinels (D)" (U = 635, p = 0.015), "Organizational support (D)" (U = 380, p = 0.000), "Openness to external sources (D)" (U = 658.5, p = 0.023), "Internal networking (L)" (U = 526.5, p = 0.001) and "Listening to the customers (L)" (U = 689, p = 0.045). It can be further concluded that the ambidextrous firms are characterized by statistically significant higher values of these search dimensions than the non-ambidextrous firms.

<i>Null Hypothesis</i>	<i>Mann-Whitney U test</i>	<i>Wilcoxon W</i>	<i>Z</i>	<i>Asymp. Sig. (2-tailed)</i>	<i>Decision</i>
The distribution of <b>Internal networking (D)</b> is the same across the two clusters	426.000	1911.000	-4.234	0.000	<b>Reject</b> the null hypothesis
The distribution of <b>Market sentinels (D)</b> is the same across the two clusters	635.000	2120.000	-2.437	0.015	<b>Reject</b> the null hypothesis
The distribution of <b>Organizational support (D)</b> is the same across the two clusters	380.000	1865.000	-4.649	0.000	<b>Reject</b> the null hypothesis
The distribution of <b>Idea collector (D)</b> is the same across the two clusters	781.500	2266.500	-1.178	0.239	<b>Retain</b> the null hypothesis

The distribution of <b>Openness to external sources (D)</b> is the same across the two clusters	658.500	2143.500	-2.268	0.023	<b>Reject</b> the null hypothesis
The distribution of <b>Listening to the customer (D)</b> is the same across the two clusters	744.500	2229.500	-1.510	0.131	<b>Retain</b> the null hypothesis
The distribution of <b>Internal networking (L)</b> is the same across the two clusters	526.500	2011.500	-3.380	0.001	<b>Reject</b> the null hypothesis
The distribution of <b>Listening to the customer (L)</b> is the same across the two clusters	689.000	2174.000	-2.002	0.045	<b>Reject</b> the null hypothesis
The distribution of <b>Insight into the customer (L)</b> is the same across the two clusters	759.500	2244.500	-1.485	0.138	<b>Retain</b> the null hypothesis
The distribution of <b>Idea collector (L)</b> is the same across the two clusters	788.000	2273.000	-1.128	0.259	<b>Retain</b> the null hypothesis

**Table 64 - Mann Whitney U-test output.**

## 5.5 Discussion

The aim of this preliminary research is to explore the association between practices put in place by firms in order to generate local and distant knowledge and ambidexterity capability. The objective is in fact to assess if any difference exists between firms that have ambidexterity capability and firms that do not present such a capability in the search phase, when taking into consideration a number of practices for conducting the search of knowledge and ideas. To this end, a survey has been designed with the purpose of collecting data about the use, by high and medium technology firms, of a number of search practices. The questionnaire additionally investigates the presence (or not) of ambidexterity capability within the sample firms.

To better evaluate the content and value of search practices, two exploratory factor analyses have been conducted on the data to determine the latent variables that underlie the questionnaire: a total of ten meaningful factors, six for distant search and four for local search have been extracted: the factors have been empirically evaluated for validity, unidimensionality and reliability. These factors measure the different dimensions through which search activities, for local and distant search, can be carried out.

Analysis of the results regarding the usage of the practices dimensions shows the most frequently used search dimensions are “listening to the customer”, “insight into the customer”, “internal networking” “market sentinel”, “openness to external sources” and “organizational support”. These dimensions can also be retrieved in existing literature on search and are widely recognized as fostering both local and distant knowledge generation, as depicted in Chapter 4. On the other hand, the lowest values of use are recorded for the

“idea collector” dimension. The “Idea collector” dimension groups together practices aimed at connecting people through the use of social-media tools (wikis, blogging, internal community platforms, etc.) which allow collaboration, sharing and organizing knowledge. In other words, this dimension calls to mind the concepts of Web 2.0 and Enterprise 2.0 (McAfee, 2006). As McAfee (2006) notices, even if these technologies convey big opportunities, they also bring with them several barriers to adoption, such as resistance to change, difficulties in integrating with existing technologies, security concerns, lack of support by senior management and compliance, which have slowed their extensive use by firms.

Although this is at an embryonic stage, the bundles of practices identified with the exploratory factor analysis allow us to assess the differences between ambidextrous and non-ambidextrous firms within the search phase. Our results support the idea that firms that have developed ambidexterity capability in the search phase have higher values in all the search dimensions. Six out of the ten dimensions in particular show a statistically significant difference between the two clusters. These dimensions are: “Internal networking”, “Openness to external sources”, “Organizational support”, “Market sentinels” and “Listening to the customer (L)”. No statistically significant differences have however been found for “Idea collector”, “Listening to the customer (D)” and “Insight into the customer” dimensions.

According to the Mann Whitney U test results, the ambidextrous firms are characterized by greater internal connections between employees pertaining to different functions: inter-functional integration and bringing together people from different knowledge sets, backgrounds or functions are in fact widely used practices. Such practices, which are useful both for the generation of local and distant knowledge, involve the sharing of information among members, collaborative decision making, and agreement focusing all employees’ activities on common goals. Unsurprisingly ambidextrous firms are characterized by a higher value of the “internal networking” dimension. Having an internal network allows the organization to better overcome conflicts, disagreements and incoordination by creating a common set of values and shared meanings that provide a common identity, even if employees are called to perform different and opposite tasks and even if they pursue different business strategies. This is in line with the works of Westerman, Iansiti, and McFarlan (2005), Govindarajan and Trimble (2005) and Siggelkow and Rivkin (2006) that sustain that in order to capture the benefits of local and distant search, the organization should provide the targeted integration necessary to leverage both activities and capture the benefits of both by fostering a better understanding of organizational values and objectives through an improved transmission of knowledge and experience (Meyer, Paunonen, Gellatly, Goffin and Jackson, 1989; Allen, Meyer, 1990; Ashforth and Saks, 1996).

Firms that have developed ambidexterity capability in the search phase additionally appear to have built an open environment by creating not only strong connections between employees, but also with external actors for the purpose of continuously looking outside their normal knowledge zones and keeping up-to-date regarding developments in their particular field of expertise. According to Chesbrough (2003), external networking is one of the big management challenges of the 21st Century. Within the ambidextrous cluster the different functions are in fact strongly encouraged to collect ideas and opinions from outside sources in a systematic way and to build intensely on interorganizational knowledge transactions to extend their internal knowledge bases. Organizational boundaries are porous

and firms strongly interact with different actors in their environment (universities, research labs, customers, exhibitions, venture capital firms, etc.) in the search for interesting ideas and knowledge. Our result is in line with the results of Herzog and Leker (2010) who stress the importance of openness to external sources for building ambidexterity for the reason that adopting an open perspective fosters the generation of distant knowledge thus ensuring a high level of exploration (Herzog and Leker, 2010).

According to Smith and Tushman (2005), realizing ambidexterity brings with it a further set of challenges for senior managers who have to clearly communicate the importance of engaging in the experimentation of the new and not previously experienced, to provide support to employees with new ideas by encouraging them to put such ideas forward. In the absence of an explicit strategy that justifies this experimentation, the default option is to focus on short-term profitability, usually by eliminating variance and costs. Our result is perfectly in line with these considerations: ambidextrous firms in fact show significantly higher values for “organizational support” than non-ambidextrous firms. Ambidextrous firms have managers who succeed in creating a culture of innovation characterized by high autonomy, risk-taking and tolerance of mistakes. A culture that promotes innovation is one that allows the most creative employees to manifest their creativity (Amabile, 1996; Holly and Gyskiewicz, 1993; Oldham and Cummings, 1996; Levitt, 2002).

As regards the “market sentinel” dimension, ambidextrous firms invest more deeply in specialized search functions in order to have a dedicated group of people whose role is to search actively for new ideas and knowledge to trigger the innovation process. They could be searching for technological triggers, emerging markets or trends, or competitor behaviour. They are officially charged with searching out new ideas that will take the business into new strategic directions. Clearly, focusing actions helps to maximize the different benefits of contrasting poles, maintaining multiple competencies within the organization (Gilbert, 2005; Fiol, 1995; Scarbrough, Swan, Laurent, Bresnen, Edelman and Newell, 2004), for the reason that it allows complex activities to split up into small, more elementary tasks. In fact specialized people clearly know what their jobs are and how they should do their work. This is in accordance with the organizational literature that analyzes the differentiation process in depth, highlighting its benefits for organizations (Lawrence and Lorsh, 1967).

Finally, ambidextrous firms appear to be engaged in closer relationships with their customers. The exploratory factor analyses have underlined three factors that describe how firms can interface with customers. These factors are “listening to the customer” in order to generate local and distant knowledge and “insight into the customer”. These dimensions are quite different: while the first two factors (“listening to the customer (D)” and “listening to the customer” (L)) view customers as active players in the innovation process whose ideas can on the one hand provide the starting point for new directions and help create new markets, products and services and on the other suggest improvements in the existing offer, while the “insight into the customer” dimension refers to a deep observation of the everyday life of real people, capturing the experiences of people as and when they occur in order to gain a deeper understanding of how existing products and services are actually used. The results of the Mann-Whitney U Test support the hypothesis that a statistically significant difference exists only for the dimension “listening to the customer” aimed at generating local knowledge, while no statistically significant differences exists between ambidextrous and non-ambidextrous firms when considering the “listening to the customer”

dimension, aimed at generating distant knowledge, and the “insight into the customer” dimension. At first we were surprised by these results. However, we have to consider that our sample is made up of B2B, B2C and simultaneously B2B and B2C firms. It could therefore be interesting to split the sample according to the business approach used and to compare ambidextrous and non-ambidextrous firms within each subgroup. Table 65 that follows shows the mean values of the different dimensions for ambidextrous and non-ambidextrous firms within the three groups. It is interesting to notice that, while B2B firms present similar values for ambidextrous and non-ambidextrous firms, for B2C firms and firms that adopt both B2B and B2C approaches, the difference between ambidextrous and non-ambidextrous firms is much more pronounced.

	B2B		B2C		B2B and B2C	
	Not Ambidextrous	Ambidextrous	Not Ambidextrous	Ambidextrous	Not Ambidextrous	Ambidextrous
Listening to the customer (D)	3.01	3.05	3.08	3.95	2.36	3.00
Listening to the customer (L)	3.44	3.50	3.46	4.40	3.21	3.58
Insight into the customer (L)	3.62	3.63	3.85	4.20	3.14	3.83

**Table 65 - Mean values of the different dimensions for ambidextrous and non-ambidextrous firms within B2B, B2C and both B2B and B2C groups**

We have therefore conducted a Mann-Whitney U test within each group. The results of this test are presented in Tables 66, 67 and 68. The data clearly indicate that significant differences between ambidextrous and not-ambidextrous firms affect only the group of companies adopting a business to customer (B2C) approach. Ambidextrous B2C firms view customers as active players in the innovation process and not just as passive consumers, whose contribution is considered to be extremely important not only in providing the starting point for new business directions (i.e. to generate distant knowledge) but also in improving the existing offer (i.e. to generate local knowledge). Through these techniques, ambidextrous firms succeed in getting closer to what people need and want within the context they operate in.

<i>Null Hypothesis</i>	<i>Mann-Whitney U test</i>	<i>Wilcoxon W</i>	<i>Z</i>	<i>Asymp. Sig. (2-tailed)</i>	<i>Decision</i>
The distribution of <b>Listening to the customer (D)</b> is the same across the two clusters	279.000	450.000	-0.528	0.597	<b>Retain</b> the null hypothesis
The distribution of <b>Listening to the customer (L)</b> is the same across the two clusters	282.500	877.500	-0.460	0.646	<b>Retain</b> the null hypothesis
The distribution of <b>Insight into the customer (L)</b> is the same across the two clusters	290.500	885.500	-0.320	0.749	<b>Retain</b> the null hypothesis

**Table 66 – Test statistics for B2B group**

<i>Null Hypothesis</i>	<i>Mann-Whitney U test</i>	<i>Wilcoxon W</i>	<i>Z</i>	<i>Asymp. Sig. (2-tailed)</i>	<i>Decision</i>
The distribution of <b>Listening to the customer (D)</b> is the same across the two clusters	23.000	114.000	-2.667	0.008**	<b>Reject</b> the null hypothesis
The distribution of <b>Listening to the customer (L)</b> is the same across the two clusters	19.000	110.000	-2.931	0.003**	<b>Reject</b> the null hypothesis
The distribution of <b>Insight into the customer (L)</b> is the same across the two clusters	51.000	142.000	-0.994	0.410	<b>Retain</b> the null hypothesis

**Table 67 – Test statistics for B2C group**

<i>Null Hypothesis</i>	<i>Mann-Whitney U test</i>	<i>Wilcoxon W</i>	<i>Z</i>	<i>Asymp. Sig. (2-tailed)</i>	<i>Decision</i>
The distribution of <b>Listening to the customer (D)</b> is the same across the two clusters	10.500	38.500	-1.534	0.125	<b>Retain</b> the null hypothesis
The distribution of <b>Listening to the customer (L)</b> is the same across the two clusters	16.500	44.500	-0.671	0.502	<b>Retain</b> the null hypothesis
The distribution of <b>Insight into the customer (L)</b> is the same across the two clusters	12.000	40.000	-1.493	0.135	<b>Retain</b> the null hypothesis

**Table 68 – Test statistics for B2B and B2C group**

## 5.6 From a black-box towards unpacking practices

With the survey we have explored the search practices by treating them as a black box. Considering practices as a whole is a valuable and suitable approximation when the research question concerns a comparison: comparing, for example, ambidextrous and non-ambidextrous firms. Answering the first research question does not require unpacking the internal structure of practices: treating them as a black-box is in fact sufficient for the generation of useful information.

However, the black-box perspective does not allow us to answer the second and third research questions, for the reason that it leads to a too narrow understanding of practices. Indeed the internal structure of practices appears more complex and flexible than it does when viewed as black-box. Therefore, we consider that going inside practices, unpacking them and analyzing their internal structure allows us to understand more about how practices relate to fundamental organizational questions such as: how do organizations realize ambidexterity capability within the search phase and how does such capability change over time?

## 6 CASE STUDIES RESULTS - From practices towards ambidexterity, opening the black box.

In this chapter the objective is to answer the second and third research questions:

*“How can firms succeed in realizing ambidexterity capability in the search phase?”*

and

*“How does the achievement of ambidexterity capability change while co-evolving with the external environment?”*

The chapter thus presents the analysis of a firm that has succeeded in building and maintaining ambidexterity capability in the search phase.

After quickly presenting the firm selected, the results of the longitudinal case study are presented by describing the search tensions and resolutions implemented by the firm across three historical stages. Discussions of the empirical evidence are therefore provided.

### 6.1 The firm selected: SAES Getters S.p.A.

The firm analyzed is a high-tech Italian company, located in Milan, named SAES Getters. SAES Getters is a publicly traded scientific and industrial applications company. The firm was established 63 years ago and has now grown to serve a global market with average revenues (in the 2004-2008 period) of 154.2 million Euros annually.

SAES specializes in the development of getter technology and operates in sectors including information displays and lighting, complex high-vacuum systems and vacuum thermal insulation, drawing on technologies ranging from large vacuum power tubes to miniaturized devices such as microelectronic and micromechanical systems. The firm also leads the market in ultra-pure gas purification systems for the semiconductor industry and other high-tech industries. More recently, SAES entered the medical sector through a variety of products based on shape-memory alloys and, in particular, on NiTiNOL. Table 69 synthesizes the main features of the company.

SAES customers number about 3000, spread all over the world, including companies of all sizes, universities and research institutions, active in many fields, from information display, automotive, aeronautics, telecommunications, medical industry, defence and security, home automation and transportation. The company also counts among its customers NASA and CERN in Geneva. For CERN SAES has developed a non-evaporable getter system 27 km long.

Concerning the high-energy machines, the firm's ultra-thin non-evaporable getter film called "Integra Torr" has been used to maintain extreme vacuum conditions in the synchrotron Soleil, located in Saint Aubin (south of Paris). The commercialization of "Integra Torr" is the result of a technology transfer from CERN, which first devised the technology and then assigned the licence for sales to SAES Getters. In the area of aerospace applications, the Italian group has developed for the NASA Goddard Space Flight Center pumps for holding vacuums in certain scientific instruments aboard the Huygens probe launched in 1997, and which landed on Titan in 2005, the Saturn satellite.

<b>YEAR FOUNDED</b>	1947
<b>SPECIALIZATION</b>	Getter technology, ultra-high purification of gases, pure metal dispensing, shape-memory alloys technology
<b>INDUSTRY</b>	Information displays and lighting, complex high-vacuum systems, vacuum thermal insulation, medical
<b>LOCATIONS</b>	China, Germany, Italy, Japan, Latvia, Republic of Korea, Russian Federation, Singapore, United States
<b>REVENUE</b>	128.8 EUR Million
<b>HEADQUARTER</b>	Lainate (Milan)
<b>N° OF EMPLOYEES</b>	1021
<b>R&amp;D INVESTMENTS</b>	15.6 EUR Million (12.1% of the turnover)

**Table 69 - Overview of SAES Getters Group's main characteristics (data from 2009)**

The Group has a global presence thanks to its 14 manufacturing plants that span across three continents, bringing together multicultural skills and experiences, and a worldwide-based sales and service network that make SAES a global firm. Each manufacturing plant operates within different business areas as depicted in Table 70.

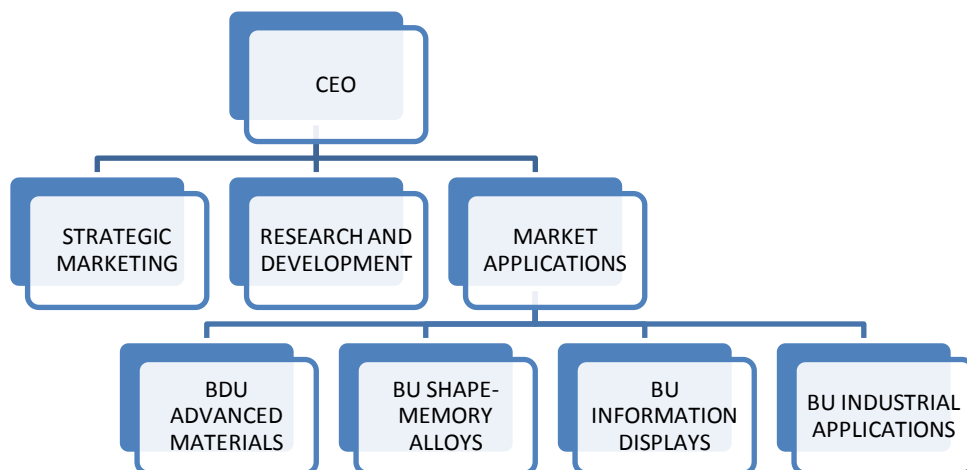
<b>MANUFACTURING PLANTS</b>	<b>LOCATION</b>	<b>PRODUCT TYPE</b>	<b>BUSINESS AREAS</b>
SAES Getters S.p.A.	Lainate (MI) - ITALY	Patterned Getter films, Pilot production of new products	Business Development Getters for MEMS
SAES Advanced Technologies S.p.A.	Avezzano (AQ) - ITALY	Getters (Evaporable, Non Evaporable, Pumps), Pure Metal Dispensers	Liquid Crystal Displays Lamps Electronic Devices Vacuum System and Thermal Insulation
SAES Opto S.r.l.	Lainate (MI) - ITALY	Crystals for lasers	Optoelectronic Mater.
SAES Getters USA, Inc	Colorado Springs (CO) - USA	Non Evaporable Getters	Electronic Devices Lamps Vacuum System and Thermal Insulation
SAES Getters America,	Independence	Vacuum insulated panels, Evaporable	Vacuum System and

Inc.	Cleveland (OH) -USA	Getters	Thermal Insulation Lamps
SAES Pure Gas, Inc.	San Luis Obispo (CA) - USA	Gas Purifiers	Semiconductor
Spectra-Mat, Inc.	Watsonville (CA) - USA	Laser Submount, Wafers for LED	Electronic Devices
SAES Smart Materials, Inc.	New York (NY) - USA	Nitinol wires, bars, sheets	SMA Medical SMA Industrial
Memry Corporation Eastern Operations	Bethel (CT) - USA	Stent graphs, nitinol wires, tube components	SMA Medical SMA Industrial
Memry Corporation Western Operations	Menlo Park - USA	Stent graphs, nitinol wires, tube components	SMA Medical SMA Industrial
Memry GmbH <sup>16</sup>	Weil am Rhein - GERMANY	Nitinol wires, sheets, tube components	SMA Medical SMA Industrial
SAES Getters Nanjing Co., Ltd.	Nanjing - P.R. of CHINA	Evaporable Getters	Cathode Ray Tubes
SAES Getters Korea Corporation	Seoul - South Korea Jincheon-kun - South Korea	Mercury Dispensers	Liquid Crystal Displays
SAES Huadong Vacuum Material Co. Ltd. <sup>17</sup>	Nanjing - P.R. of CHINA	Evaporable Getters Non Evaporable Getters Mercury Dispensers	Local BA Organization

**Table 70 – SAES Group structure**

The Group Headquarters is located in Lainate, near Milan, and it is here that the management, Corporate R&D laboratories, corporate functions, commercial, marketing and technical support functions are located (Figure 26).

The Group headquarters (SAES Getters S.p.A.) is the subject of our investigation.



**Figure 26 – Lainate organization for innovation**

<sup>16</sup> 60% controlled by SAES Getters S.p.A.

<sup>17</sup> Joint Venture, 51% owned by SAES Getters S.p.A.

In particular corporate R&D laboratories in Lainate cover an area of 3,300 square metres, where over 60 people are daily committed to investigating problems, developing proposals and testing solutions using highly advanced instrumentation and mathematical modelling. At present, R&D in Lainate is made up of three different areas: the “Application Labs”, the “Service Labs” and the “Materials Labs”.

The *Application Labs* are laboratories that develop prospective products and prototypes according to specific application needs, in close cooperation with customers, SAES business managers and SAES manufacturing sites. The Application Lab Manager should therefore be able to understand both the commercial and technological dimensions of the products and is in charge of developing and finely tuning the functional properties required.

The *Service Labs* are transverse laboratories that support other R&D laboratories, SAES manufacturing sites (e.g. managing quality issues), SAES BAs (Business Areas) and BDAs (Business Development Areas) (e.g. through benchmarking activities) and customers (e.g. through specific characterization, modelling and engineering activities). They group the knowledge required for the diverse applicative needs, and are committed to the chemical, physical and functional characterization of materials and products, modelling and simulation as well as technological and engineering problems.

The *Materials Labs* are responsible for the development of knowledge-intensive materials. There are three main laboratories within this group. The oldest laboratory deals with the development of metallic materials (alloys and metallic composite materials, for example). A second laboratory gathers multiple complementary knowledge on non-metallic materials (polymer-matrix nano-composite getters, for example). Finally, a third laboratory is dedicated to the development of metallic thin-films of different natures (room-temperature hydrogen getters, for example).

### 6.1.1 SAES Business description

---

Nowadays, the company operates its business through three Business Units, namely, Information Displays Business Unit, Industrial Applications Business Unit and Shape Memory Alloys Business Unit. It also operates one business development unit, Advanced Materials Business Unit.

In the *Information Displays Business Unit*, SAES develops and markets getters and other components used in cathode ray tubes and flat panel displays. For the flat panel business market, the company provides technologies for absorbing harmful gases and maintaining vacuums. The company’s products are used in Field Emission Displays, LCD screen backlighting devices and Organic Light Emitting Diode displays. The getters supplied by SAES are used in cathode ray tubes which find their application in televisions and monitors. In 2009, the Information Displays business Unit’s revenues accounted for 26.09% of the total revenues of the company.

Through the *Industrial Applications Business Unit*, SAES supplies getter and other products for lamps, vacuum systems, electronic devices and semiconductors. The company supplies

the lamp industry with getters and metal dispensers and mercury dispensers. For the electronics industry, the company provides advanced technological solutions. The company's solutions find their application in the medical, industrial, aeronautical, security and defence sectors. The products developed by SAES are used in infrared seeking devices, X-ray tubes, night vision devices, laser gyroscopes and solar collectors. For vacuum systems, the company provides non-evaporable getter materials for cryogenic applications, vacuum flasks, and vacuum insulating panels. For the semiconductor industry, the company provides gas purification systems. SAES, through its subsidiary SAES Pure Gas, offers purifiers for bulk gases, special gases and vacuum pumps. In 2009, the Industrial Applications Business Unit's revenues accounted for 47.03% of the company's total revenues.

The *Shape Memory Alloys Business Unit* of the company is engaged in providing shape memory alloy components, a family of advanced materials characterized by super elasticity and by the property of assuming predefined forms when subjected to heat treatment. The shape memory alloy components of the company find their applications mainly in the biomedical field and in niche industrial fields. In 2009, the Shape Memory Alloys Business Unit's revenues accounted for 26.61% of the total revenues of the company.

The *Advanced Material Business Development Unit* of the company is engaged in providing optical crystals which find applications in industrial lasers, electronic devices and scintillator markets. Thin film getter products for wafer-level packaged Micro Electro Mechanical and microelectronic systems are developed by the company. The company's inventions are covered worldwide by 35 granted patents and 28 pending applications regarding getters in MEMS. The patents have made it possible for the company to offer a technological package capable of fitting into STMicroelectronics' MEMS technology. In 2009 the Advanced Material Business Development Unit's revenues accounted for 0.27% of the company's total revenues.

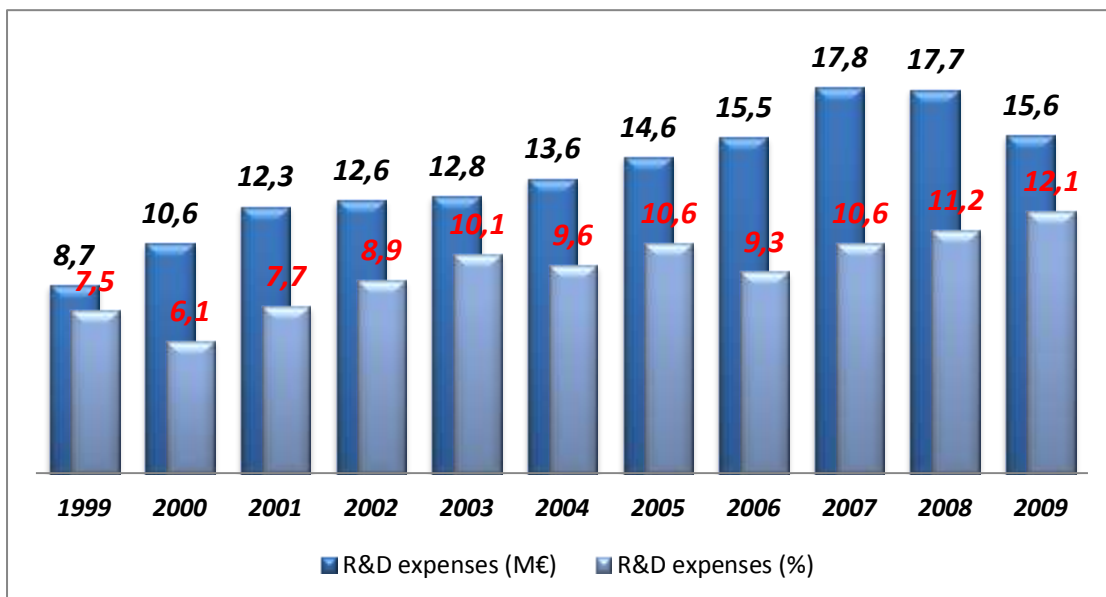
### **6.1.2 Some motivations for the selection of SAES Getters S.p.A.**

There are several reasons behind the company selection.

First, SAES belongs to a knowledge-intensive industry, where frequent technological downturns (such as the change from valves to transistors, from black and white TV to colour TV, from CRT (Cathode Ray Tube) to LCD (Liquid Crystal Display), from CCFL (Cold Cathode Fluorescent Lamps) to LED) coupled with intense competition, significantly compress product lifecycles. The industry is characterized by high dynamics, velocity and demand for continuous innovation and the company has shown, throughout its history, that it has considerable abilities to dynamically adapt and respond to the dynamics of such a complex environment: these abilities allow the firm to maintain a leadership position in the market. In seventy years, getter solutions have in fact sustained technological innovation in information displays (85% of televisions in the world run thanks to the technology developed at Lainate) and lighting, in high vacuum complex systems and vacuum-based thermal insulation, in technologies spanning from large vacuum power-tubes to miniaturized devices

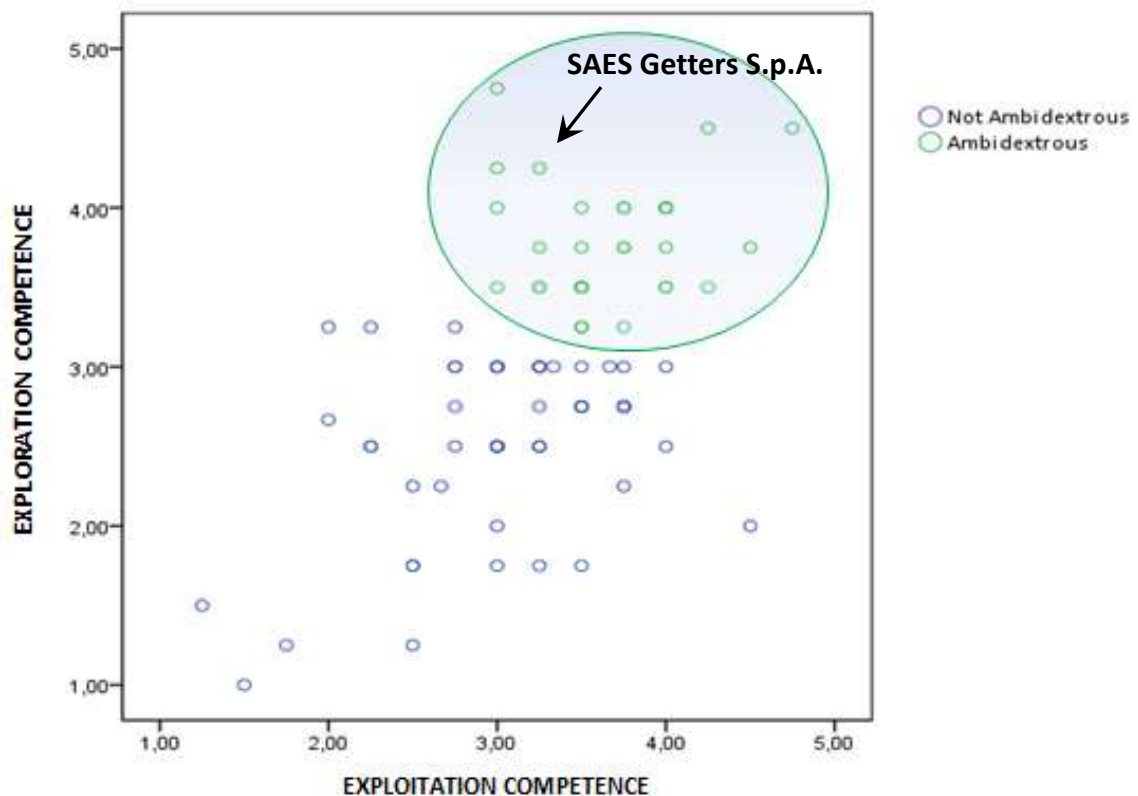
such as microelectronic and micromechanical systems made of silicon. The Group also holds a leadership position in the purification of ultra-pure gases for the semiconductor and other hi-tech industries. Since 2004, by leveraging the core competencies in special metallurgy and materials sciences, SAES has expanded its business into advanced materials markets, particularly the markets of optical crystals and shape memory alloys.

Second, innovation activities are a must for the company that can boast over 300 inventions in 70 years of activity. Research investment, which in SAES Getters is between 9% and 10% of turnover, is considered the distinctive cornerstone of the Group, the "engine" that over the years has enabled SAES to acquire a position of technological leadership and also to overcome difficulties, develop innovative technologies and open new lines of business. The research and innovation activity is very intense, as shown by the amount of the related expenditure shown in Figure 27. Expenditure has remained essentially unchanged as a percentage of net sales, bearing witness to the importance placed on research by the SAES Getters Group. Additionally, SAES has more than one hundred employees in R&D, including both those employees directly involved in research activities as well as employees involved in activities supporting innovation, including the protection of intellectual property, knowledge management, marketing, technology and coordination projects.



**Figure 27 - SAES group research and innovation expenses**

Finally, the case firm is a good example of how firms can succeed in resolving tension and building ambidexterity capability: SAES is in fact renowned for its excellence in both exploitation and exploration activities as shown in Figure 28. By analyzing SAES's answers to the Search questionnaire described in Chapter five, it is in fact possible to place the firm within the ambidextrous group.



**Figure 28** – SAES positioning in the exploration/exploitation space

## 6.2 Findings

By adopting a temporal bracketing approach, the history of the company can be divided into three stages characterized by different environmental configurations. Such phases present different levels of dynamism, complexity and competitive threats which are accompanied by changes in the strategic intent and objectives of the firm. The three stages identified are:

- (1) Stage 1, up until 1970
- (2) Stage 2, between 1971 and 2008
- (3) Stage 3, from 2008 onwards

The following sections will show how the firm adapts its searching practices and organizational design to meet the different environmental configurations, thus resolving the tensions in the search phase which have arisen as a consequence of the changing strategic intent.

To this purpose, the analysis is divided into three sections corresponding to the three successive phases. For each phase a description of the different tensions faced by the firm during the search phase when dealing with changing competitive environment is provided;

then how the firm resolved these tensions is explained, i.e. how it realized ambidexterity capability, by modelling organizational design and adapting search practices.

## 6.2.1 Stage 1 (up until 1970)

---

### 6.2.1.1 Competitive environment

---

The Company is founded in Florence in 1940 for the production of electrical and scientific apparatus and moves to Milan in 1943. In 1947 representatives of the Canale and della Porta families become majority shareholders in SAES Getters: they see the small company as an interesting investment opportunity. Soon, however, SAES is in dire straits owing to bad management of the scientific and technical aspects. At this point (December 1949) Paolo della Porta, a young engineer, makes his decisive entry into the company: his passion for research and technology becomes immediately apparent. In a small laboratory in the Milan office he begins to deal with the problem of producing enough reactive materials to absorb the waste gas discharged into systems, which could be manipulated in the air without significant deterioration (i.e. safe handling without significant deterioration). These stable materials, initially based on an alloy of barium and aluminium, are called evaporable getters. Evaporable getters are metal alloy based devices which exhibit a chemical affinity towards specific gases and, when introduced into an evacuated device, absorb the targeted gaseous molecules present, creating and maintaining an appropriate vacuum or a suitable gas composition. By heating the getter to a high enough temperature, barium vapour condenses onto the surface of the device and the resulting barium film acts as a sponge absorbing the remaining gas molecules, maintaining a suitable vacuum level without the need for an external pump to discharge the gases. Without a getter the vacuum would quickly degrade due to the remaining gas molecules released from the internal surfaces and other components of the device.

The invention of getters in the early 1950s launches SAES into the global market of thermo-ionic valves used for receiving tubes. Quite soon, evaporable getters will find another suitable application in Cathode Ray Tubes (CRTs) thus enabling the rapid development of TV sets. SAES quickly becomes the worldwide market leader in the production of getters for valves: a production of 1 billion getters per year was reached at the end of the 1950s. In this period, a key factor for the company's success is the creation of a very close connection with the scientific and academic world, which allows della Porta to start several theoretical and experimental studies focused on the principles of gettering. The small SAES lab is enriched with instruments specifically designed to study gas-surface interaction phenomena: the large amount of data obtained in this way becomes the basis for a number of future patents. This first phase of applied research is essential for SAES: in fact, besides allowing the company to

develop high quality production techniques that its competitors are lacking, it gives SAES significant prestige both with customers and the scientific community.

Thanks to this activity, SAES is starting to become market leader with a significant technological advantage over competitors that will soon make the difference. Moreover, this scientific activity drives SAES to deepen its competences concerning adjacent technologies, such as special metallurgy and vacuum technology. In this way, the growth of knowledge and capabilities enlarge the firm's core competences allowing development of getters which were not focused on one specific function or application, but engineered to meet the different needs of more general vacuum applications. From this first stage the company's orientation towards technology is well defined and it is embodied in the figure of the entrepreneur, Paolo della Porta.

*“I set myself the task of spending at least one hour per day in the laboratories to monitor the work of researchers, to nose around and to understand: this assignment allowed me to keep pace with the potential evolutions and development of products and also gratified the work of researchers who felt appreciated and esteemed for their efforts in the company” (Paolo della Porta’s biography)*

This attitude allows the company to survive, at the end of the 1950s, the first technological downturn it experienced during its long history: the advent of transistors, which, in a few years, totally substituted thermionic valves. At this time SAES was already able to develop larger barium getters, able to cope with the greater amount of gas released inside CRTs.

In the 1960s, the technological development carried out in the laboratory allows SAES to extend the concept of getters, creating non-evaporable getters (Table 71): these have been developed for devices in which condensation of a barium film for gettering through the heating of an evaporable getter is not possible. Non-evaporable getters are thus adequate for applications in lamps for street lighting and other high efficiency industrial lighting, in evacuated electron tubes and in vacuum insulation devices such as vacuum bottles and dewars. Moreover, in the 1960s there is a second technological downturn with the advent of colour television sets, characterized by much more stringent requirements in terms of gas absorption. Black and white getters could ensure only a few dozen hours of life, but the robustness of the getter technological platform developed by SAES is already so strong that in a few months a new family of larger barium getters (suitable for colour CRTs) is set-up.

MAIN PRODUCTS IN THE FIRST STAGE	MAIN APPLICATIONS	PRINCIPAL CUSTOMERS
Evaporable Ba getters	Thermionic valves, CRTs	Philips, Sony, Matsushita, Toshiba, Hitachi, USA manufacturers
Non evaporable getters	Electronic tubes, lamps, vacuum tubes	Osram, GE, Sylvania, several more

**Table 71 – SAES’s offer during the first stage**

The company's considerable efforts made in refining and developing the getter technology on the one hand ensures its ability to respond to customer requests with high quality products, and on the other, to build, using advanced technologies which are difficult to imitate and usually protected by patents, strong barriers to competition.

In the initial stage, the competitive threats in this field are quite limited: as an example, the Group has only a few major competitors for evaporable getters used in Cathode Ray Tubes. Moreover, some important SAES customers (e.g. Philips), which produce getters for their CRTs, agree to delegate this production to SAES, thus freeing themselves from all the responsibility for quality control and incremental development. SAES therefore has an established position that enables it to develop absolute sustainable competitive advantages and generate high profit potential. In fact the firm acts under quasi-monopoly conditions, which are also ensured by a significant technological advantage. During the 1960s and 1970s another element of great importance in the company's growth is the expansion of the overseas sales network that ensures its presence in major industrialized countries: SAES establishes sales subsidiaries in Europe and the United States. Stage 1 is also characterized by low levels of dynamism: customers' preferences are relatively stable and profound modifications to the product are not required, which therefore leads to no relevant fluctuations in demand for SAES's products. The main products in stage 1 are in fact evaporable getters, the demand for which remains quite stable, despite changes in the final applications.

Table 72 summarizes the trait of the competitive environment within the first stage in terms of dynamisms, complexity and competitive threats

<b>DIMENSIONS OF THE COMPETITIVE ENVIRONMENT</b>		
<b>Dynamism</b>	- <i>progresses in new product development and reduction of product lifecycles</i>	L
	- <i>technological instability</i>	L
	- <i>changes in consumer needs and preferences</i>	L
	- <i>fluctuations in product demand</i>	L
	- <i>changes in economic and fiscal trends</i>	L
	- <i>globalization</i>	L
	- <i>crisis, economic shocks and changes in economic cycles</i>	L
<b>Complexity</b>	- <i>geographical concentration of firm</i>	H
	- <i>number of distinct product categories</i>	L
	- <i>technical intricacy</i>	L
<b>Competitive threats</b>	- <i>competitive intensity</i>	L
	- <i>hostility</i>	L

**Table 72 - The competitive environment during stage 1<sup>18</sup>**

<sup>18</sup> L = Low; H = High

### 6.2.1.2 Strategic intent and search tensions

---

Building on the cognitive representation of the competitive landscape presented above, SAES's management is able to identify the key success factors and strategic objectives for search activities which are:

1. to improve knowledge about existing customers' needs and markets,
2. to identify potential new customers and markets,
3. to grow the technological core competencies and know-how within gettering, vacuum technology, gas surface interaction, special metallurgy fields.

Top management's push towards these conflicting goals feeds two main tensions in the search phase of the innovation process: the tension between "local market search" and "distant market search" and the tension between "market search" and "technology search".

SAES in fact decides to follow a technology and competence deepening strategy based on powering existing technology to create difficult-to-imitate products with very specific properties which would be difficult to match, in order to maintain a stronger competitive position in that market. The company believes that a constant commitment to internal research and development is critical in maintaining its technological leadership. As mentioned above, technological search is mainly directed towards the recombination and improvement of the components of a familiar set of technologies already in use such as gettering, vacuum technology, gas surface interaction, special metallurgy fields (local search). This technological search tends to hinder the discovery of solutions that are distant from the current knowledge domain so that there is limited involvement in technology exploratory activities, such as the search for distant technological knowledge: an exploratory strategy is not required by the current stable and low-competitive environment, whereas the continuous growth of the customer base requires a strong commitment to incremental innovation aimed at customizing existing products.

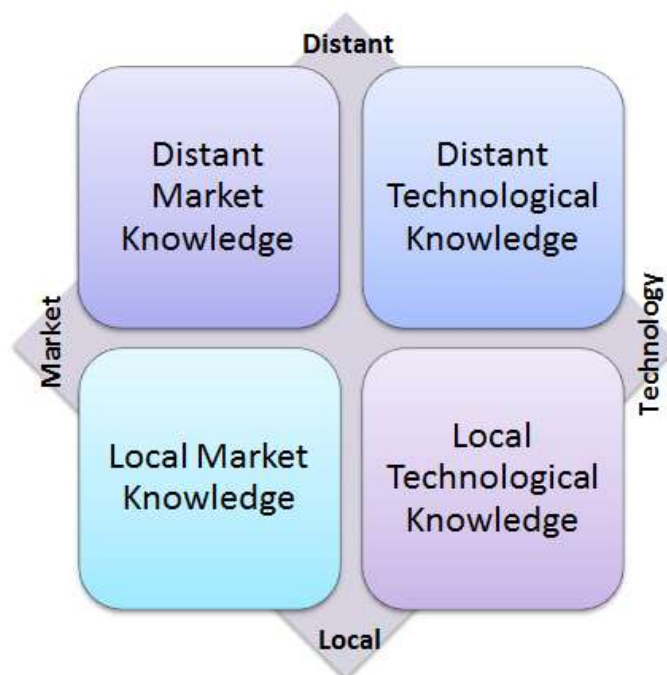
*"From the beginning of my activity, I understood that, since getters are produced to become components of complex systems, it is absolutely necessary to know all their features. This was the first step of a company's leit motive based completely on the understanding of the final application of the products; a leitmotif which enhanced the SAES development potential and its innovation capacity" (Paolo della Porta's biography).*

SAES management realizes that the getter technology was an extremely promising technology, with a high potential of applications in the market. This awareness is translated in impulses from the top management towards market diversification with the goal of supplying getter technology to a wider range of vacuum applications outside those markets already supplied by SAES such as scientific applications, traditional electronics, lighting and telecommunications. SAES's strengths are therefore directed both towards improving market knowledge pertaining to current customers' needs and simultaneously towards the identification of new markets that the firm has not previously had experience of. As a consequence a first tension arises for searching activities: the tension between Local and Distant market search.

The potential of the search activities concerning the market dimension is however rigorously limited within a familiar frame of reference delineated by the existing technological competencies. In other words, the effort of market search activities, both local and distant, is guided by the firm's core competences and technological know-how. Even though great attention is paid to market applications, it is important to remember that SAES is a technology-oriented firm. The close and sometimes conflicting relationship between market and technology domains is the fuel that powers the second tension for search activities.

*“Technological and market knowledge are important building blocks for SAES’s competitive advantage but SAES’s culture is historically a technology oriented firm” (Corporate R&D Manager at SAES Getters).*

It is thus possible to map these tensions in a two-dimension map as depicted in Figure 29. The vertical axis refers to the distance between the existing knowledge base and new knowledge generated through search activities, whilst the second relates to the nature of the knowledge generated, technology or market knowledge. SAES Getters in this phase covers only three of the map quadrants, because it does not perform any exploratory technology searches.



**Figure 29** - The search space in SAES

---

### **6.2.1.3 The resolution of the search tensions: realizing Ambidexterity**

---

Initially, during the first decade after the invention of the getter technology, there is a substantial lack of distinction between the direction of research, production and trade, all headed by the figure of the entrepreneur and leader Paolo della Porta.

Since the 1960s, with the advent of non-evaporable getters and the expansion of the evaporable products range, the organization however begins to articulate, with the creation on the one hand of a more structured R&D function in charge of conducting technological search and on the other a market-oriented structure in charge of carrying out market search activities and customer management. Different units and several professional roles with different but intensely interrelated tasks are therefore involved within the search phase.

A clear physical separation starts to be formed between the technology and market oriented search activities: market search, both local and distant search, is in fact conducted by employees within the commercial function while technological search, mainly local technological search, is realized within the Research and Development function (Figure 30). Keeping the two domains (market and technology) physically separate helps to avoid confusion, perplexity and conflicts between them while simultaneously ensuring high specialization in different tasks: monitoring the market or monitoring the technology respectively.

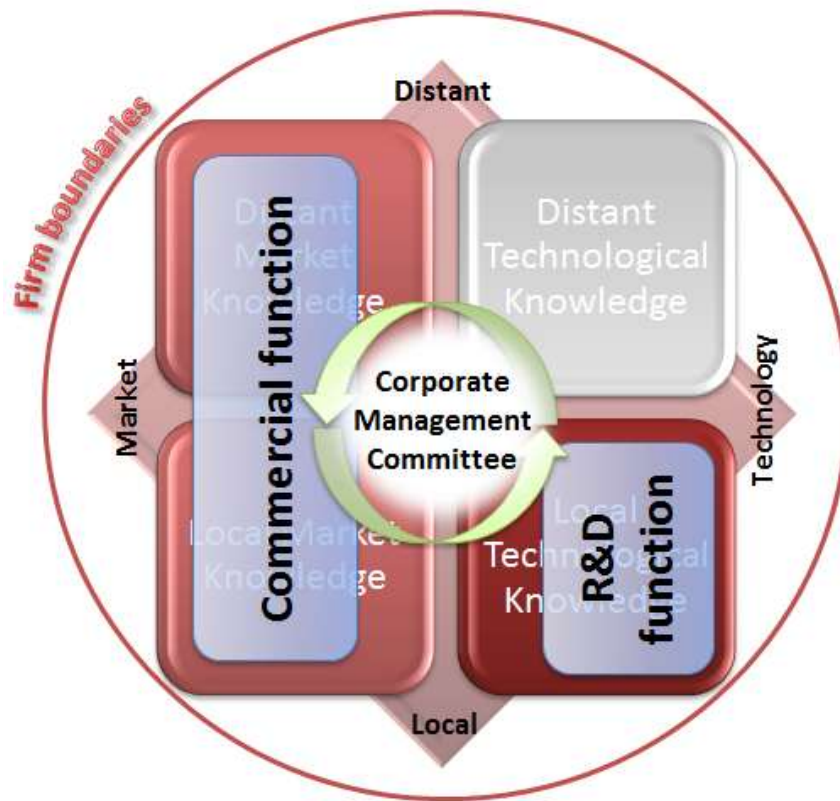
While a structural separation is chosen to resolve the market versus technology tension, a contextual solution is instead adopted to resolve the tension between local and distant market search. Each employee within the commercial function in fact concentrates simultaneously on monitoring existing market and customers' needs and on identifying new potential markets, customers and applications for getter technology. Within the commercial function, the search for market knowledge is realized through a constant monitoring of current customers' needs: visits to the main customers are regularly organized in order to gain insights into their application requirements. Commercial employees, furthermore, continually seek to establish relationships with potential new customers (prospective customers) with the aim of identifying new applications for getter technology. Finally, they actively participate in sector tradeshows, sometimes directly organized by SAES, which are useful ways to build connections with competitors, suppliers, customers and individuals who have an interest in a specific typology of products/technology. Commercial staff are therefore able both to collect knowledge for improving the existing knowledge and to gather new knowledge about prospective market applications for SAES technology. It is mainly thanks to their training (they are all trained within the firm's R&D laboratory) that can lead to these two opposing activities: R&D is considered the "greenhouse" for the whole organization. Often commercial employees are accompanied on their visits to clients by an R&D researcher who has to collect as much information as possible about possible improvements to existing technologies. Within the R&D function researchers and engineers continuously deal with the improvement of existing technologies also by talking with suppliers, participating in sector tradeshows, fairs and congresses and through an activity of continuous updating via consultation of scientific documentation.

Table 73 summarizes the main characteristics of the search practices within stage 1, according to Antonacopoulou's (2007) framework.

<i>Purposes</i>	<ul style="list-style-type: none"> <li>• Improve knowledge about existing markets and products (Local Market - <b>LM</b>)</li> <li>• Identify potential new products and markets (Distant Market - <b>DM</b>)</li> <li>• Improve existing technological knowledge (Local Technology – <b>LT</b>)</li> </ul>
<i>Place</i>	<b>LM:</b> Business areas <b>DM:</b> Business areas <b>LT:</b> R&D function
<i>Principles</i>	Continuous improvement orientation, conservative culture, closed innovation, focus on short term
<i>Practitioners</i>	<b>LM:</b> Business area managers <b>DM:</b> Business area managers <b>LT:</b> Researchers
<i>Procedures</i>	<b>LM:</b> Traditional market research tools such as focus-groups, brainstorming. Periodic contacts with customers. Visits to customers. Tradeshow participation <b>DM:</b> Periodic contacts with customers. Visits to the customers. Lead-user involvement <b>LT:</b> Visits to customers. Literature consultation. Tradeshow participation. Consultant agreements with external experts

**Table 73 – Search practices dimensions during Stage 1**

Even if taken structurally separate, the knowledge generated within the market and the technological domains, needs to be integrated and coordinated in order to generate worth for the firm: if taken isolated and widespread this knowledge would in fact be useless. There is therefore the need to integrate, to transfer as well as achieve synergies between the knowledge generated: formal and informal integration mechanisms are therefore arranged in order to minimize divergent perspectives and enhance a sense of mutual interests among different units. The Corporate and Management Committee (CMC) (Figure 30) plays a critical role in providing the cross-functional interfaces, formal channels of communication, permeability across differentiated units and information processing mechanisms desired. Different actors have a hand in the CMC such as the CEO, the commercial director, the operations director, the R&D director. However, in this period, the entrepreneur remains the key figure, with his ability to create a synthesis between his vision and all the activities performed inside the company.



**Figure 30** - How SAES resolved the search tensions at the end of the first stage

## 6.2.2 Stage 2 (1971 - 2007)

### 6.2.2.1 *Competitive environment*

The second phase begins with a general economic crisis of significant intensity: the petrol crisis of 1973, mainly due to the sudden and unexpected interruption of the flow of petrol from OPEC member nations. The consequences of this energy crisis are immediate for SAES, which sees the growth rates registered in previous decades severely reduced.

Additionally, several changes are on their way: the technological centroid begins in fact to shift towards Asia, technological development wildly accelerates, economic globalization is becoming more and more pressing (by the multiplying the competition) and, starting from the second half of the 1980s, the IT revolution lays the basis for the development of the information and knowledge society.

Therefore from the last decade of the 20th century a competitive environment starts to emerge with levels of complexity, uncertainty, dynamism and competitive threats never before experienced by SAES (Table 74). Continuous global proliferation of technologies and managerial know-how, the reorganization of international economic boundaries, and the ongoing emergence of new players in world markets promises an even more turbulent and complex competitive environment.

*“Increasing pace of technological change, globalization of the economy, growing pressure from competitors, associated with an environment where information has to circulate faster and faster (information age) represent emerging threats for SAES when entering the 21st century”* (Knowledge Manager at SAES Getters).

SAES reacts to these changes by exploiting the high profits generated over time by barium-getters by investing in completing a vertical integration process of getter production already started in the previous stage, in the acquisition of competitors to consolidate its market share, in expanding its sales network by opening new offices, especially in Asia (Japan, Korea and China, followed by Singapore and Taiwan) and in diversifying the products offered, through a dual policy of acquisitions and internal technology development.

If the first stage is characterized by high geographical concentration, a small number of distinct product categories and relatively low technical intricacy, in this second stage the firm is inserted in a context that becomes more and more complex. The long period of stability and growth guaranteed by the getter technology, which extends up until around 2000, associated by high profitability of the company's products, provides the company with significant financial resources which allow it to invest considerable amounts in R&D projects as well as make numerous acquisitions.

During the 1980s the company acquires King Laboratories, which produces evaporable getters in the United States, and the getter business of the Kemet Division of Union Carbide, which is the main producer of evaporable getters in the United States. Also in the 1980s, the acquisition of SAES Pure Gas permits the Group to establish an important presence in the gas purification field. This presence is enlarged to encompass trace gas analysis with the acquisitions of Trace Analytical and FST Consulting Group in 1998, PCP in 1999 and Molecular Analytics in 2000. These actions allow SAES to leverage its core competencies on gettering.

Being a Business-to-Business company that supply components for integration into high technology products, the demand for SAES's products inevitably reflect the demand trend of the technical product market served by the firm. Some markets (for example semiconductors) are characterized by high cyclicity while other markets (for example displays) are subjected to significant and rapid technological changes. Such changes lead in turn to the rapid obsolescence of some products that utilize SAES's technology: for example, Colour Cathode Ray Tubes, which are the main application of SAES's evaporable getters, decline over a few years, despite the rapid growth of Liquid Crystal Display (LCD) monitors for desktop computers and the commercial availability of Plasma Display Panels. Thus the barium market (200 million getters per year) disappears in a few years while the market for Hg dispensers for CCFLs (Cold Cathode Fluorescent Lamps for LCD backlighting) grows authoritatively. This is the third technological downturn (and by no means the last) faced by SAES during its history.

*“... because of the significant technological changes that have taken place in the industries in which the Group’s customers operate and those that may occur in the future, and the possible introduction of new advanced products by the Group’s competitors, the Group’s business is dependent upon expenditures on research and development and upon the time necessary to develop, industrialize and commercialize new products ...”* (SAES’s annual report, 2001).

The diversifications that characterize the 1980s are followed by further diversifications with increasing frequency. Some examples are:

- 1990s: vacuum thermal insulation (vacuum insulated panels) leveraging vacuum technology competences
- 2000s: photonics (lithium niobate crystals) for telecommunications, heterogeneous catalysis (for pollution reduction in automotive industry and boilers), smart materials (shape memory alloys)

The last one is particularly important: in fact, in order to leverage more than sixty years of core competencies in vacuum metallurgy and serve new emerging markets such as medical devices and innovative compact actuators, in 2001 SAES Getters Group started in-house development of Nitinol material and a thin-diameter Nitinol wire for automotive applications. The year 2004 thus marks the Group’s decision to expand its business in advanced materials niche markets, mainly with the introduction of shape memory alloys for the automotive, transportation and electronic appliance industries and of getters for MEMS and microelectronic hermetically packaged devices. Such acquisitions and investments, whether conducted nationally or internationally, involve a number of risks and uncertainties such as the necessity to implement a variety of additional systems, procedures, controls and integrate different company cultures, personnel, technologies, products and facilities. The result is increasing complexity that the firm has to face.

During the last decade of the 20th century, SAES’s operating results are heavily influenced by existing competitors who are increasing their production and marketing efforts and decreasing the price at which they offer getters or other competing products. Furthermore, given the limited barriers to entry with respect to some standard products due to the low cost of their production and expiration of certain patents, SAES is more and more exposed to increasing extensive competition, in particular from certain Asian companies (i.e. for large purifiers) and from certain U.S. companies (i.e. for small purifiers). In particular, China’s rapid growth and integration into the world economy represent an increasing competitive threat. The 1980s represent in fact the beginning of a global adaptation of society’s economic institutions to the realities of a more uniformly developed world. SAES stands on the edge of the arising global economy. Another competitive threat is represented by mergers between some of SAES’s customers forming new and larger companies. For example, in July 2001, two of the main customers in the Group’s Display Devices Business Area (Philips and LG Electronics) begin operating a newly formed company (“LG.Philips Displays”) resulting from the merger of their Cathode Ray Tubes businesses. In addition, in April 2003, Toshiba Corporation and Matsushita Electric Industrial Co., Ltd, both of which are Group customers for barium getters, begin operating a joint venture (“Matsushita Toshiba Picture Display Co, Ltd.”) resulting from the merger of both companies’ Cathode Ray Tubes operations (which includes R&D, manufacturing and sales). As a result, the firm’s overall client base is declining,

thereby increasing the dependence on a limited number of generally larger customers with increased negotiating power.

This picture is even more exacerbated by the fact that the company, in this stage, not only faces competition from new entrants but also, by entering new markets and technological applications, has to clash with existing competitors (this occurs for the purification of gases, for insulation panels, and, more importantly, in the case of heterogeneous catalysis). In addition, certain products, such as metal dispensers, getter pumps and modules and gas purifiers and analyzers, are also more and more subject to competition from alternative products using competing technologies.

SAES however succeeds in reacting to these changes, consolidating its success: after the crisis of the mid 1970s the company in fact keeps on registering steady growth in turnover, profit, staff, etc until 2000.

Table 74 summarizes the main characteristics of the competitive environment within the second stage.

<b>DIMENSIONS OF THE COMPETITIVE ENVIRONMENT</b>		
<b>Dynamism</b>	- <i>progresses in new product development and reduction of product lifecycles</i>	H
	- <i>technological instability</i>	H
	- <i>changes in consumer needs and preferences</i>	H
	- <i>fluctuations in product demand</i>	M
	- <i>changes in economic and fiscal trends</i>	L
	- <i>globalization</i>	M
	- <i>crisis, economic shocks and changes in economic cycles</i>	L
<b>Complexity</b>	- <i>geographical concentration of firms</i>	H
	- <i>number of distinct product categories</i>	H
	- <i>technical intricacy</i>	H
<b>Competitive threats</b>	- <i>competitive intensity</i>	H
	- <i>hostility</i>	H

**Table 74 - The competitive environment during stage 2<sup>19</sup>**

<sup>19</sup> L = Low; M = Medium; H = High

---

### 6.2.2.2 Strategic intent and search tensions

---

Major changes in the evolution of the competitive environment unavoidably trigger significant alterations in the search strategic objectives: within such a context, SAES's search strategy inevitably has to change.

The company in fact becomes aware that a constant commitment to internal research and development and the exploration of new fields of technology are critical in order to maintain a technological leadership and overcome the problem of technology obsolescence. The Group therefore intends not only to increase its core areas of competence (namely the reactivity of gases with surfaces and metals, sophisticated alloy metallurgy, vacuum and ultra-high vacuum technologies, gas purification and impurity monitoring) but also to enter into new, but related technology fields aimed at new markets which are less affected by the cyclicity that characterizes those markets in which it currently operates.

So, while in the first stage the company's efforts are mainly directed towards pursuing a strategy of deepening the technological competencies; breaking new ground and pioneering new fields become new additional cornerstones of a changing strategy that characterizes the second stage. As a consequence, a new tension starts to make itself felt within the search phase: the tension between local and distant technological search. SAES's efforts are in fact directed towards both searching for knowledge that makes it possible to improve and deepen existing technological knowledge and competences and searching for knowledge that makes it possible to broaden the existing technological capability through the generation of unfamiliar, distant and remote technological knowledge.

*“The self-reinforcing strategy alone was not sufficient to guarantee the firm's survival within the new competitive environment. Without a doubt, it additionally represented a competency trap and it became essential to make a significant leap forward” (Corporate R&D Manager at SAES Getters).*

With regards to the market domains, the existing tension between search activities targeted towards the generation of market intelligence pertaining to current needs (“local market search”) and search activities aimed at producing knowledge about new opportunities outside of immediate markets (“distant market search”) is intensified further in this second historical stage. In fact SAES is increasingly involved in a process of broad diversification that leads the company to supply getters to all vacuum applications and to enter new sectors: the sector of ultra-purification of process gases directed towards the production of semiconductors and the sector of analyzers of micro-contaminants in the same gases.

*“The Group intends to [ ] expand into new niche applications, including certain areas of the vacuum applications, lamp industry, special alloys, semiconductor and opto-electronic industries and impurity monitoring in gases ... The Company believes that its getter technologies may extend into new areas of application [ ] such as vacuum thermal insulation (including refrigeration for households), vacuum systems and vacuum-sealed micro electronics devices for industrial products, new types of flat displays and devices to improve the efficiency of certain vacuum manufacturing equipment. The Company believes that its*

*mercury dispensing technologies may be further extended to fluorescent lighting”*  
(SAES’s Annual Report, 2002).

Both local and distant search for knowledge about existing and prospective markets are closely connected with the local and distant search that occurs within the technological domain. Improved or new technologies should in fact enable development of new products, improvement of existing ones, production at a lower cost, a better response to existing customers’ needs or fuel future demands: for the firm this means that behind each search activity there should always be a market application. As a consequence, also the tension between market and technology appears to be more pronounced within the second stage.

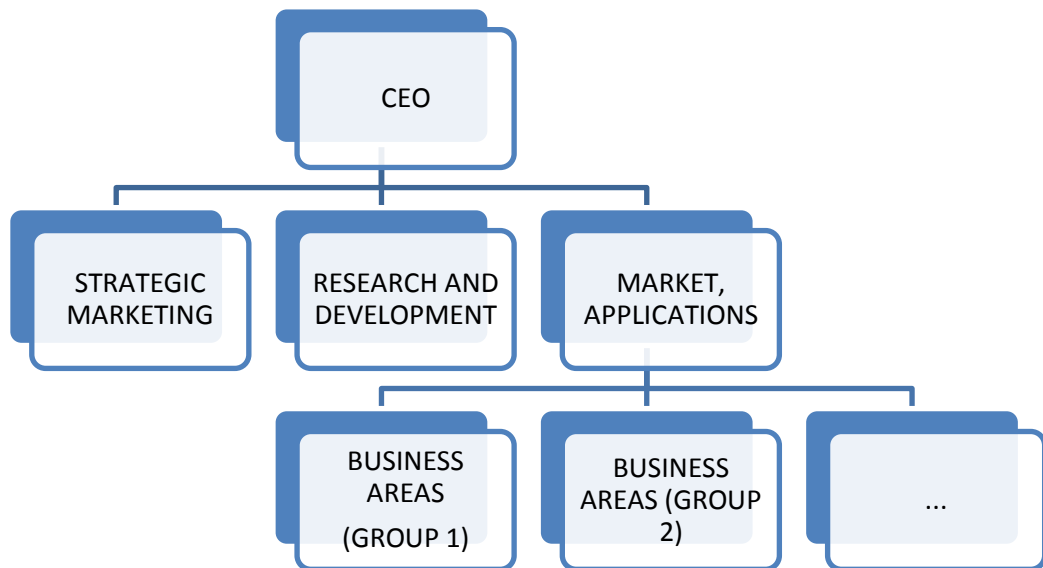
---

### **6.2.2.3 *The resolution of the search tensions: realizing Ambidexterity***

---

In the threatening competitive environment described above, and the consequent tensions to be solved, a re-organization of the architecture and practices for search is required. In particular, the firm, according to the organizational form adopted in the first stage, keeps on separating market search from technological search. Different solutions are instead chosen in order to manage the tension between local and distant search within two domains, technology and market. Within the market search there is a transition from a contextual solution to a structural one, while a contextual solution is adopted to solve the tension between local and distant search within the technological domain.

At the beginning of the 1970s SAES in fact decides to structurally separate the search phase for market exploration and exploitation. The increasing drive towards diversification of products and markets leads to the creation of the Business Area and the creation of a dedicated unit, the "Technological Marketing". During the second phase "Technological Marketing" subsequently changes its name to "Strategic Marketing" (Figure 31).



**Figure 31** - A schematic representation of SAES’s organization during the second stage

In 2002 the company’s businesses are organized into two divisions, or “Aggregates”: the “Components Aggregate” and the “Equipment Aggregate” (see Table 75). Each Aggregate is in turn organized into “Business Areas”. The Components Aggregate is made up of the Display Devices, Light Sources, Electronic Devices and Flat Panels and Vacuum Systems and Thermal Insulation Business Areas while the Equipment Aggregate is made up of the Pure Gas Technologies, Analytical Technologies and Facilities Technologies Business Areas. Within each Aggregate, the Business Areas are defined by specific market needs and strategies as well as by clearly identified technological or manufacturing characteristics.

<b>Components Aggregate:</b>
• <i>Display Devices</i>
• <i>Light Sources</i>
• <i>Electronic Devices and Flat Panels</i>
• <i>Vacuum Systems and Thermal Insulation</i>
<b>Equipment Aggregate:</b>
• <i>Pure Gas Technologies</i>
• <i>Analytical Technologies</i>
• <i>Facilities Technologies</i>

**Table 75** - Summary of the divisions according to Aggregates and Business Areas in 2002

In 2004, in order to follow the trends of the markets in which the company operates more efficiently, operations, activities and actions are reorganized further. In particular, the Group's businesses are split into three Business Units (Information Displays, Industrial Applications and Equipment) and then into Business Areas (Table 76). Each Business Unit and Business Area is under the responsibility of the Business Unit Managers and Business Managers respectively. The innovative aspect of the Business Unit Manager is that they do not administer the single products, but whole areas of application, extending and optimizing control over all aspects of a family of products, its applications and market needs.

<b>Information Displays Business Unit:</b>	
• <i>Cathode Ray Tubes</i>	Barium getters for cathode ray tubes
• <i>Flat Panels</i>	Getters and metal dispensers and for flat panels
<b>Industrial Applications Business Unit:</b>	
• <i>Lamps</i>	Getters and metal dispensers used in discharge lamps and fluorescent lamps
• <i>Electronic Devices</i>	Getters and metal dispensers for electron vacuum devices
• <i>Vacuum Systems and Thermal Insulation</i>	Pumps for vacuum systems and products for thermal insulation
<b>Equipment Business Unit:</b>	
• <i>Pure Gas Technologies</i>	Gas purifier systems for semiconductor industry and other industries
• <i>Analytical Technologies</i>	Trace gas analyzers for semiconductor and other industries
• <i>Facilities Technologies</i>	Quality assurance, quality control and material inspection of the gas distribution system in semiconductor industry and other industries, installations for the telecommunications industry

**Table 76 - Summary of the divisions according to Business Units and Business Areas in 2004**

Another reconfiguration of the Group's organizational structure occurs in January 2005: at this point SAES's business organization consists of two Business Units (Information Displays and Industrial Applications) and one Business Development Unit (Advanced Materials). In particular the Equipment Business Unit is included within the Industrial Applications Business Unit as a Business Area and renamed Semiconductors. Furthermore, a new business unit is introduced: the Advanced Materials Business Unit (Table 77).

<b>Information Displays Business Unit:</b>	
• <i>Cathode Ray Tubes</i>	Barium getters for cathode ray tubes
• <i>Flat Panel Displays</i>	Getters and metal dispensers for flat panel displays
<b>Industrial Applications Business Unit:</b>	
• <i>Lamps</i>	Getters and metal dispensers used in discharge lamps and fluorescent lamps
• <i>Electronic Devices</i>	Getters and metal dispensers for electron vacuum devices
• <i>Vacuum Systems and Thermal Insulation</i>	Pumps for vacuum systems and products for thermal insulation
• <i>Semiconductors</i>	Gas purifier systems for semiconductor industry and other industries and installations for the telecommunications industry
<b>Advanced Materials Business Development Unit:</b>	
• <i>Advanced Materials</i>	Getters for microelectronic and micromechanical systems, optical crystals, shape memory alloys, metalorganic precursors

**Table 77 - Summary of the divisions according to Business Units and Business Areas in 2005**

Within the different Business Areas, the Business Area manager concentrates on sales and on growth of their business, through a constant monitoring of the market needs and their developments. Business Area managers are therefore in charge of collecting knowledge for improving “the existing knowledge” and therefore undertakes mainly Local Market Search activities. The search for market knowledge is realized through a constant monitoring and evolution of the customers’ needs through regular visits to the main customers in order to receive insights about their application requirements. SAES in fact strives to build upon many collaborative projects and long-term relationships with customers in order to fully understand their needs and properly translate them into technology and product improvements. The involvement of customers from the initial development stage of a device or project for which a getter or other products will be used, represents a key procedure of search practices that frequently leads to the improvement of the existing offer. Additionally, they actively participate in sector tradeshows, sometimes directly organized by SAES, which are useful ways to build connections with competitors, suppliers, customers and individuals who have an interest in a specific typology of products/technology.

While within the different Business areas employees are involved in Local search market activities, within the Strategic Marketing and the Business Development Unit managers are in charge of identifying new potential markets: in other words, they are involved in Distant Market search activities (Figure 32).

*“Creating a dedicated and separate business unit to discover new market application is extremely important for the reason that this separation allows us to break all links with the existing market in order to not be influenced by them”*  
(Corporate R&D Manager at SAES Getters)

Strategic Marketing employees and the Business Developer Manager (BDM) therefore constantly seek to establish relationships with prospective customers with the aim of identifying new potential applications for SAES technology. Their activity is therefore complementary to those of the different Business Area Managers, who in turn operate inside consolidated markets. They actively frequent tradeshows, read market studies and "road maps" for the development of technology, made available, for instance, by the European Commission (EC), the Department of Energy (DOE), the New Energy and Industrial Technology Development Organisation (NEDO) and many others. Even though the Business Development function is institutionally entrusted with exploring new markets, and in particular collecting application demands that can already be satisfied by the functional properties of existing products, the function, due to the technological training that all employees receive, often gets involved in issues of technology development, collaborating closely with R&D or even directing R&D's projects first hand: the risk is to have a vast set of technologies with elevated potentialities which are rather heterogeneous and barely integrable and sustainable. Therefore, the role of the Business Developer Manager is, at the end of the second stage (and also within the third stage), more clearly defined and focalized on garrisoning specific areas of interest.

The research and development function has changed its clothes too. While in the previous stage, researchers were essentially committed to technology excellence and improvement, at this point their objective is also to keep the firm at the forefront in innovation. To this end, in March 2003, SAES implements a reorganization of its research, development and innovation activities by creating the Research and Innovation Department, headed by a Chief Technology and Innovation Officer ("CTIO") encompassing the Group's Research, Development, Engineering, and Technology Transfer activities. This new configuration allows the company to expand into other areas, in addition to the scientific fields of the reaction of gases with surfaces and metals, sophisticated alloy metallurgy and vacuum and ultra-high vacuum technologies.

*"Present areas of research and development activities include a new generation of getters and other products for the lamp industry, MEMS devices, opto-electronic devices, and new generations of "eco-friendly" high yield alkali metal dispensers for the manufacture of OLEDs. Research in recent years has also focused on developing a new generation of non-evaporable, highly porous getters, new types of thin film getters for Plasma Display Panels, Field Emission Displays and special chemical absorbers for OLEDs. The Group also made significant progress in researching and developing a new generation of mercury dispensing products for both standard and cold cathode fluorescent lamps applications, special alloys for novel applications, innovative gas monitoring technologies and new materials for gas purification." (SAES's Annual Report, 2005)*

Within the R&D function, researchers represent a community which, due to their own personal attitudes, are directed towards, in addition to constantly improving the existing technological knowledge also generating completely new technological knowledge. Each single researcher is in fact called upon constantly to seek new technologies able to respond to the emergent application demands and evaluate how such technologies can be integrated with the existing and well known ones. Their roles are crucial in ensuring a medium- and

long-term view, suggesting for example alternative future scenarios, especially those which do not necessarily follow the current technological trajectory. Listening to customers and involving them in the first stage of the innovation process are important procedures not only for the generation of knowledge concerning the market but also the technology. Often the Business Area Managers are in fact accompanied on their visit to clients by a Research and Development researcher who collects as much information as possible about the possible improvement of existing technologies. Researchers additionally act as brokers by continuously capturing knowledge about technologies identified outside the firm, participating in events and conferences even outside their current realms of experience and fostering the creation of an open innovation climate, by promoting an open and collaborative research environment with, for example, universities, research centres and specialized agencies. They in fact seek to combine the internal expertise with that of outside entities through cooperation agreements with corporations and advanced public and private research institutes and universities). The Group also starts cooperating with other important European industries in various projects funded by the European Community. SAES responds to hyper-competition by not only working on the architectural design and organizational practices, but also reconsidering its conservative culture. SAES in fact succeeds in building up an organizational culture that instead of fearing the pace of change, relishes it: free exchange of knowledge and information between the various disciplines are supported, socialization processes, and a high tolerance are key success factors. Exceptions involving violations of the formal rules are possible. Additionally, the external orientation is very open and long-term oriented.

Table 78 summarizes the main characteristics of the search practices during stage 2, according to Antonacopoulou's (2007) framework.

<i>Purposes</i>	<ul style="list-style-type: none"> <li>• Improve knowledge about existing markets and products (Local Market - <b>LM</b>)</li> <li>• Identify potential new products and markets (Distant Market - <b>DM</b>)</li> <li>• Improve existing technological knowledge (Local Technology – <b>LT</b>)</li> <li>• Identify new technological opportunities (Distant Technology – <b>DT</b>)</li> </ul>
<i>Places</i>	<p><b>LM:</b> Business areas  <b>DM:</b> Strategic Marketing and Business Development Unit  <b>LT:</b> R&amp;D function  <b>DT:</b> R&amp;D function</p>
<i>Principles</i>	Continuous improvement orientation but simultaneously keeping open towards economically interesting new markets even those which are far from existing competencies, less conservative culture, more open to external stimuli, focus on short term and medium term
<i>Practitioners</i>	<p><b>LM:</b> Business area managers  <b>DM:</b> Strategic Marketing employees and Business Developer Manager  <b>LT:</b> Researchers  <b>DT:</b> Researchers</p>

<i>Procedures</i>	<p><b>LM:</b> Traditional market research tools such as focus-group, brainstorming. Periodic contacts with customers. Visits to the customers. Tradeshow participation.</p> <p><b>DM:</b> Periodic contacts with customers. Visits to the customers. Tradeshow participation .Scenario planning techniques. Future analysis.</p> <p><b>LT:</b> Visits to the customers. Literature consultation. Tradeshow participation. Consultant agreements with external experts.</p> <p><b>DT:</b> Visits to the customers. Literature consultation. Consultant agreements with external experts. Conference participations. Tradeshow participation. Hiring people importing new knowledge. Open company-wide system for ideas submission, creation of an internal network among employees</p>
-------------------	---

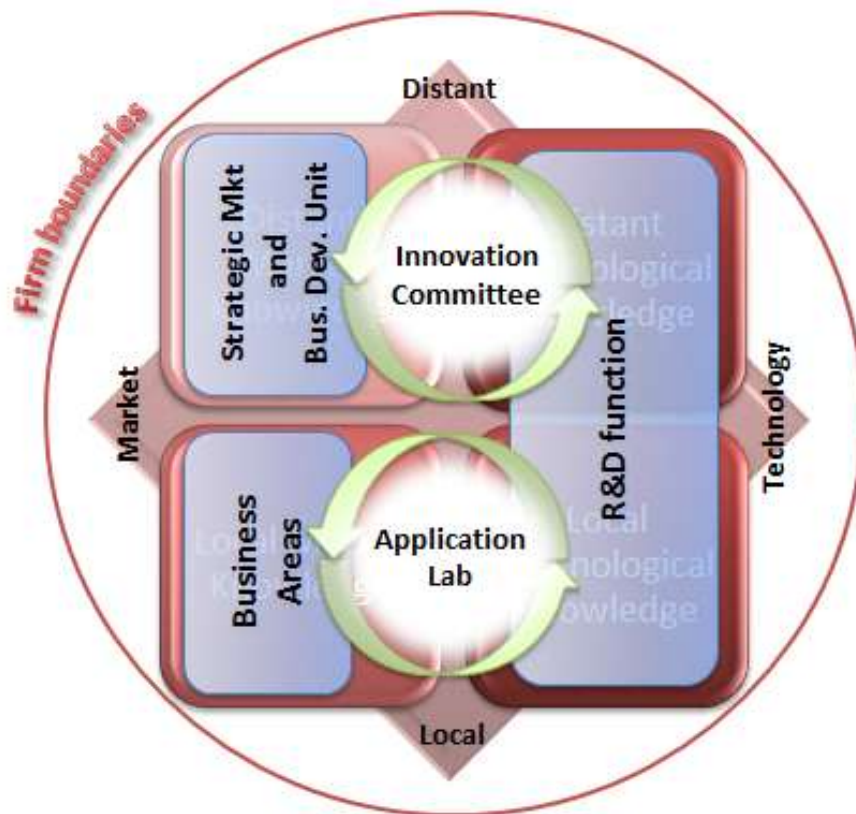
**Table 78 – Search practices dimensions during Stage 2**

The result of structural separation between technology and market search activities and local and distant market search activities appears as a set of autonomous units strongly coupled by the Application Labs and the Innovation Project Planning Committee (“IPPC”) integrative efforts (Figure 32).

The Application Labs are critical sites where the integration between local market search and local technology search takes place. The Application Labs are laboratories that develop products and prototypes according to specific application needs, in close cooperation with customers, SAES business managers and SAES manufacturing sites. The Application Lab Manager is therefore able to understand both the commercial and technological dimensions of the products and is in charge of developing and finely tuning the functional properties required. Within the application final devices are also analyzed, in order to increase the understanding of specific issues and in particular to assess the full impact of the products in the final applications

The Company believes that the synergies created among the scientific, technological and marketing functions, reduce the time required for the innovation to result in new business. In order to guarantee that the innovation process, and in particular each major project, is in conformance with SAES’s strategies, different committees have been created: as an example, in the mid-1990s SAES introduces the "Innovation Project Planning Committee” (IPPC) that groups together the innovation leaders, plus occasional guests depending on the specific area covered. The purpose of the committee is chiefly to propose, evaluate and make decisions about new projects and their implementation. This occurs within a climate that fosters the integration of diverse points of view and the sharing of specialized knowledge.

Figure 32 summarizes the choices made by the firm in order to face the tensions in the search phase that characterize the second stage.



**Figure 32** - How SAES resolved the search tensions during the second stage

### 6.2.3 Stage 3 (2008 onwards)

#### 6.2.3.1 Competitive environment

If the second stage is characterized by high levels of complexity, uncertainty, dynamism and competitive threats, this situation is even more exacerbated in the last three years which depict a “hyper-competitive” environment, according with the definition of D’Aveni (1994).

The new environment is in fact characterized by increasing risk and uncertainty, decreasing forecastability and increasing ambiguity in industry boundaries. Several challenges arise for firms that, in order to survive, should develop capability in coping with a market demand that has become unstable, increasing aggressiveness of competitors who quickly build their advantage and erode their rivals’ advantage and a broadening global scope of such competitors. Additionally, in this phase the firm witnesses an increasing rate and disruptive nature of technological change which makes it difficult to identify causes or predict

outcomes of competitive and market actions with relative certainty. As an example, in this stage it is possible to see the fourth technological downturn, produced by the shifting from Cold Cathode Fluorescent Lamps (CCFL) to Light-Emitting Diode (LED) which become the mainstream backlighting source for LCD displays. This entails a significant decline in sales of Hg dispensers and the need to redirect R&D activities towards these new technologies.

Furthermore, these years are accompanied by shocks and discontinuities that make the environment ever more hostile and turbulent. After a first half marked by a turnover and a net profit in line with those of the corresponding period of the previous year, the second part of 2008 is affected by the world economic crisis. The occurrence of such unimagined and dramatic changes transforms the world and sets up new rules of the game. In the second half of the year financial markets become increasingly volatile, which leads to severe repercussions for various financial institutions and, more generally, the overall performance of the economy. In greater detail, widespread difficulties in securing access to credit and the ensuing decreased availability of liquidity penalizes the development of many industrial sectors, including some of the markets in which the SAES Getters Group operates. The most heavily penalized of these markets is the consumer electronics segment, driven by a decline of end consumers who feel like buying, which is translated into a decline in demand for components by manufacturers. The recession, which causes a decrease in consumption, has particularly affected the Information Displays Business Unit: the LCD market, after a first half year of growth, starting from the third quarter of 2008 and even more in the fourth quarter of 2008 registers a decrease in volumes that continues also in 2009 (Figure 33).

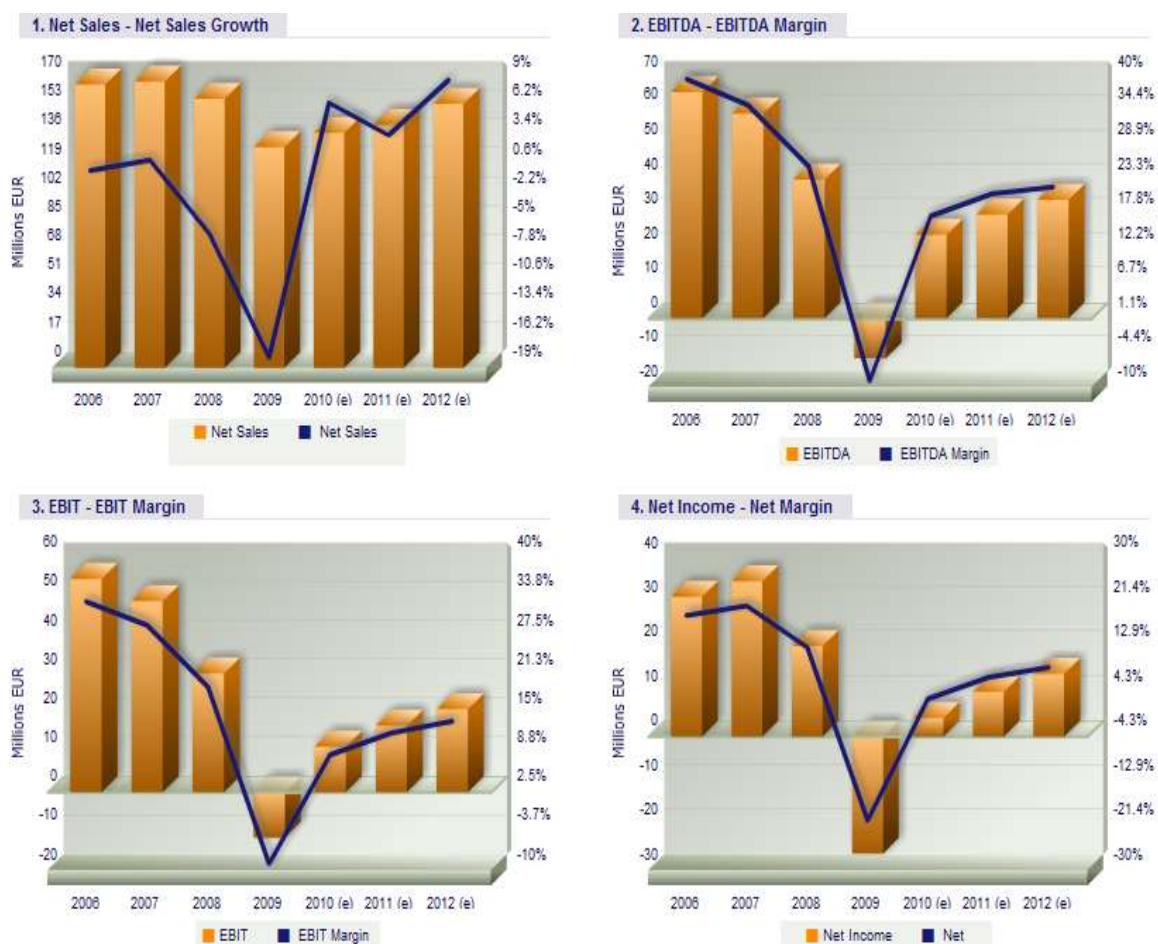


Figure 33 - SAES's fundamentals charts<sup>20</sup>

Table 79 that follows summarizes the main characteristics of the competitive environment.

#### DIMENSIONS OF THE COMPETITIVE ENVIRONMENT

<b>Dynamism</b>	- progresses in new product development and reduction of product lifecycles	H
	- technological instability	H
	- changes in consumer's needs and preferences	H
	- fluctuations in product demand	H
	- changes in economic and fiscal trends	H
	- globalization	H
	- crisis, economic shocks and changes in economic cycles	H

<sup>20</sup> Source: <http://www.infinancials.com/>

<b>Complexity</b>	- <i>geographical concentration of firms</i>	L
	- <i>number of distinct product categories</i>	H
	- <i>technical intricacy</i>	H
<b>Competitive threats</b>	- <i>competitive intensity</i>	H
	- <i>hostility</i>	H

**Table 79** - The competitive environment during stage 3<sup>21</sup>

### 6.2.3.2 Strategic intent and search tensions

*“The assumption of continuity that has characterized the previous stages no longer holds. To survive, we need to exploit existing markets and technologies and explore new ones. Short- to long-term NPD planning is performed according to a well-defined business strategy. Sustainability of our business models strictly requires also long-term research activities.”* (Corporate R&D Manager at SAES Getters)

Following a discontinuous event that disrupts the existing stability, SAES enters a phase in which there is an urgency to explore new options, learn fast and at the same time look for ways to develop the technology into a form that can become widely adopted. “Do differently” becomes an imperative and SAES needs a new set of approaches to organize and manage the search phase of the innovation process.

Faced with unrelenting uncertainty and turbulence, the firm has no choice but to change its search strategy. The new competitive landscape requires that SAES i) uses the latest technology while continuing to develop new technology, ii) actively participates in global markets, iii) structures themselves to gain advantage in these markets, iv) develops and maintains strategic flexibility, and v) builds a long-term vision that allows managers to balance short-term performance with long-term needs.

While in the previous stages, technological search activities were totally or partially guided by existing or possible market applications, the new context in which the firm operates calls for a systematic exploration of new technologies, even if it is not clear what their future applications will be. As a consequence, R&D strengths should be directed not only towards short-medium term development but also to the development of products and technologies well beyond the state-of-the-art, with a long-term perspective; it should extend and enhance its peripheral vision and broaden the scope of research activities into new and unexpected areas.

*“To survive, we need to exploit existing markets and technologies and explore new ones. Short- to long-term NPD planning is performed according to a well-*

<sup>21</sup>L = Low; H = High

*defined business strategy. Sustainability of our business models strictly requires also long-term research activities” (Corporate R&D Manager at SAES Getters)*

The result is an exacerbation of all the search tensions that characterized the second stage. Even though in stage two the firm succeeded in resolving and managing tensions between local and distant search (within both the market and the technology domains) and between market and technology, during the third stage these tensions have been revitalized by the changing competitive environment. A critical challenge for the firm is in particular to succeed in both searching for knowledge that makes it possible to improve and deepen existing technological knowledge (“Local technology search”) and searching for knowledge that makes it possible to broaden existing technological capability through the generation of unfamiliar, distant and remote technological knowledge (“Distant technology search”).

The completely new and unfamiliar knowledge that would result from “distant technology search” should not be constrained in any way by the market applications and must be made in the interests of very long-term open-ended projects: in the previous stage the firm was not so sensitive to such a long-term vision

---

### **6.2.3.3 The resolution of the search tensions: realizing Ambidexterity**

---

To face this challenging competitive environment the firm chose a different solution to resolve the tension between local and distant technological search. A structural division between market and technology domains persists, as a structural separation between local and distant market search activities, as depicted in the previous paragraphs.

Being aware of the limits of the current organizational design, in 2008 SAES decides therefore to create a “New Company”. SAES’s existing R&D organizational structure is in fact not entirely adequate for generating distant technological knowledge to be conveyed into “disruptive innovation” projects: the long term projects, for which the applications and returns are not clear, are struggling to find commitment in a contextually ambidextrous unit. It is in fact inevitable that resources in such a structure are mainly concentrated in the short term: the results are immediate and highly predictable while there is high resistance and difficulties in justifying the use of resources for search activities that are “a bit of a shot in the dark”. The same researchers feel more comfortable using existing knowledge, reutilizing and increasing it to achieve short-term results than moving towards the unknown and managing emergent processes. What is lacking is an impetus and the interest towards what is unknown and uncertain.

The solution identified by SAES is the establishment of ETC S.r.l. (85% controlled by SAES Getters S.p.A.), an independent company supported by the National Research Council (CNR) and involving local and foreign excellence centres. In general, ETC represents a strategic alliance between SAES and the CNR, oriented towards the implementation of knowledge-intensive projects, administered through original innovation models and finalized towards the development of business in the long term. In 2008 SAES starts an intensive programme in its laboratories to develop highly innovative products, in general for the Organic and

Hybrid Electronics/Photonics and Plastic Electronics/ Photonics markets which includes also the OLED display market. In 2009 the R&D Director becomes aware that a CNR-ISMN Bologna research group is developing strong and distinctive know-how in Organic Photonic Device Physics, with particular reference to organic light emitting Transistors (OLET), Organic Light Emitting Diodes and Organic Photovoltaic Cells. He immediately recognizes the potential of a strategic alliance between SAES and the CNR.

SAES and CNR thus decide to invest in ETC S.r.l.. The strength of ETC is that it is not affected by the parent company's history and gives potential to the development of completely new ideas, helping them grow in a new environment. The new company additionally ensures the structural separation between local and distant technological search avoiding resource duplication (money and people) that the partition of the R&D function into two distinct internal business units may require. The R&D Director is the formal leader of this project, apprised of the responsibility on the new company. He, relying on his authority and expertise, acts as a "bridge" between the project team involved in the new company, the R&D of Lainate and the senior management: in other words, he is a formally recognized channel for knowledge transmission.

Within the new company, SAES's R&D director collaborates with researchers from the CNR, following an approach of open innovation: the connection of different bodies of knowledge, diverse skills and experience sets, the transfer of ideas from one sector to another all represent powerful sources of ideas.

*"CNR is connected to the world through an enormous number of nodes. Through CNR we can reach all these nodes that are so different and heterogeneous. The more players the firm is connected to, the more potential points at which an interesting new signal might be detected."* (Corporate R&D Manager at SAES Getters)

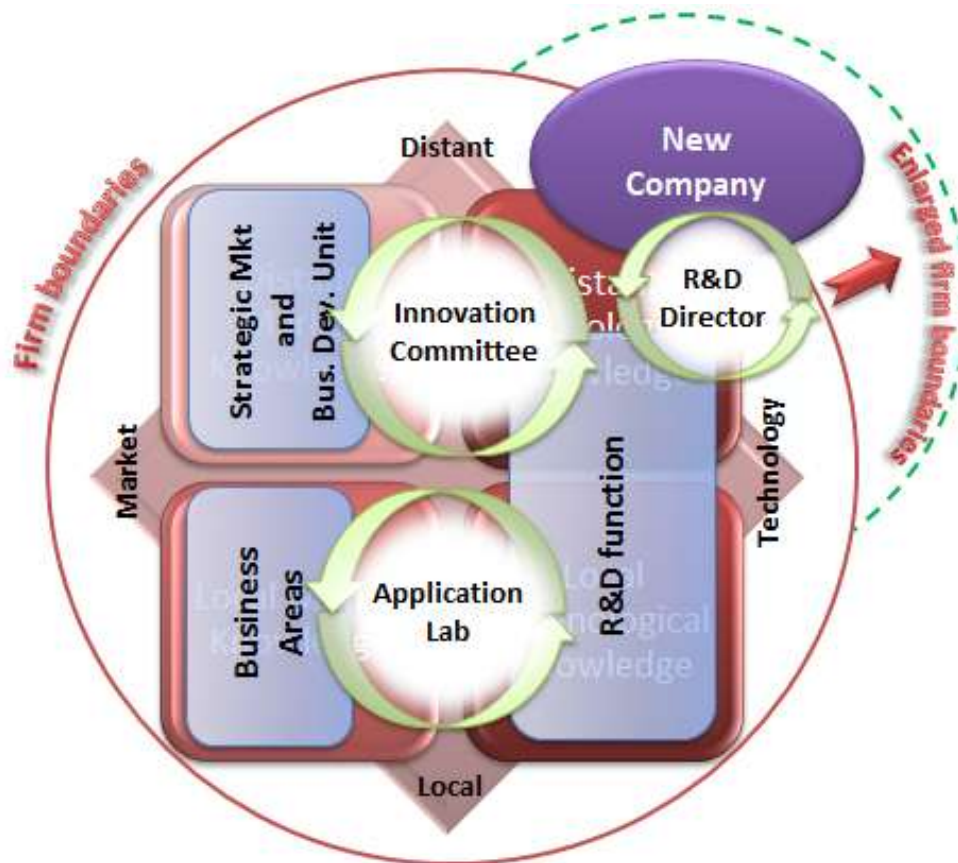
The Corporate Research and Development Director is a leader who venerates the past but, rather than becoming complacent, is willing to continuously change in order to meet the future. As a result of this career path the R&D director is a multi-tasker: he is able both to guide the improvement of existing knowledge and recognize new opportunities. Additionally, he is capable of dexterously orchestrating the researchers' activities and creating a commitment towards challenging projects. He is highly cooperative and able to combine the efforts of different units around the world with a constant attention to the creation of strong links and a network within the company. In this activity the Corporate R&D director is supported by the Knowledge Management function, a young function introduced in 2008, which has the main task of keeping the information park updated and easily accessible by all the functions involved in development, research and innovation projects.

Table 80 summarizes the main characteristics of the search practices during stage 3, according to Antonacopoulou's (2007) framework.

<i>Purposes</i>	<ul style="list-style-type: none"> <li>• Improve knowledge about existing markets and products (Local Market - <b>LM</b>)</li> <li>• Identify potential new products and markets (Distant Market - <b>DM</b>)</li> <li>• Improve existing technological knowledge (Local Technology – <b>LT</b>)</li> <li>• Identify new technological opportunities, even if their possible market applications are not known (Distant Technology – <b>DT</b>)</li> </ul>
<i>Places</i>	<p><b>LM:</b> Business units  <b>DM:</b> Strategic Marketing and Business Development Unit  <b>LT:</b> R&amp;D function  <b>DT:</b> R&amp;D function and “New Company”</p>
<i>Principles</i>	<p>Continuous improvement orientation but simultaneously keeping open towards economically interesting new markets even if far from existing competencies, seeded growth of completely new technologies, open innovation and knowledge transfer from other sectors, organization’s efforts to create a culture that support radical innovation, focus on short, medium and long term.</p>
<i>Practitioners</i>	<p><b>LM:</b> Business area managers  <b>DM:</b> Strategic Marketing employees and Business Developer Manager  <b>LT:</b> Researchers  <b>DT:</b> R&amp;D director with a selected group of researchers</p>
<i>Procedures</i>	<p><b>LM:</b> Traditional market research tools such as focus-group, brainstorming. Periodic contacts with customers. Visits to the customers. Tradeshow participation.  <b>DM:</b> Periodic contacts with customers. Visits to the customers. Tradeshow participation .Scenario planning techniques. Future analysis.  <b>LT:</b> Visits to the customers. Literature consultation. Tradeshow participation. Consultant agreements with external experts.  <b>DT (within the R&amp;D function):</b> Visits to the customers. Literature consultation. Consultant agreements with external experts. Conference participations. Tradeshow participation. Hiring people importing new knowledge. Open company-wide system for ideas submission, creation of an internal network among employees. Collaboration with universities and research centres  <b>DT (within the New company):</b> Partnership with external research centres, universities, firms and involving both local and foreign excellence centres. Knowledge transfer. Fostering diversity.</p>

**Table 80 - Search practices dimensions during Stage 3**

Figure 34 displays the choices made by the firm in order to face the tensions in the search phase that characterize the third stage.



**Figure 34** - How SAES resolved the search tensions during the third stage

### 6.3 Discussion

The case study we presented in the previous paragraph provides a good example of the how ambidexterity capability can actually be achieved and maintained. Before discussing in depth how the ambidexterity capability is achieved and maintained by SAES, we think it is useful to say a few words to describe the tensions that emerge in the search phase.

The case study in fact emphasizes two main dimensions that cause tensions in the search phase and that should be managed: the first dimension, widely recognized in the exploration vs. exploitation literature, concerns the proximity of the knowledge that is generated within the search phase, while the second dimension concerns the nature of the searched-for knowledge. The former emphasizes the fact that companies should search for knowledge which is either known or new to the organization. The latter concerns the nature of the knowledge, specifically the tension existing between market and technological domains. In this context, being ambidextrous means that SAES has to be able to both generate local and distant searches within both market and technological domains. In other words, exploitation thus involves both local technological search that builds on a firm's existing technology field with the goal of deepening the technological capability, and local market search that builds

on the generation of market intelligence pertaining to current needs and is linked to exploiting existing competencies within a familiar frame of reference (Nerkar and Roberts, 2004; Jansen, Van Den Bosch and Volberda, 2006). Exploration similarly involves both distant technological search defined as search that leads to a broadening of the technological capability, search for new technology within or outside the firm's organizational boundary or technology field, and distant market search defined as knowledge search in the peripheral environment, and new markets and services that the firm does not at present emphasize in order to assess the market potential of opportunities outside of immediate markets. This result is in line with the different definitions of exploration and exploitation that can be found in the literature: Ahuja and Lampert (2001), for example, define exploration and exploitation on the basis of knowledge distance along the technical dimension, Danneels (2002) defines exploration and exploitation according to two dimensions of competence used in product innovation (technology and market), Jansen, Van Den Bosch and Volberda (2006) define exploration and exploitation in terms of the search for new or existing knowledge on the customers/markets, etc.

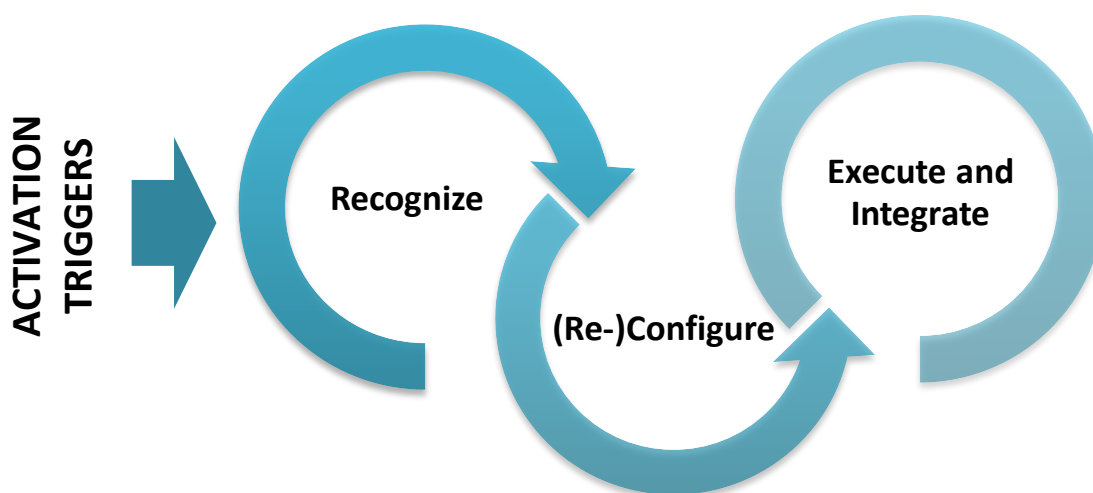
As the case study outlines, these tensions do not remain the same over time but change as a consequence of the changing strategic objectives of the firm: as the competitive environment exhibits increasing turbulence, existing tensions are in fact amplified and new tensions arise. As a consequence, how the company organizes its organizational structure, the mechanisms for integrating competing activities and how search practices are carried out change over time as well. As environments shift, resources are in fact reallocated by senior managers to reconfigure the organization to match changing environments and tensions. This is in line with more recent researches that equate ambidexterity with a dynamic capability, the ability to maintain ecological fitness and, when necessary, to reconfigure existing assets and develop the new skills needed to address emerging threats and opportunities (Eisenhardt and Martin, 2000; Helfat and Peteraf, 2003; Teece, Pisano and Shuen, 1997; Winter, 2003; O'Reilly and Tushman, 2008).

Nevertheless, how can organizations succeed in building this capability? As the case study analyzed shows, ambidexterity is not simply rooted in an individual's ability to divide time between competing activities as suggested by Gibson and Birkinshaw (2004); nor is ambidexterity simply a matter of organizational structure (Tushman and O'Reilly, 1996; Gupta, Smith and Shalley, 2006) but the case study suggests that ambidexterity, in all the historical stages of the case firm analyzed, is the result of a three-phased process that leads to the achievement of the ambidexterity capability (Figure 35).

In the first phase top management senses the tensions that characterize the search phase of the innovation process, such as the search for improving existing knowledge while concurrently searching in order to generate completely new knowledge both in the technological and market domains. In the second phase top management combines and recombines, shapes and reshapes the organizational assets and structure and designs the necessary integration mechanisms in order to resolve tensions and respond to changes in the market and in technologies. Coherently with the directions of the top management, the execution phase involves the employees, who carry out search practices with the aim of guaranteeing high levels of both the poles of the previously identified tensions. This phase is very important because without it firms may only become aware of tensions but will not be able to really resolve them and, in this way, benefit from them.

The process, as depicted in Figure 35, does not follow a perfectly sequential path: the movement from recognition down to the execution phase is not linear. By depicting each phase as a circle, our intent is therefore to underline the recursive nature of the process and that the three phases are deeply linked to each other and concurrently performed. If we consider for example the configuration phase, we notice that it does not only build on the preceding recognition phase but it is also determined by the output of the subsequent execution phase. We have additionally observed that this process repeats itself within the three subsequent stages that characterize the history of the firm and it is activated by changes within the competitive environment - the “Activation Triggers” - that lead the company to redefine the search's strategic objectives and therefore to the arise of new tensions (or to changing magnitude of the existing ones) which in turns leads to a different execution of the search practices.

It is therefore important to point out that what we present in the following paragraph is a simplified view of a process whose dynamics are in actual fact extremely complicated and highly complex.



**Figure 35** - The interpretative model for building ambidexterity

### 6.3.1 First phase: recognize

The process begins, at strategic level, when top management becomes aware of the contrasting strategic objectives and tensions that characterize the search phase. We call this phase “Recognize” for the reason that managers not only are receptive towards tensions but also become aware that succeeding in realizing different and contradictory goals to their maximum and in a simultaneous way is a core premise for being competitive.

Quickly recognizing tensions and their evolution is as important as it is hard to do. It requires managers with a dual mind-set and capacities, who are able, in other words, whether consciously or not, to perform “paradoxical thinking”; they should be able to sense signals from the external context and translate them into strategic objectives.

As the case study shows, SAES's top management succeeds in identifying changes in existing tensions and the emergence of new tensions in the search phase which is strongly related to the varying dynamicity, complexity and competitive threats of the environment. In fact, as the company moves from a stable competitive environment, in which it operates in conditions of a quasi-monopoly, to a competitive environment which is increasingly dynamic, complex and characterized by growing competitive pressure, managers become aware that it is necessary to manage both the tension between market and technology as well as that between local and distant search (Tables 81 and 82). Before the 1980s, for example, SAES’s business environment is stable, characterized by low complexity and a small number of very few companies who fuel the competition. Technology exploration activities (Distant Technology Search) are, at that time, treated like add-on programmes, i.e. not strictly necessary. The only exploratory effort of the firm is directed towards the market dimension. However, starting from the early 1980s, due to increasing dynamism, complexity and competitive intensity, the demand for new and explorative technologies rises.

ENVIRONMENT DIMENSIONS	STAGE 1	STAGE 2	STAGE 3
<b>Supply-side Dynamism</b>	-	+	++
<b>Demand-side Dynamism</b>	-	+	++
<b>Macro-side Dynamism</b>	-	+	++
<b>Complexity</b>	-	+	++
<b>Competitive Threat</b>	-	+	++

**Table 81** - Overview of the changes in the competitive environment

ENTITY OF THE SEARCH TENSIONS	STAGE 1	STAGE 2	STAGE 3
<b>Local market search vs. Local technology search</b>	++	++	+++
<b>Distant market search vs. Distant technology search</b>	-	+	++
<b>Local market search vs. Distant market search</b>	+	++	++
<b>Local technology search vs. Distant technology search</b>	-	+	++

**Table 82** - Search tensions across the three stages

Top management's capability in sensing tensions and their evolution is a necessary prerequisite for building ambidexterity. It is the spark that triggers the process: in fact managers who have the capability to recognize and value tensions retain the potential for laying the foundations on which ambidexterity will be built. The output of the recognition phase is in fact a clear statement of the strategic objectives that represent the keystones for both the configuration and execution phases.

### 6.3.2 Second phase: (re-)configure

---

As stated in the previous paragraph, the output of the first phase is a clear picture of the strategic tensions that the firm has to face and resolve in order to gain competitive advantages. Tensions within the search phase appear as paradoxes: our respondents in fact visibly describe opposing poles as complementary and both necessary, even if they call for contrasting strategic objectives. In order to achieve these objectives, top management is then called upon to configure and re-configure, shape and re-shape the organizational assets and structure and adequate integration mechanisms in order to, on the one hand, guarantee that strategic objectives are reached within a varying competitive environment and on the other ensure that the different strategic objectives are attained in a synergetic way.

In other words, within the second phase top management is therefore called upon to choose and shape the most adequate organizational design and the formal integration mechanisms by building on the available resources.

Looking at the organizational solution adopted by the firm to achieve ambidexterity, the case study analyzed shows that increasing dynamisms, complexity and competitive threats of the environment correspond to a shift from contextual solutions to structural solutions (Table 83). In stable environments there is no spatial separation between competing activities: local and distant search on the one hand and market and technology search on the other, are indeed embedded in the same unit and employees, and, according to Gibson and Birkinshaw (2004), they are expected to use their own judgment as to how to divide their time between local and distant, market and technology search activities. However, as the environment becomes more turbulent, a structural separation is perceived to be the best solution. Physically separating competing activities helps to avoid confusion, perplexity and conflicts while simultaneously ensuring high specialization in different tasks such as monitoring the market or monitoring the technology, the search for distant or proximate knowledge respectively. A structural solution is adopted for the reason that it conveys higher specialization and focalization of roles involved in the searching activities. Clearly, focusing actions helps in fact to maximize the different benefits of contrasting poles by maintaining multiple competencies within the organization (Gilbert, 2005): this allows complex activities to be split up into small, more elementary tasks, thus making employees fully understand what their jobs are, who they have to report to and how they should do their work. As Fang, Lee and Shilling (2010, p. 625) observe: "evolving populations are typically divided into small

subgroups that are sufficiently isolated from one another to limit mating across subgroups. This isolation permits subgroups to maintain genetic diversity and to explore more diverse solutions in the space of possibilities”.

Within the technology domain the shift from a contextual to a structural solution is even more stressed. The contextual solution that characterizes the second phase, where dynamism, complexity and competitive threats are still modest, becomes inadequate when the environment becomes more turbulent and hostile as a consequence of unforeseen shocks and discontinuous events that transform the world and set up new game rules. Top managers are in fact aware that in order to survive in such an environment it is not only sufficient to search for new technological solutions but it is also necessary to search for new technological knowledge for which immediate market applications might not be clear. In such a context relying on individuals is not effective because it would cause them stress, and burden them with tasks which go beyond their rationalities and capacities. A structural separation is therefore planned. However, simply separating R&D into two distinct sub-units would be inefficient for the reason that this structural separation would cause resource duplications and it would take too long to reach full implementation. An extreme structural solution is therefore implemented where a new company is created outside the firm boundary. This new company is the result of a partnership between SAES and a research centre which possesses high exploration capabilities in different technological fields. We label this form of ambidexterity solution as “Inter-firm Structural Ambidexterity” for the reason that it shifts the topic of how ambidexterity can be realized from an intra-organizational level (through the adaptation of organizational architectures in order to better fit the changes in competitive environment) to an inter-organizational level where ambidexterity is realized thanks to cooperation, coordination and responsiveness among two or more partners. According to Oliver (1990) and Folta (1998) this solution provides a way to spread risk and to more promptly respond to rapid technological changes and uncertainties.

The choice of creating structurally separate units goes hand-in-hand with the design of formal integration mechanisms that have the aim of coordinating the efforts of all the specialists involved in search activities thus reconciling their distinct objectives. Top management's efforts to integrate separate units become more and more critical, moving from a contextual solution to a structural solution: increasingly top management's attention is in fact focused on the configuration of formal integration mechanisms. Therefore, while the contextual solution is accompanied mainly by informal mechanisms, formal integration mechanisms are shaped within the structural solution (Table 83). Considerable efforts are in fact dedicated to periodic top management meetings (SAES's innovation committees), which are structural mechanisms that, according to Daft and Lengel (1984; 1986), provide opportunities for sharing understanding, debating issues, and developing consensus on problem definitions. An important contribution to the integration of the market and the technology domains comes also from a dedicated unit, the Application Labs, created at the end of the second stage, whose role is precisely that of joining technological development with the market requirements. Formal project leadership is another key integration mechanism: when SAES constitutes the new company, the responsibility of the project is put into the hands of the corporate R&D director, who retains authority over all aspects of the project. By relying on his authority and expertise he acts as a “bridge” between the project team involved in the new company, the R&D of Lainate and senior management: in other

words, he is a formally recognized channel for knowledge transmission. Finally, SAES is actually investing in knowledge management which is expected to facilitate coordination, to increase the speed of communication and to widen the scope of the information network thus fostering knowledge sharing (Dean and Snell, 1991; Hitt, Hoskisson, and Nixon 1993; Adler, 1995; Fulk and DeSanctis, 1995).

ENVIRONMENTAL DYNAMISM, COMPLEXITY AND COMPETITIVE THREATS			
	LOW	MEDIUM	HIGH
<b>Tension resolution</b>	<ul style="list-style-type: none"> <li>• <i>Contextual</i> for the market domain</li> <li>• <i>Structural separation</i> between market and technology domains</li> </ul>	<ul style="list-style-type: none"> <li>• <i>Structural separation</i> between market and technology domains</li> <li>• <i>Structural separation</i> for the market domain</li> <li>• <i>Contextual</i> for the technology domain</li> </ul>	<ul style="list-style-type: none"> <li>• <i>Structural separation</i> between market and technology domains</li> <li>• <i>Structural separation</i> for the market domain</li> <li>• <i>Mixed form</i>: contextual and structural separation (outside the firm's boundaries) for the technology domain</li> </ul>
<b>Formal integration mechanisms</b>	<ul style="list-style-type: none"> <li>• Periodic top management meetings</li> </ul>	<ul style="list-style-type: none"> <li>• Periodic top management meetings</li> <li>• Dedicated unit</li> </ul>	<ul style="list-style-type: none"> <li>• Periodic top management meetings</li> <li>• Dedicated unit</li> <li>• Formal project leadership</li> <li>• Knowledge management</li> </ul>

**Table 83 - Organizational solutions for resolving tensions and their corresponding integration mechanisms**

### 6.3.3 Third phase: execute and integrate

While the recognition and (re-)configuration phases, carried out at strategic level, create the potential for ambidexterity by providing the grounds, organizational structure and formal integration mechanisms through which it is possible to manage search tensions, in order to realize that potential, searches should be executed at the operative level. It is clear that the two last phases are strongly related to one another because the execution of activities may reveal some key points that require some reconfiguration and adjustments.

In this phase employees have clear what their objectives are, what their jobs are and how they should do their work. To this end, the role played by the top management meetings (innovation committees), previously described as one of the formal integration mechanisms, is extremely important. In these meetings senior managers from the different functions and

units (Business managers, R&D director, entrepreneurs, etc.) converge. During these meetings they assimilate the strategic objectives and translate them at the operative level where they are in charge of creating convergence and enthusiasm among employees around specific goals. In other words, they should indicate to employees the purpose that should be realized through the implementation of search practices. They should make employees aware of the challenges that arise from the dynamically changing environment. This is a hard task: the increasing turbulence of the competitive environment that brings with it the rise of new tensions and the increased magnitude of existing tensions correspond to both new purposes and a greater emphasis on existing ones.

It is important to underline that the translation of objectives from the strategic level to the operative one should not be reduced to management directives that the people concerned just have to comply with, whether they like it or not. There are in fact strong information and training activities that should be carried out: lower level and middle management and employees must be convinced, for example, of the need for change. In other words there is a nonstop negotiation effort. Top management therefore not only translates the objectives from the strategic level to the operative one but it is also responsible for supporting employees by establishing the principles, values and culture that should guide the search efforts as well as adapting to changing environmental conditions. In stable condition SAES's principles at the basis of search practices value reliability, low risk, low tolerance of ambiguity and efficiency while, when the environment becomes more turbulent, these principles move towards a higher tolerance of risk and ambiguity, greater receptivity to innovation, and active resistance to bureaucracy. There is also a shift from a closed external orientation, which is mainly short-term and reactive, to an external orientation that is very open and long-term oriented.

Guided by the principles and the values described above employees put a series of procedures in place with the aim of realizing the different search purposes. Searches aimed at improving knowledge about existing markets and products are, for example, realized through traditional market research tools, focus-groups, brainstorming, and periodic contact with customers while searches aimed at identifying potential new products and markets are realized through scenario planning techniques and future analysis. In particular, moving from a stable to a turbulent environment, there is a shift from the formal, stable procedures and rules, mentioned above, towards more dynamic procedures based on cooperation, internal networking among employees (frequent contact between employees, team working, open-wide system for ideas submission are only some examples) and openness towards external actors, for example universities or research centres, with whom to collaborate and transfer knowledge. These procedures are of course slowly embodied by the employees who adapt them to the specific context and characteristics of the specific function and unit they belong to. According to Antonacopoulou and Pesqueux (2010), "procedures are contextually specific and they are reflective of the cultural and social conditions that shape the space a practice occupies in the place in which it is performed" (p. 14).

What has been said so far paints a picture showing that in all the three stages there are several people, located in different places, who perform diverse search practices with sometimes conflicting objectives. The result of performing such procedures is the generation of both local and distant, market and technology knowledge that needs to be synthesized and integrated through integration mechanisms aimed at achieving synergies. Drawing on

the case study analyzed, it appears that within a stable competitive environment, where contextual configuration is chosen, integration occurs mainly at individual level: employees are in fact expected to use “their own judgment as to how they divide their time between competing activities” (Gibson and Birkinshaw, 2004). The case company illustrates this description, showing that when local and distant search are embedded in the same unit, employees are flexible when sharing their time between two tasks. Employees should therefore retain dual mind-sets and capacities.

However, as the environment becomes increasingly turbulent and a structural solution is adopted, integration is best achieved through vertically imposed bureaucratic processes, described in the previous paragraphs, which coordinate the efforts of many specialists within the organization. There is nothing surprising about this: several studies in fact agree that the integration of structurally separated units should be carried out at top management level to make sure that the knowledge generated is consistent with the vision and strategy of the firm: in order to integrate the knowledge created among the scientific, technological and marketing functions, SAES in fact creates two senior manager committees and one specialized business unit. Within such committees senior managers provide “a compelling vision and strategic intent, a clear consensus and commitment within the team, the skills to manage differentiated sub-units with aligned sub-unit organizational architectures with clearly defined interfaces to leverage existing assets, and the ability to resolve the inevitable conflicts that this design entails” (O'Reilly and Tushman, 2008, p. 46). SAES's case however highlights that integration between separate units not only occurs at a strategic level but may involve also the individual level. Even though a physical separation exists between market and technology units, all the business managers in charge of monitoring the market, have in fact been trained within the R&D laboratories, thus developing robust technological competences and so facilitating the rise of synergies between the two domains. Additionally, all separated units are located within a circumscribed area and the resulting proximity is extremely important in order to foster socialization, to create mutual information exchanges and to achieve high synergies among the knowledge generated. This is not the case of the New Company created during the third stage. When the firm decides to create the New Company (ETC) the objective is in fact to foster search activities capable of detecting signals about potential technologies that lie far outside the mainstream of SAES's competences. In this case the activities of the two companies (SAES and the New Company) do not have to influence each other and there is no synergy to be realized between the knowledge that is generated within the two sites. The integration of SAES and the new company is therefore made only through the Corporate R&D manager, a key figure who presents all the distinctive features of the ambidextrous individual: he “takes the initiative and is alert to opportunities beyond the confines of [his] own job”, he “is cooperative and seek[s] out opportunities to combine [his] efforts with others”, he “is [a] broker, always looking to build internal linkages”, he “is [a] multitasker and is comfortable wearing more than one hat” (Birkinshaw and Gibson, 2004, p. 49).

## 7 CONCLUSIONS AND IMPLICATIONS

In this final section we comment on three things: the answer to our research questions, the theoretical and managerial implications, and finally some thoughts on limits and future research.

### 7.1 Answer to research questions

Building on the results of a systematic literature review that outlined some gaps, we formulated three research questions in chapter 2. In this paragraph we briefly answer each research question by referring to the results obtained in the empirical sections of this dissertation.

The first question concerns the relationship between practices implemented by firms in order to generate local and distant knowledge and ambidexterity capability.

**Are there any differences, in terms of search practices, between firms that show ambidexterity capability in the search phase of the innovation process and firms that do not show such a capability? What are these differences?**

To answer this question, a survey has been designed with the purpose of collecting data about the use, by high and medium technology firms, of some search practices identified in the literature and through case studies carried out within an international network.

To better evaluate the content and value of search practices, two exploratory factor analyses have been first conducted on the data: a total of ten meaningful factors (latent variables), six for distant search and four for local search have been extracted. These factors represent the different dimensions through which search activities, local and distant, can be carried out.

We have therefore classified firms into two groups: one group comprises the firms that show ambidexterity capability in the search phase while the other group clusters together those firms that do not show ambidexterity capability. The two groups have then been confronted on the basis of the ten local and distant search dimensions identified with the exploratory factor analysis.

Results show that statistically significant differences exist between ambidextrous and non-ambidextrous firms. The distinctive traits of search dimensions that characterize ambidextrous firms in the search phase have therefore been identified. The overall statistical results in fact reveal that firms in the “ambidexterity” cluster are characterized by a greater

propensity in the creation of internal networks that link together individuals with different background and skills thus fostering knowledge and experience exchange and facilitating a cross fertilization process. Firms within this cluster also show greater organizational support and the use of practices that convey high involvement in the innovation efforts across the whole organization, providing, for example, strong incentives for those employees who propose innovative ideas. Within the ambidextrous group great attention is also paid to the establishment of deep connections with external actors in order to continuously keep up-to-date with developments in a particular field of expertise and to systematically monitor and collect ideas and opinions. Furthermore, ambidextrous firms pay more attention, when compared to firms that belong to the other cluster, to having a dedicated and specialized group of people who carry out market and technology exploration activities. Finally, ambidextrous firms, and in particular B2C ambidextrous firms, are more engaged in closer connections with final customers in order to obtain regular feedback on their demands and to generate useful insights for the improvement of the existing offer.

With the first research question we have verified that there are differences between firms that show ambidexterity capability and firms that do not possess such a capability when considering the search phase of the innovation process and not the whole organization. This result suggests that adopting a more fine-grained level of analysis, such as the search phase, is a suitable choice. This first analysis, where practices are considered as a black-box, however, has not allowed us to go more in depth into how the ambidexterity capability in the search phase can be achieved. With the second research question our intent is therefore to contribute to the understanding of how firms can succeed in building ambidexterity capability in the search phase.

### **How can firms succeed in realizing ambidexterity capability in the search phase?**

Seeking to learn from an ambidextrous exemplar, we have studied a case firm which is a good example of how firms can succeed in resolving tensions and building ambidexterity capability within the search phase. By unpacking the search practices and analyzing their dimensions (purpose, practitioners, places, principles, procedures, past and present) we have been able to understand more about how organizations can realize ambidexterity capability within the search phase.

Our results show that ambidexterity is not simply rooted in an individual's ability to divide time between competing activities, as suggested by Gibson and Birkinshaw (2004), nor is it simply a matter of organizational structure (Tushman and O'Reilly, 1996; Gupta, Smith and Shalley, 2006), nor is it only determined by the role of top managers (Jansen, George, Van den Bosch and Volberda, 2008). The analysis of the internal structure of search practices shows that architectural and contextual issues and managers' role coexist and are deeply linked in building and sustaining ambidexterity.

Additionally, our results show that ambidexterity is achieved through a three-phased process, where both strategic and operative levels are involved. The first two phases (recognize and configure) are carried out at strategic level and create the potential for ambidexterity by providing the ground, the principles and some issues regarding the organizational structure and systems implemented to face tensions. They are then translated into operative procedures executed in the third phase by employees.

In this picture a distinction between “potential” and “realized” ambidexterity capability appear. Potential ambidexterity capability refers to the recognition and configuration phases and is achieved where the foundations for realizing ambidexterity capability are built upon the definition of strategic objectives, organizational architecture and context. Only through the execution and integration phase is ambidexterity capability really attained or, in other words, realized. Potential and realized ambidexterity have complementary roles. If taken alone, they accomplish a necessary but insufficient condition for the successful resolution of tensions. Firms are in fact unable to realize ambidexterity if a previous recognition of tension and configuration of structure and context is lacking and, similarly, without execution and integration, firms may only become aware of tensions but not be able to benefit from them.

Potential and realized ambidexterity are connected by top management which plays a critical role in clearly defining and translating at the operative level the strategic objectives that indicate the willingness of the firm to achieve opposite and conflicting objectives. Senior managers therefore are in charge of sharing the company’s vision, principles and values throughout the organization. Our study additionally shows that top management is also responsible for keeping and enhancing integration within the firm. The case study in fact confirms what has emerged in the survey: internal networking, close cooperation and collaboration between people and organizational support are extremely important for the management of tensions and for building ambidexterity capability. Therefore top management acts as a catalyst for ambidexterity along the whole process, and it is important that it has a paradoxical mind-set. According to the paradox literature, having paradoxical thinking in fact turns out to be vital for combating natural, often counterproductive tendencies to over-rationalize or avoid tensions (Poole and Van de Ven 1989; Eisenhardt 2000; Smith and Tushman, 2005).

The state of the competitive environment is considered as a primary source of change within organizations. The third research question therefore concerns the co-evolution of the ambidexterity capability with the competitive environment.

### **How does the achievement of ambidexterity capability change while co-evolving with the external environment?**

Our results show that the organizational solutions adopted to attain ambidexterity capability change along the three main historical stages that characterize SAES, depending on the competitive environment conditions, while the underlying process remains the same. This process in fact repeats itself within the three successive stages which are all characterized by potential (recognition and configuration) and realized (execution) ambidexterity. In each phase, the process is activated by changes within the competitive environment: the “Activation Triggers”.

What emerges is that the choice of organizational solution to achieve ambidexterity is deeply dependent on the dynamisms, complexity and competitive threats of the environment: one single design does not provide the exhaustive functionality required to deal with the entire range of boundary conditions and new tensions faced by an organization over time. More specifically, competitive environment conditions seem to drive companies to follow a specific option in order to achieve ambidexterity.

In particular it is possible to notice that when firms are working in a stable competitive environment the best option to achieve ambidexterity is a contextual solution, by leaving employees free to make choices on how to divide time between competing activities. When the competitive environment becomes increasingly dynamic, complex and characterized by growing competitive pressure, a physical separation of competing activities is the best option: physically separating competing activities helps in fact to avoid confusion, perplexity and conflicts while simultaneously ensuring high specialization in different tasks, thus maximizing the different benefits of contrasting poles and maintaining multiple competencies within the organization. When the competitive environment becomes hypercompetitive and there are no synergies or linking point between competing activities, inter-firm structural separation is preferred over intra-firm structural separation.

As the environment becomes increasingly turbulent, the role of top management becomes more and more central. Top management should in fact be able to perceive the changes in existing tensions and the emergence of new tensions in the search phase that correspond to varying dynamicity, complexity and competitive threats in the environment. Subsequently they are in charge of re-configuring and re-shaping the organizational assets and structure and adequate integration mechanisms in order to meet the changed competitive environment.

Additionally, within a stable competitive environment integration occurs mainly at individual level through informal integration mechanisms. Moving from a stable to a turbulent environment there is instead a shift from informal to increasingly formalized and vertically imposed bureaucratic integration mechanisms: top management's efforts at integrating separate units become in fact more and more critical. The literature widely agrees that the integration of separate units occurs at a strategic level. We confirm this position and add that integration may involve also the operative level through the creation of an internal network among employees that fosters socialization and creates mutual information exchanges. Finally, top management is responsible for supporting employees by establishing and adapting (to the changing environmental conditions) the principles, values and culture that should guide the search efforts: while in a stable environment the principles at the basis of search practices value reliability, low risk, low tolerance of ambiguity and efficiency, however, when the environment becomes more turbulent these principles move towards a higher tolerance for risk and ambiguity, greater receptivity to innovation, and active resistance to bureaucracy. There is also a shift from a closed external orientation, which is mainly short-term and reactive, to an external orientation that is very open and long-term oriented.

## **7.2 Theoretical contributions**

The results of this study convey several theoretical implications for both the ambidexterity capability and the innovation management literatures.

First, through bibliometric analysis, we have provided a synthesis of the papers published on ambidexterity and an analysis of the intellectual structure of the field. Recent years have in fact seen a growing interest among scholars in the study of ambidexterity: a quick search in the main management journals shows an exponential growth in the number of articles published on this topic during the last three years. Even though the topic is attracting increasing interest from researchers, the results of the bibliometric analysis show some important issues that may be addressed in further research. Ambidexterity literature is still at an embryonic state and thus represents a fertile land for researchers to cultivate and nurture.

Second, in this dissertation we have opened a new perspective for analyzing ambidexterity, by using a more fine-grained unit of analysis - the search phase of the innovation process - and by adopting a practice-based approach. The results of the survey, by showing that a significant statistical difference exists between firms that show ambidexterity capability in the search phase and firms that do not show such capability when confronted regarding their use of search practices, confirm in fact that it makes sense to analyze ambidexterity through the use of more fine-grained levels of analysis. Adopting such a perspective along with the use of qualitative methods is, in our opinion, the gateway that allows us to develop insights into “how” ambidexterity is really achieved for the reason that they highlight aspects which are not noticeable when using quantitative survey methods or considering a firm level of analysis.

Third, by adopting a qualitative approach and a practice-based perspective, we have succeeded in opening the “black box” of ambidexterity and have provided a first contribution to understand the inner process of ambidexterity capability building. Results of the analysis suggest that we should make a distinction between “potential” and “realized” ambidexterity. These two sides of ambidexterity have complementary roles and are both necessary for achieving competitive advantage. More studies are therefore needed to study this issue more in depth.

Fourth, we have demonstrated the potential value of conducting longitudinal qualitative studies that analyze how the ambidexterity capability co-evolves with the competitive environment. We think that this contribution is very important, since, as Tushman and his colleagues in the special issue of *Organization Science* journal in 2007 clearly state that little is known about how ambidextrous organizations evolve. We confirm that a single design does not provide the exhaustive functionality required to deal with the entire range of boundary conditions: on the contrary, organizational structure and integration mechanisms are deeply dependent on the traits of the competitive environment.

As regards the innovation management literature, our main contribution is the development of some scales to measure the different dimensions of local and distant search activities. Researchers can in fact use search components to build structural models and test hypotheses by linking search factors, for example, to organizational performances such as quality, profitability, etc. In our case, guided by the first objective of this study, we have used these factors in order to verify whether any difference between two clusters of firms exists.

### 7.3 Practical contributions

There are some important implications for practice that can be derived from both the quantitative and the qualitative studies constituting this dissertation.

First, the results of the literature analysis informs practitioners on the concept of ambidexterity and on the importance that such capability has in building the competitive advantages for medium and high tech firms.

Second, the questionnaire, besides being the instrument for collecting the data needed to answer the first research question, plays the role of a diagnostic tool that allows firms to have a picture of how they rate in terms of search practices. Managers can in fact use these factors to guide them in their local and distant knowledge search strengths: the search dimensions and practices that constitute them, can act as a catalyst for companies to analyze and reflect on their own situation, highlighting any deficiencies in the use of certain practices or suggesting new practices that may not have been taken into account.

Third, the findings of the survey research provide managers with a useful starting point for understanding the distinctive traits of search dimensions that characterize firms showing ambidexterity capability in the search phase if confronted with firms that do not show this capability. Starting from our results, managers can in fact find a useful guide for formulating the appropriate strategies that foster both the generation of local and distant knowledge.

Fourth, building both on the quantitative study's empirical findings and the case study evidence, the following recommendations for managers can be derived.

- When managers face tensions, they should be able to perceive them according to a "both/and" approach and not an "either/or" approach. In other words, they should value each side of the tensions as well as the synergies between opposite poles: top management should have a paradoxical mind-set.
- Managers should clearly establish and communicate a common vision, principles, values that should represent the background of their search efforts. Building and communicating this common vision and values throughout the whole organization could in fact help in reducing anxiety, stress and frustrations by supporting a paradox oriented mind-set also at the operative level. Having paradoxical thinking, in fact, turns out to be vital for combating natural, often counterproductive tendencies to over-rationalize or avoid tensions.
- Managers should be particularly sensitive to environmental changes and promptly adapt organizational design and integration mechanisms in order to resolve new tensions that arise and those tensions that change in their magnitude by maintaining high synergy between conflicting activities. In this way they have to consider ambidexterity as a dynamic capability that has to co-evolve with the external environment. This means that one single best solution does not exist but firms have to search each time for the one that better fits the external context.
- It is not only managers who should have a paradoxical mind-set, but also employees, in particular when a contextual solution is adopted, employees should be able to push for ambitious goals and validate the importance of competing activities
- Both managers and employees should contribute to fostering and nurturing internal networking, close cooperation and collaboration. Having close connections and

communication within the firm is in fact extremely important for the management of tensions and for building ambidexterity capability.

#### **7.4 Limitations and suggestions for future research**

We hope this research has contributed to a greater understanding of ambidexterity in medium-high tech firms. While we have found some important and interesting results, this study is a first step in many respects. Future research should build on the results presented here.

There are however several limitations of this study that merit discussion.

Some first limitations regard the survey methodology. Although the survey has allowed us to develop a valid and reliable instrument for measuring search practices dimensions, this result should be considered as a preliminary measurement instrument that is susceptible to further improvements. As a consequence, future studies that extend, refine and strengthen the constructs identified (search dimensions), by adding indicators bolstering the discriminant and convergent validity, are in fact needed. It is reasonable to use exploratory factor analysis to generate a theory about the constructs that should be followed by a confirmatory factor analysis, but this must be done using separate data sets. If the results of exploratory factor analysis are in fact directly put into a confirmatory factor analysis on the same data, the data are merely fitted, and constructs are not fully generalizable. The confirmatory factor analysis we carried out on local and distant search dimensions was in fact aimed only at obtaining some indications about the model fit: confirmatory factor analysis should therefore be conducted on data coming from a different sample. Another limit concerns the low number of firms that answered the questionnaire: there is no doubt that we would have greater confidence in the results if the size of the sample was greater. While it might be said that the sample size in this study is sufficient, a larger sample could provide more robust results and would also provide the opportunity to conduct cross-validation and confirmatory factor analysis. Future studies may also benefit from collaborative efforts among researchers working in this area (researchers within the innovation lab), which might increase the sample size and also collect data from different countries.

Second, the scope of our study, both quantitative and qualitative, is limited to high technology organizations. We chose to focus on medium and high tech companies because there are numerous studies in the literature that have tested the positive association between ambidexterity capability within medium and high tech firms and financial and innovative performances; also the search practices considered are suitable for high technology industries. As a consequence, our results regarding ambidexterity capability and search dimensions cannot be extended beyond these contingencies. However, what is not fully understood is if all organizations really need to build ambidexterity capability in order to survive and be competitive. Is there a contingency perspective to organizational ambidexterity? Further studies could address this gap.

Third, in the previous paragraphs we have stated that it is necessary, for building and maintaining ambidexterity capability, that managers and employees have a double mind-set and should be capable of paradoxical thinking. However, it is not fully understood how they should develop such paradoxical thinking. The case study analyzed suggests that an important role may be played by training practices, socialization practices, team working and job rotation practices that support the enhancement and enlargement of employees' skills, the sharing of information and collaboration efforts. Further studies are needed to analyze these aspects more in depth. To this purpose, we suggest studying ambidexterity by adopting an individual level of analysis.

Fourth, future studies should continue to pursue a longitudinal approach to investigating ambidexterity: only longitudinal designs are in fact able to fully explain ambidexterity, described as a dynamic capability. Cross-sectional studies lack the ability to fully capture such a phenomenon and its evolution.

Finally, our case stressed the role of top management in achieving ambidexterity. This is due to the fact that the organizational context of the firm analyzed is mainly characterized by a "leadership perspective" (Cannella and Monroe, 1997; Rowe, 2001) where top management can and should "dare to take the responsibility of imposing a new strategic agenda in the organization and should be at the forefront in breaking away from organizational inheritance where necessary and to impose their will on the organization" (De Wit and Meyer, 2005). As a consequence, our results cannot be extended beyond this contingency. A competing perspective however exists and is not considered in this dissertation: it is the "organizational dynamics perspective" that places strong emphasis on chaos and facilitating bottom-up processes of self-organizations: in other words, organizational developments are the result of a bottom-up process. The question now is: how do firms that follow this perspective succeed in achieving ambidexterity? We therefore encourage future studies to extend our results by analyzing the ambidexterity capability also by considering firms that have an "organizational dynamics perspective". Such studies will be vital to extending and refining the lessons learned here.

## 8 APPENDIX A

ARTICLE	THEORETICAL LENS	DEFINITION	TENSION
<i>Tushman and O'Reilly (1996)</i>	Organizational design	The <u>ability</u> to simultaneously pursue both incremental and discontinuous innovation and change that result from hosting multiple contradictory structures, processes, and cultures within the same firm.	Incremental innovation vs. Discontinuous innovation
<i>Adler et al. (1999)</i>	Organizational design	Exceptional <u>capability</u> for both first-order and second-order learning.	Efficiency vs. Flexibility
<i>Birkinshaw and Gibson (2004)</i>	Organizational design	The behavioural <u>capacity</u> to simultaneously demonstrate alignment and adaptability across an entire business unit. Contextual ambidexterity can be viewed as a meta-level capacity that permeates all functions and levels in a unit, rather than as a “dual structure” in which the two demands are kept separate.	Alignment vs. Adaptability
<i>Gibson and Birkinshaw (2004)</i>	Organizational design	The behavioral <u>capacity</u> to simultaneously demonstrate alignment and adaptability across an entire business unit. Contextual ambidexterity can be viewed as a meta-level capacity that permeates all functions and levels in a unit, rather than as a “dual structure” in which the two demands are kept separate.	Alignment vs. Adaptability
<i>He and Wong (2004)</i>	Innovation management	The <u>capability</u> to operate in both mature markets and develop new products and services for emerging markets.	Explorative innovation vs. Exploitative innovation
<i>Smith and Tushman (2005)</i>	Strategic management	The organization's <u>ability</u> to adapt and change through innovation while simultaneously continuing to perform in the short term	Exploration vs. Exploitation Cognitive differentiation vs. Cognitive integration
<i>Gupta et al. (2006)</i>	Organizational learning	Firms that are <u>able</u> to deploy both exploration and exploitation strategies at the same time	Exploration vs. Exploitation

<i>Lubatkin et al. (2006)</i>	Strategic management	Ambidextrous firms are <u>capable</u> of exploiting existing competences as well as exploring new opportunities with equal dexterity.	New opportunity exploration vs. Existing competence exploitation
<i>Cegarra-Navarro and Dewhurst (2007)</i>	Organizational learning	The <u>ability</u> to manage an appropriate balance between exploration and exploitation	Knowledge exploration vs. Knowledge exploitation
<i>Han and Celly (2008)</i>	Strategic management	“Strategic ambidexterity” is the <u>capability</u> that enables a firm to carry out inherently paradoxical strategies that embody and manifest two main strategic objectives.	Few investments vs. Many countries Standardization vs. Innovation.
<i>Im and Rai (2008)</i>	Organizational learning	An organization’s <u>capability</u> to conduct two paradoxical things at the same time by requiring organizations and their people to have two heterogeneous but related skills simultaneously.	Exploitative knowledge sharing vs. Explorative knowledge sharing
<i>Jansen et al. (2008)</i>	Innovation management	Organizations <u>capable</u> of pursuing exploration and exploitation simultaneously.	Exploratory innovation vs. Exploitative innovation
<i>Judge and Blocker (2008)</i>	Strategic management	“Strategic ambidexterity” is the <u>ability</u> to simultaneously pursue exploitation and exploratory strategies in ways that lead to enhanced organizational effectiveness	Exploitation of existing markets vs. Exploration of new market opportunities.
<i>Menguc and Auh (2008)</i>	Strategic management	A firm's higher-order <u>capability</u> of simultaneously pursuing competing, contradictory, discrete capabilities	Efficiency vs. Growth
<i>O'Reilly and Tushman (2008)</i>	Strategic management	A specific <u>capability</u> embodied in senior leadership’s learning and expressed through their ability to reconfigure existing organizational assets and competencies in a repeatable way to adapt to changing circumstances.	Exploration vs. Exploitation
<i>Tiwana (2008)</i>	Strategic alliances	Alliance ambidexterity is the <u>capacity</u> to simultaneously exhibit alignment with alliance objectives and adaptiveness to changes in the environment	Bridging ties vs. Strong ties
<i>Andriopoulos and Lewis (2009)</i>	Innovation management	The <u>ability</u> to excel at conflicting modes of innovation: at exploiting existing products to enable incremental innovation and at exploring new opportunities to foster more radical innovation.	Profit strategic intent vs. Breakthroughs strategic intent Tight-loose customer orientation vs. Coupling customer orientation Discipline vs. Passion

<i>Cao, Simsek and Zhang (2009)</i>	Strategic management	An ambidextrous firm is one that is <u>capable</u> of both exploiting existing competencies as well as exploring new opportunities	Exploration vs. Exploitation
<i>Cao et al. (2009)</i>	Strategic management	Firm <u>capable</u> of both exploiting existing competencies as well as exploring new opportunities. There exist two distinct but related dimensions of ambidexterity, one pertaining to the balance between exploration and exploitation, “balance dimension of ambidexterity” (BD), and the other pertaining to their combined magnitude, “combined dimension of ambidexterity” (CD)	Competence exploration vs. Competence exploration
<i>Carmeli and Halevi (2009)</i>	Strategic management	The synchronous pursuit of both exploration and exploitation via loosely coupled and differentiated subunits or individuals, each of which specializes in either exploration or exploitation.	Exploration vs. Exploitation
<i>Jansen et al. (2009)</i>	Innovation management	A dynamic <u>capability</u> that refers to the routines and processes by which organizations mobilize, coordinate, and integrate dispersed contradictory efforts, and allocate, reallocate, combine, and recombine resources and assets across differentiated exploratory and exploitative units	Explorative innovation vs. Exploitative innovation
<i>Lichtenthaler and Lichtenthaler (2009)</i>	Open innovation	The authors point to new types of ambidexterity by combining internal and external knowledge processes.	Internal knowledge management processes vs. External knowledge management processes
<i>Luo and Rui (2009)</i>	International venturing	Ambidextrous organizations are <u>able</u> to pursue simultaneous fulfillment of two disparate, and sometimes seemingly conflicting, objectives.	Seek short-term survival vs. Long-term growth Utilize transactional (market-based) capabilities vs. Utilize relational (network-based) capabilities Compete with international business stakeholders vs. Cooperate with international business stakeholders Respond to the external environment vs. Actively influence the external environment Compliance/adaptation to external constraints vs. Influence/change over external constraints

<i>Mom et al. (2009)</i>	Strategic management	A manager's behavioral orientation toward combining exploration and exploitation related activities within a certain period of time	Search for new market needs and technological opportunities vs. Being sensitive to reinforce existing product-market positions Elaborate on existing goals, beliefs, and decisions vs. Reconsider existing goals, beliefs, and decisions Short-term orientation vs. Long-term orientation
<i>Nemanich and Vera (2009)</i>	Organizational learning	The <u>ability</u> to explore new capabilities while exploiting existing ones	Radical learning (exploration) vs. Incremental learning (exploitation)
<i>Rothaermel and Alexandre (2009)</i>	Organizational learning	A firm's <u>ability</u> to simultaneously balance different activities in a trade-off situation.	Sourcing of known technology (exploitation) vs. Sourcing of new technology (exploration) Internal technology sourcing vs. External technology sourcing
<i>Taylor and Helfat (2009)</i>	Innovation management	The <u>ability</u> of managers not only to manage established and new business units simultaneously but also to manage linkages within and across business units during the replacement of a company's core business with a completely new business.	Having well-aligned current businesses vs. Having processes to search for and exploit new business opportunities
<i>Andriopoulos and Lewis (2010)</i>	Innovation management	The <u>ability</u> to excel at conflicting modes of innovation	Long-term adaptability vs. short-term survival Possibilities vs. Constraints Diversity vs. Cohesiveness Passion vs. Discipline
<i>Bodwell and Chermack (2010)</i>	Strategic management	The <u>ability</u> of an organization to embrace and balance deliberate and emergent approaches to strategy at the same time.	Deliberate strategy vs. Emergent strategy
<i>Kristal et al. (2010)</i>	Operation management	The authors define an ambidextrous supply chain strategy from a manufacturer's perspective, as a manufacturing firm's strategic choice to simultaneously pursue both supply chain exploitation and exploration practices.	Explorative supply chain practices vs. Exploitative supply chain practices

**Table 84 – Ambidexterity definitions**

## 9 APPENDIX B

Gent.mo/a [...],

Come Le ho anticipato telefonicamente, La contatto a nome del team italiano del Discontinuos Innovation Lab (DILab) (per maggiori informazioni: <http://www.innovation-lab.org/>), un laboratorio di ricerca avente l'obiettivo di analizzare, ad un livello operativo, il tema dell'innovazione radicale/discontinua.

Il laboratorio promuove la creazione e lo scambio di conoscenze, coinvolgendo molte imprese ed università di diversi Paesi, europei e non (Germania, Francia, Inghilterra, Australia, Danimarca, Spagna, Benelux, Finlandia, Norvegia, Svezia, ed Australia). In Italia, il DILab è guidato dalle Università di Padova e di Pisa.

Partecipare al network offre l'opportunità di conoscere i nuovi approcci che le imprese stanno adottando sul tema dell'innovazione radicale/discontinua: oltre a workshop periodici a livello internazionale, si terrà un convegno in Italia per presentare i risultati della ricerca condotta presso le maggiori imprese high e medium tech italiane, con la possibilità di conoscere i dati dell'indagine su diversi settori.

Il questionario proposto è inoltre un efficace strumento di analisi e riflessione sulla propria realtà. Alle aziende partecipanti sarà inviato un report finale personalizzato contenente un'analisi di posizionamento dell'azienda rispetto al proprio settore, sul tema dell'innovazione

Verrà infine offerta, alle aziende che aderiranno, l'opportunità di entrare nella community DILab, i cui membri condividono pratiche ed esperienze attraverso momenti di confronto e dibattito.

Siamo certi che l'iniziativa possa interessare la Sua azienda ed è per questo che chiediamo la Sua cortese collaborazione.

Abbiamo pertanto predisposto un questionario online, che intende analizzare le pratiche attualmente adottate dalle imprese italiane con riferimento al duplice obiettivo che queste pratiche possono avere:

1. per generare idee e conoscenza rivolte ad incrementare la base di conoscenze esistenti in azienda (IDEE INCREMENTALI)
2. per generare idee e conoscenza completamente nuove per l'azienda ed in grado di ampliare la base di conoscenze esistenti in azienda (IDEE RADICALI).

Il questionario è accessibile e compilabile al link seguente:

[LINK PERSONALE AL QUESTIONARIO]

Per la compilazione del questionario è sufficiente seguire le seguenti indicazioni:

- Andare al link indicato (qualora il link non fosse abilitato copiare il link e incollarlo nella barra degli indirizzi del browser)
- Seguire le istruzioni via via riportate per fornire le risposte. E' possibile uscire dal questionario e riprenderlo successivamente cliccando nuovamente sul medesimo link senza perdere i dati delle pagine precedentemente compilate. Il salvataggio dei dati inseriti avviene nel momento in cui si seleziona "NEXT PAGE"
- In ogni momento è possibile tornare alle pagine precedenti selezionando "PREVIOUS PAGE"
- Una volta concluso il questionario è importante selezionare il pulsante "DONE": il link viene in questo modo disattivato

Sottolineiamo che per proteggere le informazioni che vengono trasmesse, i dati vengono criptati tramite la tecnologia SSL (Secure Socket Layer) e che, ovviamente, le informazioni saranno trattate nel rispetto assoluto della privacy.

Per eventuali problemi in fase di compilazione non esitati a contattare:

*Ing. Silvia Cantarello*  
*Dipartimento di Tecnica e Gestione dei Sistemi Industriali (DTG)*  
*Università degli Studi di Padova*  
*telefono: [...]*  
*e-mail: [...]*

RingraziandoLa anticipatamente per la collaborazione, colgo l'occasione per porgerLe distinti saluti.

Here's an extract of the questionnaire, containing only the questions that have been used for the statistical analysis presented in Chapter 5.

**TUTTE LE INFORMAZIONI INSERITE SONO PRETTAMENTE CONFIDENZIALI E  
NON SARANNO CONDIVISE CON TERZI**

Le domande contrassegnate da asterisco \* sono obbligatorie  
Le domande contrassegnate da un cerchio richiedono un'unica risposta  
Le domande contrassegnate da un quadrato ammettono più di una risposta

**INFORMAZIONI GENERALI**

**\*Inserisca il nome dell'azienda**

**Indichi il Suo nome**

**\*Indichi la Sua funzione di appartenenza**

- R&S (Ricerca e Sviluppo)     ICT     Direzione Generale  
 Marketing     Produzione  
Altro (specificare)

**\* Qual è l'approccio al mercato che meglio descrive l'azienda?**

- B2B     B2C     Centro di ricerca

**Indichi la percentuale di incidenza sul fatturato delle spese in Ricerca e Sviluppo nei  
seguenti anni**

% 2006      
% 2007      
% 2008

## PRATICHE PER IL SEARCH

Le chiediamo di esprimere una valutazione, per ciascuna pratica, relativamente ai seguenti aspetti:

- **l'uso effettivo della pratica** nella SUA AZIENDA per la generazione di conoscenza completamente nuova ed in grado di ampliare la base di conoscenze esistenti in azienda (ricerca di IDEE RADICALI)
- **l'uso effettivo della pratica** nella SUA AZIENDA per la generazione di conoscenza volta a migliorare la base di conoscenze già presente in azienda (ricerca di IDEE INCREMENTALI) (laddove richiesto)

La valutazione è espressa in termini di accordo/disaccordo rispetto alle singole affermazioni. I valori della scala utilizzata vanno da 1 a 5 ed assumono i seguenti significati:

- (1) Sono fortemente in disaccordo con l'affermazione
- (2) Non sono d'accordo con l'affermazione
- (3) Non sono né d'accordo né in disaccordo con l'affermazione (sono neutrale)
- (4) Sono d'accordo con l'affermazione
- (5) Sono fortemente d'accordo con l'affermazione

**Si fa ricorso a metodi di ricerca del mercato convenzionali quali ad esempio: focus-group, interviste dirette o telefoniche, survey on line, brainstorming.**

	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
È una pratica utilizzata per la ricerca di IDEE RADICALI	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
È una pratica utilizzata per la ricerca di IDEE INCREMENTALI	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

**E' presente in azienda un gruppo dedicato di persone (ad esempio del marketing, delle vendite, della R&S) che 'esplora' modi innovativi di applicare le tecnologie esistenti a mercati e clienti nuovi.**

	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
È una pratica utilizzata per la ricerca di IDEE RADICALI	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

**E' presente una figura professionale che aiuta i team per l'innovazione a connettersi con il resto dell'azienda laddove è necessaria conoscenza insight.**

	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
È una pratica utilizzata per la ricerca di IDEE RADICALI	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
È una pratica utilizzata per la ricerca di IDEE INCREMENTALI	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

**E' presente personale incaricato di trovare nuove fonti di potenziali idee radicali e di individuare trend e sviluppi che possono avere qualche implicazione per il futuro dell'azienda.**

	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
È una pratica utilizzata per la ricerca di IDEE RADICALI	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

**E' presente un sistema centralizzato per la gestione delle idee, accessibile all'intera azienda, al quale ogni dipendente può sottoporre idee e sulle quali riceverà un feedback.**

	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
È una pratica utilizzata per la ricerca di IDEE RADICALI	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
È una pratica utilizzata per la ricerca di IDEE INCREMENTALI	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

**Esiste un sito web (ad es un blog, wiki, corporate social network) dove i diversi attori esterni possono sottoporre suggerimenti ed idee inerenti mercati, prodotti e/o servizi.**

	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
È una pratica utilizzata per la ricerca di IDEE RADICALI	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
È una pratica utilizzata per la ricerca di IDEE INCREMENTALI	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

**I team per l'innovazione vengono incoraggiati ad espandere la loro rete in modo da entrare in contatto con i dipendenti e scambiare con loro conoscenza.**

	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
È una pratica utilizzata per la ricerca di IDEE RADICALI	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
È una pratica utilizzata per la ricerca di IDEE INCREMENTALI	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

**Il top management lavora per sviluppare una cultura innovativa all'interno dell'organizzazione.**

	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
È una pratica utilizzata per la ricerca di IDEE RADICALI	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

**In azienda sono presenti pratiche organizzative che consentono di integrare competenze, background o funzioni diverse.**

	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
È una pratica utilizzata per la ricerca di IDEE RADICALI	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
È una pratica utilizzata per la ricerca di IDEE INCREMENTALI	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

**L'azienda deliberatamente incoraggia la diversità di pensiero.**

	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
È una pratica utilizzata per la ricerca di IDEE RADICALI	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

**L'importanza dell'innovazione radicale per la sopravvivenza nel lungo termine è chiaramente comunicata a tutta l'organizzazione.**

	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
È una pratica utilizzata per la ricerca di IDEE RADICALI	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

**L'impresa ha team dedicati alla ricerca ed all'implementazione di idee per nuovi business strategicamente rilevanti.**

	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
È una pratica utilizzata per la ricerca di IDEE RADICALI	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

**L'impresa, accanto alle alleanze strategiche di lungo termine e consolidate, sviluppa partnership tecnologiche di breve termine con altre imprese.**

	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
È una pratica utilizzata per la ricerca di IDEE RADICALI	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

**L'organizzazione supporta i dipendenti che hanno idee innovative dando loro l'opportunità di gestirle all'interno di unità dedicate.**

	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
È una pratica utilizzata per la ricerca di IDEE RADICALI	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

**Le diverse funzioni all'interno dell'impresa sono incoraggiate a raccogliere in modo sistematico idee ed opinioni da fonti esterne.**

	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
È una pratica utilizzata per la ricerca di IDEE RADICALI	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
È una pratica utilizzata per la ricerca di IDEE INCREMENTALI	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

**Le persone vengono incoraggiate ad avanzare idee, anche se non è completamente chiaro quali saranno le loro potenziali applicazioni di mercato.**

	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
È una pratica utilizzata per la ricerca di IDEE RADICALI	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

**Quando si dispone di una tecnologia estremamente innovativa vengono ricercate applicazioni promettenti.**

	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
È una pratica utilizzata per la ricerca di IDEE RADICALI	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

**Si analizza l'uso dei prodotti/servizi nelle varie situazioni di vita reale.**

	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
È una pratica utilizzata per la ricerca di IDEE INCREMENTALI	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

**Si incoraggiano le persone a partecipare ad eventi, conferenze, corsi etc.**

	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
È una pratica utilizzata per la ricerca di IDEE RADICALI	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
È una pratica utilizzata per la ricerca di IDEE INCREMENTALI	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

**Si instaurano relazioni con i clienti finali (clienti di clienti nel caso B2B) e si ottengono regolarmente feedback sui loro bisogni.**

	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
È una pratica utilizzata per la ricerca di IDEE INCREMENTALI	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

**Si stringono relazioni con i lead-users (particolari utilizzatori di un prodotto/servizio che suggeriscono cambiamenti e miglioramenti ai prodotti esistenti o che sono in grado di anticipare dei bisogni ancora inespressi dal mercato).**

	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
È una pratica utilizzata per la ricerca di IDEE RADICALI	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
È una pratica utilizzata per la ricerca di IDEE INCREMENTALI	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

**Spesso sono utilizzati prototipi e test pilota, come strumenti di apprendimento e di raffinamento, per testare le idee.**

	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
È una pratica utilizzata per la ricerca di IDEE RADICALI	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
È una pratica utilizzata per la ricerca di IDEE INCREMENTALI	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

**Viene utilizzato un sistema di open innovation nel quale problemi e/o sfide relative alla tecnologia sono messi on line dalla ricerca e sviluppo in modo che i membri della comunità scientifica interessati possano proporre le loro soluzioni.**

	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
È una pratica utilizzata per la ricerca di IDEE RADICALI	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

## PERFORMANCE E COMPETENZE

**Esprimere una valutazione da 1 a 5 relativamente alle seguenti tipologie di innovazione per il business principale dell'impresa:**

	Per niente importante	Poco importante	Abbastanza importante	Determinante	Essenziale
	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
Innovazione radicale di prodotto: prodotto assolutamente nuovo o fortemente migliorato	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Innovazione di processo: significativo cambiamento nel metodo di produzione o delivery che ha comportato una sostanziale riduzione di costo (> del 30%)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Innovazione incrementale di prodotto e/o processo	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

**L'impresa, rispetto al passato, negli ultimi 3 anni:**

	Per niente	Poco	Abbastanza	Molto	Moltissimo
	1	2	3	4	5
Ha acquisito tecnologie produttive ed abilità interamente nuove	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Ha acquisito abilità di sviluppo prodotto e processi nuovi per il settore	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Acquisito capacità gestionali ed organizzative interamente nuove importanti per l'innovazione (ad esempio forecast tecnologico e di mercato)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Ha rafforzato abilità innovative in aree nelle quali non era presente un'esperienza precedente	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Ha migliorato le abilità e la conoscenza relativamente a prodotti e tecnologie familiari	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Ha migliorato le abilità nello sfruttamento di tecnologie mature che permettano di migliorare la produttività	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Ha potenziato le competenze nella ricerca di soluzioni ai problemi dei clienti, a partire da soluzioni esistenti, piuttosto che da soluzioni completamente nuove	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Ha valorizzato le abilità nei processi di sviluppo del prodotto/servizio nei quali è già presente una significativa esperienza	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Ha migliorato le proprie skills su tecnologie mature	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>



## 10 REFERENCES

### A

- Adler, P.S. (1995). Interdepartmental interdependence and coordination: the case of the design/manufacturing interface. *Organization Science*, **6**(2), p. 147-167
- Adler, P.S., Goldoftas, B. and Levine, D. (1999). Flexibility versus efficiency? A case study of model changeovers in the Toyota production system. *Organization Science*, **10**(1), p. 43-68.
- Ahuja, G., Lampert, C.M. (2001). Entrepreneurship in the large corporation: A longitudinal study of how established firms create breakthrough inventions. *Strategic Management Journal*, **22**, p. 521-543.
- Aiman-Smith, L., Goodrich, N., Roberts, D. and Scinta, J. (2005). Assessing Your Organization's Potential For Value Innovation. *Research Technology Management*, **March-April**, p. 37-42.
- Allen, N.J. and Meyer, J.P. (1990). The measurement and antecedents of affective, continuance and normative commitment to the organization. *Journal of Occupational Psychology*, **63**, p. 1-18.
- Amabile, T. M., Hardley, C.N. and Kramer, S.J. (2002). Creativity under the gun. *Harvard Business Review*, **August**, p. 52-61.
- Amabile, T.M., Conti, R., Coon, H., Lazenby, J. and Herron, M. (1996). Assessing the work environment for creativity. *Academy of Management Journal*, **39**(5), p. 1154-1184.
- Amit, R. and Sehoemaker, P. (1993). "Strategic assets and organizational rent". *Strategic Management Journal*, **14**(1), p. 33-46.
- Anderson, N. and Gasteiger, R.M. (2007). Helping Creativity and Innovation Thrive in Organizations: Functional and Dysfunctional Perspectives. In Langan-Fox, J., Cooper, C. L., and Klimoski, R. J., *Research Companion to the Dysfunctional Workplace: Management Challenges and Symptoms*. Cheltenham: Edward Elgar Publishing.
- Andriopoulos, C. and Gotsi, M. (2005). The virtues of "Blue-Sky" projects: How Lunar Design taps into the power of creative imagination. *Creativity and Innovation Management*, **14**(3), p. 316-324.
- Andriopoulos, C. and Lewis, M.W. (2009). Exploitation-Exploration Tensions and Organizational Ambidexterity: Managing Paradoxes of Innovation. *Organization Science*, **20**(4), p. 696-717.

- Andriopoulos, C. and Lewis, M.W. (2010). Managing Innovation Paradoxes: Ambidexterity Lessons from Leading Product Design Companies. *Long Range Planning*, **43**(1), p. 104-122.
- Antonacopoulou, E.P. (2007). Practice. In Clegg, S. and Bailey, J. (Eds), *International Encyclopaedia of Organization Studies*. Sage, London, p. 1291-1298.
- Antonacopoulou, E.P. (2008). On the practise of practice: in-tensions and ex-tensions in the ongoing reconfiguration of practice. In Barry, D. and Hansen, H. (Eds), *Handbook of New Approaches to Organization Studies*, Sage, London, p. 112-31.
- Antonacopoulou, E.P. and Pesqueux, Y. (2010). The practice of socialization and the socialization of practice. *Society and Business Review*, **5**(1), p. 10-21.
- Argote, L., McEvily, B. and Reagans, R. (2003). Managing Knowledge in Organizations: An Integrative Framework and Review of Emerging Themes. *Management Science*. **49**(4), p. 571-582.
- Argyris, C. and Schon, D. (1978). *Organisational learning: A theory of action perspective*. Reading, Mass: Addison Wesley.
- Ashforth, B.E. and Saks, A.M. (1996). Socialization Tactics: Longitudinal Effects on Newcomer Adjustments. *Academy of Management Journal*, **39**, p. 149-178.
- Atuahene-Gima, K. (2005). Resolving the Capability-Rigidity Paradox in New Product Innovation. *Journal of Marketing*, **69**, p. 61–83.

## **B**

- Babbie, E. (1990). *Survey Research Methods*, Wardsworth, Belmont, CA.
- Backman, M., Börjesson, S. and Setterberg, S. (2007). Managing Concepts in the Fuzzy Front End - Exploring the context for different kind of concepts at Volvo Cars. *R&D Management*, **37**(1), p. 17-28.
- Barnett, W.P. and Burgelman, R.A. (1996). Evolutionary perspectives on strategy. *Strategic Management Journal*, **17**(Summer), p. 5-19.
- Becker, M.C. and Lazaric, N. (2009). *Organizational Routines*. Edward Elgar Publishing Ltd.
- Becker, M.C., Lazaric, N., Nelson, R.R. and Winter, S.G. (2005). Applying organizational routines in understanding organizational change. *Industrial and Corporate Change*, **14**, p. 775-791.
- Benner, M.J. and Tushman, M.L. (2003). Exploitation, exploration, and process management: The productivity dilemma revisited. *Academy of Management Review*, **28**(2), p. 238-256.
- Bentler P.M. (1990). Fit indexes, Lagrange multipliers, constraint changes, and incomplete data in structural models. *Multivariate Behavioral Research*, **25**(1), p. 163-72.
- Bentler, P.M. and Bonnett, D.G. (1980). Significance tests and goodness-of-fit in the analysis of covariance structures. *Psychological Bulletin*, **88**(3), p. 588-606.
- Bernstein, R.T. (1971). *Praxis and Action: Contemporary Philosophies of Human Activity*. Philadelphia: University of Pennsylvania Press.

- Bessant, J. (2003). *High Involvement Innovation: Building and sustaining competitive advantage through continuous change*. Publisher: John Wiley and Sons.
- Bessant, J. (2005). Enabling continuous and discontinuous innovation: some reflections from a private sector perspective. *Public Money and Management*, **25**, p. 35-42.
- Bessant, J. and Von Stamm, B. (2007). *Twelve search strategies which might save your organization*. London, AIM Executive Briefing.
- Bessant, J., Lamming, R., Noke, H. and Philips, W. (2005). Managing innovation beyond the steady state. *Technovation*, **25**, p. 1366-1376.
- Bierly P.E. and Chakrabarty, A.K. (1996). Technological learning, strategic flexibility, and new product development in the pharmaceutical industry. *IEEE Transactions on Engineering Management*, **43**, p. 368-380.
- Bierly, P. and Daly, P.S. (2007). Alternative Knowledge Strategies, Competitive Environment, and Organizational Performance in Small Manufacturing Firms. *Entrepreneurship: Theory and Practice*, **31**(4), p. 493-516.
- Birkinshaw, J. and Gibson, C. (2004). Building ambidexterity into an organization. *MIT Sloan Management Review*, **45**(4), p. 47-55.
- Bledow, R., Frese, M., Anderson, N., Erez, M. and Farr, J. (2009). A dialectic perspective on innovation: Conflicting demands, multiple pathways, and ambidexterity. *Industrial and Organizational Psychology: Perspectives on Science and Practice*, **2**, p. 305-337.
- Bodwell, W. and Chermack, T.J. (2010). Organizational ambidexterity: Integrating deliberate and emergent strategy with scenario planning. *Technological Forecasting and Social Change*, **77**(2), p. 193-202.
- Boer, H., Kuhn, J. and Gertsen, F. (2006). Continuous innovation: managing dualities through co-ordination. *CINet Working Paper Series*, WP2006-01. Available at: [http://www.continuous-innovation.net/Publications/CINet\\_Publications.html](http://www.continuous-innovation.net/Publications/CINet_Publications.html)
- Bollen, K.A. and Long, J.S. (1993). *Testing Structural Equation Models*. Sage, Newsbury Park, CA.
- Boyack, K.W. (2009). Using detailed maps of science to identify potential collaborations. *Scientometrics*, **79**(1), p. 27-44.
- Boyack, K.W. and Klavans, R. (2010). Co-citation analysis, bibliographic coupling, and direct citation: Which citation approach represents the research front most accurately?. *Journal of the American Society for Information Science and Technology* (to appear).
- Brown, J.S. and Duguid, P. (2001). Knowledge and organization: A social-practice perspective. *Organization Science*, **12**(2), p. 198-213.
- Brown, S.L. and Eisenhardt, K.M. (1997). The Art of Continuous Change: Linking Complexity Theory and Time-paced Evolution in Relentlessly Shifting Organizations. *Administrative Science Quarterly*, **42**, p. 1-34.
- Browne M.W. and Cudeck, R. (1993). Alternative ways of assessing model fit, in Bollen, K.A. and Long, J.S. (Eds), *Testing Structural Equation Models*, Sage, Newbury Park, CA, 136-62.

- Burgelman, R.A. (2002). Strategy as vector and the inertia of co-evolutionary lock-in. *Administrative Science Quarterly*, **47**, p. 325-357.
- Byrne, B.M. (1998). *Structural Equation Modeling with Lisrel, Prelis, and Simplis: Basic Concepts, Applications and Programming*. Lawrence Erlbaum Associates, Mahwah, New Jersey.

## C

- Caffyn, S.(1998). *The scope for the application of continuous improvement to the process of new product development*. PhD thesis submitted at the University of Brighton. Accessible to download at: <http://www-centrim.bus.bton.ac.uk/open/we/are/sarahcaffyn/>
- Cameron, K.S. and Quinn, R.E. (1988). Organizational paradox and transformation. In Quinn, R.E. and Cameron, K.S., *Paradox and Transformation: Toward a Theory of Change in Organization and Management*. Ballinger, Cambridge, MA, p. 12–18.
- Cannella, A.A. and Monroe, M.J. (1997). Contrasting perspectives on strategic leaders: toward a more realistic view of top managers. *Journal of Management*, **23**(3), p. 213-237.
- Cao, Q. Simsek, Z. and Zhang, H. (2009). Modelling the Joint Impact of the CEO and the TMT on Organizational Ambidexterity. *Journal of Management Studies*, **20**(4), p. 781-796.
- Cao, Q., Gedajlovic, E. and Zhang, H. (2009). Unpacking Organizational Ambidexterity: Dimensions, Contingencies, and Synergistic Effects. *Organization Science*, **20**(4), p. 781-796.
- Carmeli, A. and Halevi, M.Y. (2009). How top management team behavioral integration and behavioral complexity enable organizational ambidexterity: The moderating role of contextual ambidexterity. *Leadership Quarterly*, **20**(2), p. 207-218.
- Carmines, E.G. and McIver, J.P. (1981). Analyzing models with unobserved variables. In: Bohrnstedt, G.W., Borgatta, E.F. (Eds.), *Social Measurement: Current Issues*. Sage, Beverly Hills, CA, p. 65-115.
- Carmines, E.G. and Zeller, R.A. (1979). *Reliability and validity assessment*. Beverly Hills, CA:Sage.
- Cattell, R.B. (1966). The scree test for the number of factors. *Multivariate Behavioral Research*, **1**, p. 245-276.
- Cegarra-Navarro, J. G. and Dewhurst, F. (2007). Linking organizational learning and customer capital through an ambidexterity context: an empirical investigation in SMEs. *International Journal of Human Resource Management*, **18**(10), p. 1720-1735.
- Chan, K. W. and Mauborgne, R. (2001). Creating new market space. *Harvard Business Review on Innovation*, p. 1-30.
- Chan, K. W. and Mauborgne, R. (2005). *Blue Ocean Strategy: How to Create Uncontested Market Space and Make the Competition Irrelevant*. Harvard Business School Press.

- Chandler, G.N. and Lyon, D.W. (2001). Issues of research design and construct measurement in entrepreneurship research: the past decade. *Entrepreneurship Theory and Practice*, **25**(4), p. 101-113.
- Chandy, R.K. and Tellis G.J. (1998). Organizing for Radical Product Innovation: The Overlooked Role of Willingness to Cannibalize. *Journal of Marketing Research*, **35**, p. 474-487.
- Chang, Y.C., Yang, P.Y. and Chen, M.H. (2009). The determinants of academic research commercial performance: Towards an organizational ambidexterity perspective. *Research Policy*, **38**(6), p. 936-946.
- Chesbrough, H. and Rosenbloom, R.S. (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*, **11**(3), p. 529-555.
- Chesbrough, H.W. (2003). *Open Innovation, The New Imperative for Creating and Profiting from Technology*. Publisher: Havard Business School Press.
- Christensen, C.M., and Raynor, M.E. (2003). *The Innovator's Solution: Creating and sustaining successful growth*. Publisher: Harvard Business School Press.
- Conway J.M and Huffcutt, A.I.(2003). A Review and Evaluation of Exploratory Factor Analysis Practices in Organizational Research. *Organizational Research Methods*, **6**(2), p. 147-168.
- Costello, A.B. and Osborne, J.W. (2005). Best practices in exploratory factor analysis: Four recommendations for getting the most from your analysis. *Practical Assessment, Research and Evaluation*, **10**, p. 1-9.
- Crane, D. (1972). *Invisible Colleges: Diffusion of Knowledge in Scientific Communities*. Chicago: University of Chicago Press.
- Crawford, C.M. and Di Benedetto, C.A. (2003). *New Products Management*. Homewood, IL: Irwin Publishers.
- Cronbach, L.J. (1951). Coefficient alpha and the internal structure of tests. *Psychometrika*, **16**, p. 297-334.
- Cronin B. (1984). *The Citation Process*. Taylor Graham: London.
- Cruz-González, J., Navas-López, J.E., López-Sáez, P. and Delgado-Verde, M. (2010). Adaptation to Environmental Dynamism through Balancing Exploration and Exploitation. 10<sup>th</sup> EURAM Conference "Back To The Future" Proceedings.
- Culnan, M.J. (1987). Mapping the Intellectual Structure of MIS, 1980–1985: A Co-citation Analysis. *Management of Information System Quarterly*, **11**(3), p. 341–53.

## **D**

- Daft, R.L. and Lengel, R.H. (1984). Information richness: A new approach to managerial behavior and Organization Design. *Research in Organizational Behavior*, **6**, p. 191-233.
- Daft, R.L. and Lengel, R.H. (1986). Organizational Information Requirements, Media Richness and Structural Design. *Management Science*, **32**, p. 554-571.

- Danneels, E. (2002). The Dynamics of Product Innovation and Firm Competences. *Strategic Management Journal*, **23**, p. 1095-1121.
- Danneels, E. (2008). Organizational Antecedents of Second-Order Competences. *Strategic Management Journal*, **29**, p. 519-543.
- D'Aveni, R. (1994). *Hypercompetition*. Free Press, New York.
- De Visser, M., de Weerd-Nederhof, P., Faems, D., Song, M., Van Looy, B. and Visscher, K. (2009). Structural ambidexterity in NPD processes: A firm-level assessment of the impact of differentiated structures on innovation performance. *Technovation*, **30**(5-6), p. 291-299.
- Dean, J.W. and Snell, S.A. (1991). Integrated manufacturing and job design: moderating effects of organizational inertia. *Academy of Management Journal*, **34**(4), p. 776-804.
- Denison, D., Hooijberg, R. and Quinn, R. (1995). Paradox and performance: Toward a theory of behavioral complexity in management leadership. *Organization Science*, **6**, p. 524-540.
- Dess, G. and Beard, D. (1984). Dimensions of organizational task environments. *Administrative Science Quarterly*, **29**, p. 52-73.
- De Wit, B. and Meyer, R. (2005). *Strategy synthesis. Resolving strategy paradoxes to create competitive advantages*. (2<sup>nd</sup> ed.) Thomson Learning.
- Dougherty, D. (1992). A practice-centered model of organizational renewal through product innovation. *Strategic Management Journal*, **13**, p. 77-92.
- Dubin, R. (1978). *Theory Building*. Free Press, New York.
- Duncan, R.B. (1976). The ambidextrous organization: designing dual structures for innovation. In Kilmann, R.H., Pondy, L.R. and Slevin, D. (eds), *The Management of Organization*. New York: North-Holland, **1**, p. 167-188.
- Dunn, S.C., Seaker, R.F. and Waller, M.A. (1994). Latent variables in business logistics research: Scale development and validation. *Journal Business Logistics*, **15**(2), p. 145-172.
- Dziuban, C.D. and Shirkey, E.C. (1974). When is a Correlation Matrix Appropriate for Factor Analysis?. *Psychological Bulletin*, **81**(6), p. 358-361.

## **E**

- Easterby-Smith, M., Thorpe, R. and Lowe, A. (2002). *Management Research: An Introduction*, 2nd Edition, Sage Publications, London.
- Eisenhardt, K. (1989). Building Theories from Case Study Research. *Academy of Management Review*, **14**(4), p. 532-550.
- Eisenhardt, K.M. (2000). Paradox, spirals, ambivalence: The new language of change and pluralism. *The Academy of Management review*, **25**(4), p. 703-705.
- Eisenhardt, K.M. and Martin, J.A. (2000). Dynamic capabilities: What are they? *Strategic Management Journal*, **21**, p. 1105-1121.
- Emory, C.W. (1980). *Business Research Methods*. Richard D. Irwin, Homewood, IL.

## **F**

- Fabrigar, L.R., Wegener, D.T., MacCallum, R.C. and Strahan, E.J. (1999). Evaluating the use of exploratory factor analysis in psychological research. *Psychological Methods*, **4**, p. 272-299.
- Fang, C., Lee, J. and Schilling, M.A. (2010). Balancing Exploration and Exploitation Through Structural Design: the Isolation of Subgroups and Organizational Learning. *Organization Science*, **21**(3), p. 625-642.
- Fink, A. (2009). *Conducting research literature reviews: from the Internet to paper*. 3<sup>rd</sup> Edition, SAGE Publications.
- Fiol, C.M. (1995). Thought worlds colliding: the role of contradiction in corporate innovation processes. *Entrepreneurship Theory and Practice*, **19**, p. 71-90.
- Flynn, B.B., Sakakibara, S., Schroeder, R.G., Bates, K.A. and Flynn, E.J. (1990). Empirical research methods in operations management. *Journal of Operations Management*, **9**(2), p. 250-284.
- Flynn, M., Dooley, L., Sullivan, D.O. and Cormican, K. (2003). Idea management for organisational innovation. *International Journal of Innovation Management*, **7**(4), p. 417-442.
- Folta, T. (1998). Governance and uncertainty: the tradeoffs between administrative control and commitment. *Strategic management journal*, **19**(11), p. 1007-1029.
- Ford J.D. and Ford L.W. (1994). Logics of identity, contradiction, and attraction in change. *Academy of Management Review*, **19**, p.756-785.
- Ford, J.K., MacCallum, R.C. and Tait, M. (1986). The application of exploratory factor analysis in applied psychology: A critical review and analysis. *Personnel Psychology*, **39**, p. 291-314.
- Forza C. (2002). Survey research in operations management: a process-based perspective. *International journal of Operations and Production Management*, **22**(2), p.152-194.
- Fuentes-Fuentes, M.M., Albacete-Saez, C.A. and Lloreis-Montes, F.J. (2004). The impact of environmental characteristics on TQM principles and organizational performance. *Omega*, **32**, p. 425-442.
- Fulk, J., DeSanctis, G. (1995). Electronic communication and changing organizational forms. *Organization Science*, **6**(4), p. 337-349.

## **G**

- Garfield, E. (1979). *Citation indexing - its theory and application in science, technology, and humanities*. Philadelphia, Pennsylvania: ISI Press.
- Gassmann, O. (2001). Multicultural teams: Increasing creativity and innovation by diversity. *Creativity and Innovation Management*, **10**(2), p. 88-95.

- Gauthier, E. (1998). Bibliometric Analysis of Scientific and Technological Research: A User's Guide to the Methodology. *Observatoire des Sciences et des Technologies, Science and Technology Redesign Project*, Canada, ST-98-08.
- Gebert, D., Boerner, S. and Landwehr R. (2003). The risk of authonomy - Empirical evidence for the necessity of a balance management in promoting organizational innovativeness. *Creativity and Innovation Management*, **12**(1), p. 41-49.
- George, M.L., Works, J. and Watson-Hemphill, K. (2005). *Fast Innovation - Achieving superior differentiation, speed to market, and increased profitability*. Publisher: McGraw-Hill.
- Gerbing, D.W. and Anderson, J.C. (1988). An updated paradigm for scale development incorporating unidimensionality and its assessment. *Journal of Marketing Research*, **25**, p. 186-192.
- Gersick, C.J.G. (1991). Revolutionary change theories: a multilevel exploration of the punctuated equilibrium paradigm. *Academy of Management Review*, **32**, p. 274-309.
- Ghemawat, P. and Costa J. (1993). The organizational tension between static and dynamic efficiency. *Strategic Management Journal*, **14**, p. 59-73.
- Gibson, C. B. and Birkinshaw, J. (2004). The antecedents, consequences, and mediating role of organizational ambidexterity. *Academy of Management Journal*, **47**(2), p. 209-226.
- Giddens, A. (1984). *The Constitution of Society: Outline of the Theory of Structure*. University of California Press, Berkeley, CA.
- Giddens, A. and Pierson, C. (1998). *Conversations with Anthony Giddens: Making Sense of Modernity*. Stanford University Press, Stanford, CA.
- Gilbert, C. (2005). Unbundling the structure of inertia: Resource versus routine rigidity. *Academy of Management Journal*, **48**, p. 741-763.
- Glaser, B.G. and Strauss, A.L. (1967). *The Discovery of Grounded Theory: Strategies of qualitative research*. Publisher: Wiedenfeld and Nicholson, London.
- Goldberg, L.R. and Digman, J.M. (1994). Revealing structure in the data: Principles of exploratory factor analysis. In S. Strack and M. Lorr (Eds.), *Differentiating normal and abnormal personality*, p. 216-242. New York: Springer.
- Gorski, C., and Heinekamp, E.J. (2002). *Capturing employee ideas for new products*. In Belliveau, P., Griffin, A., Somermeyer, S.M. (eds), *The PDMA toolbook for new product development I*, p. 219-241. Publisher: John Wiley and Sons.
- Govindarajan, V. and Trimble, C. (2005). Building breakthrough businesses within established organizations. *Harvard Business Review*, **May**, p. 1-11.
- Grant, R. (1996). Prospering in Dynamically-Competitive Environments: Organizational Capability as Knowledge Integration. *Organization Science*, **7**(4), p. 375-387.
- Guilford, J. P. (1950). Creativity. *American Psychologist*, **5**, p. 444-454.
- Gulati, R. and Puranam, P. (2009). Renewal Through Reorganization: The Value of Inconsistencies Between Formal and Informal Organization. *Organization Science*, **20**(2), p. 422-440.

Gupta, A.K., and Govindarajan, V. (1986). Resource sharing among SBUs: Strategic antecedents and administrative implications. *Academy of Management Journal*, **29**, p. 695-714.

Gupta, A.K., Smith, K.G. and Shalley, C.E. (2006). The interplay between exploration and exploitation. *Academy of Management Journal*, **49**(4), p. 693-706.

## H

Hair, J.F., Anderson, R.E., Tatham, R.L. and Black, W.C. (1995). *Multivariate Data Analysis* (5<sup>th</sup> eds). Upper Saddle River, NJ: Prentice Hall.

Hambrick, D.C. (1998). *Navigating change*. Boston: Harvard Business School Press.

Hamel, G. (2006). The why, what, and how of management innovation. *Harvard Business Review*, **February**, p. 72-84

Hamel, G. and Prahalad C.K. (1994). *Competing for the Future*. Boston, Mass.: Harvard Business School Press.

Han, M. and Celly, N. (2008). Strategic Ambidexterity and Performance in International New Ventures. *Canadian Journal of Administrative Sciences*, **25**(4), p. 335-349.

Hancock, M.Q., Roland J..H. and Wojcik, P.J. (2005). Better B2B selling. In The Mckinsey Quarterly, No. 3, Web exclusive, June. Available to download at: <http://www.mckinseyquarterly.com/PDFDownload.aspx?L2=16&L3=18&ar=1626&srId=200&gp=1>

Hannan, M. and Freeman, J. (1984). Structural inertia and organizational change. *American Sociological Review*, **49**, p. 149-164.

Hannan, M.T. and Freeman, E.R. (1977). The population ecology of organizations. *American Journal of Sociology*, **82**, p. 929-64.

Hansen, M.T. and Birkinshaw, J. (2007). The innovation value chain, *Harvard Business Review*, **June**, p. 121-130.

Hargadon, A. and Sutton, R. I. (2000). Building an innovation factory. *Harvard Business Review*, **May-June**, p. 157-166.

He, Z.L. and Wong, P.K. (2004). Exploration vs. exploitation: An empirical test of the ambidexterity hypothesis. *Organization Science*, **15**(4), p. 481-494.

Helfat, C. and Peteraf, M.A. (2003). The dynamic resource-based view: capability lifecycles. *Strategic Management Journal*, **24**, p. 997-1010.

Helfat, C.E. (1997). Know-how and asset complementarity and dynamic capability accumulation. *Strategic Management Journal*, **18**(5), p. 339-360.

Henderson, R. and Mitchell, W. (1997). The interactions of organizational and competitive influences on strategy and performance. *Strategic Management Journal*, **18**(Summer Special Issue), p. 5-14.

Herzog P. and Leker, J. (2010). Open and closed innovation: different cultures for different strategies. *International Journal of Technology Management*, **52**(3/4), p. 322-343.

- Hitt, M.A., Hoskisson, R.E. and Nixon, R.D. (1993). A mid-range theory of interfunctional integration, its antecedents and outcomes. *Journal of Engineering and Technology Management*, **10**, p. 161-185.
- Holly, E. and Gryskiewicz, N. (1993). Entrepreneurs' problem-solving styles: an empirical study using the Kirton Adaptation/Innovation theory. *Journal of Small Business Management*, p. 22-31.
- Huber, G.P. and Van de Ven, A.H. (1995). *Longitudinal Field Research Methods: Studying Processes of Organizational Change*. Sage, Thousand Oaks, CA.
- Hull, C.H. and Nie, N.H. (1981). *SPSS Update*. McGraw-Hill, New York.
- Hurley, A.E., Scandura, T.A., Schriesheim, C.A., Brannick, M.T., Seers, A., Vandenberg, R.J. and Williams, L.J. (1997). Exploratory and confirmatory factor analysis: Guidelines, issues, and alternatives. *Journal of Organizational Behavior*, **18**, p. 667-683.

## I

- Im, G.Y. and Rai, A. (2008). Knowledge sharing ambidexterity in long-term interorganizational relationships. *Management Science*, **54**(7), p. 1281-1296.

## J

- Jansen, J.J.P., Van Den Bosch, F.A.J and Volberda, H.W. (2005). Exploratory innovation, exploitative innovation, and ambidexterity: the impact of environmental and organizational antecedents. *Schmalenbach Business Review*. **57**(4), p. 351-363.
- Jansen, J.J.P., George, G., Van den Bosch, F.A.J. and Volberda H.W. (2008). Senior team attributes and organizational ambidexterity: The moderating role of transformational leadership. *Journal of Management Studies*, **45**(5), p. 982-1007.
- Jansen, J.J.P., Tempelaar, M.P., Van den Bosch F.A.J. and Volberda H.W. (2009). Structural Differentiation and Ambidexterity: The Mediating Role of Integration Mechanisms. *Organization Science*, **20**(4), p. 797-811.
- Jansen, J.J.P.; Van den Bosch, F.A.J. and Volberda, H.W. (2006). Exploratory Innovation, Exploitative Innovation, and Performance: Effects of Organizational Antecedents and Environmental Moderators. *Management Science*, **52**, p. 1661-1674.
- Jansen, J.J.P.; Van den Bosch, F.A.J. and Volberda, H.W. (2006). Exploratory Innovation, Exploitative Innovation, and Performance: Effects of Organizational Antecedents and Environmental Moderators. *Management Science*, **52**, p. 1661-1674.
- Jarneving, B. (2005). A comparison of two bibliometric methods for mapping of the research front. *Scientometrics*, **65**, p. 245-263.
- Jarneving, B. (2007). Bibliographic coupling and its application to research-front and other core documents. *Journal of Informetrics*, **1**, p. 287-307.

- Jeppesen, L.B. and Molin, M. J. (2003). Consumers as co-developers: learning and innovation outside the firm. *Technology Analysis and Strategic Management*, **15**(3), p. 363-383.
- Jolliffe, I.T. (1972). Discarding variables in a principal component analysis. I: Artificial data. *Applied Statistics*, **21**, p. 160-173.
- Jöreskog, K.G. (1969). A general approach to confirmatory maximum likelihood factor analysis. *Psychometrika*, **34**(2), p. 183-202.
- Judge, W.Q. and Blocker, C.P. (2008). Organizational capacity for change and strategic ambidexterity. *European Journal of Marketing*, **42**(9-10), p. 915-926.

## **K**

- Kaiser, H.F. (1956). *The varimax method of factor analysis*. Unpublished doctoral dissertation, University of California, Berkeley.
- Kaiser, H.F. (1960). The application of electronic computers to factor analysis. *Educational and Psychological Measurement*, **20**, p. 141-151.
- Kang, S.C. and Snell, S.A. (2009). Intellectual Capital Architectures and Ambidextrous Learning: A Framework for Human Resource Management. *Journal of Management Studies*, **46**(1), p. 65-92.
- Katila, R. and Ahuja, G. (2002). Something Old, Something New: A Longitudinal Study of Search Behavior and New Product Introduction. *Academy of Management Journal*, **45**, p. 1183-1194.
- Kelley, T. (2005). *The ten faces of innovation*. Publisher: Currency Doubleday.
- Kenny, D.A. and Kashy, D. A. (1992). Analysis of the multitrait-multimethod matrix by confirmatory factor analysis. *Psychological Bulletin*, **112**, p. 165-172.
- Kerlinger, F.N. (1986). *Foundations of behavioral research*. Holt, Rinehart & Winston, New York.
- Kessler, M.M. (1963). Bibliographic coupling between scientific papers. *American Documentation*, **14**(1), p. 10-25.
- Kim, W. C. and Mauborgne, R. (2001). Creating new market space. *Harvard Business Review on Innovation*, p. 1-30.
- Kimberly, J.R. (1976). Issues in the Design of Longitudinal Organizational Research. *Sociological Methods and Res.*, **4**, p. 321-347.
- King, N., Anderson, N.R. and West, M.A. (1991). Organisational innovation: a case study of perceptions and processes. *Work and Stress*, **5**, p. 331-339.
- Kinney, T.C. and Taylor, J. (1996). *Marketing Research, An Applied Approach*, McGraw-Hill, Inc, United States, Fifth edition.
- Kline R.B. (1998). *Principles and Practices of Structural Equation Modeling*, New York, NY: Guilford.

- Kogut, B., and Zander, U. (1992). Knowledge of the firm, combinative capabilities, and the replication of technology. *Organization Science*, **3**, p. 383-397.
- Kristal, M.M., Huang, X. and Roth, A.V. (2010). The effect of an ambidextrous supply chain strategy on combinative competitive capabilities and business performance. *Journal of Operations Management*, **69**(7), p. 415-429.
- Kuhn, T.S. (1970). *The structure of scientific revolutions* (2nd ed.). Chicago: University of Chicago Press.

## **L**

- Lane, P.J. and Lubatkin, M. (1998). Relative Absorptive Capacity and Interorganizational Learning. *Strategic Management Journal*, **19**, p. 461-477.
- Lane, P.J., Koka, B.R. and Pathak, S. (2006). The reification of absorptive capacity: A critical review and rejuvenation of the construct. *Academy of Management Review*, **31**(4), p. 833-863.
- Lavie, D. (2006). Capability Reconfiguration: An Analysis of Incumbent Responses to Technological Change. *Academy of Management Review*, **31**(1), p. 153-174.
- Lavie, D. (2006). Capability Reconfiguration: An Analysis of Incumbent Responses to Technological Change. *Academy of Management Review*, **31**(1), p. 153-174.
- Lavie, D. and Rosenkopf, L. (2006). Balancing Exploration and Exploitation Alliance Formation. *Academy of Management Journal*, **49**, p. 797-818.
- Lawrence, Q. and Lorsch, J. (1967). Differentiation and integration in complex organizations. *Administrative Science Quarterly*, **12**, p. 153-167.
- Leifer, R., McDermott, C. M., O'Connor, G.C., Peters, L.S., Rice, M.P. and Veryzer, R.W. (2000). *Radical Innovation: How mature companies can outsmart upstarts*. Publisher: Harvard Business School Press.
- Leonard, D. (2002). Tacit knowledge, unarticulated needs, and emphatic design in new product development. In Morey, D., Maybury, M. and Thurausingham, B. *Knowledge Management – classic and contemporary works*, p. 223-237. Publisher: The MIT press.
- Leonard, D. and Rayport, J.F. (1997). Spark Innovation through empathic design. *Harvard Business Review*, **November-December**, p. 102- 113.
- Leonard, D. and Straus, S. (1997). Putting your company's whole brain to work. *Harvard Business Review*, **July-August**, p. 111-121.
- Leonard-Barton, D. (1992), Core Capabilities and Core Rigidities: A Paradox in Managing New Product Development. *Strategic Management Journal*, **13**, p. 111-125.
- Leonard-Barton, D. (1995). *Wellsprings of Knowledge: Building and Sustaining the Sources of Innovation*, Boston, MA, Harvard Business School Press.
- Lettl, C., Herstatt, C. and Gemünden, H. G. (2006). Users' contribution to radical innovation: evidence from four cases in the field of medical equipment technology. *R&D Management*, **36**(3), p. 251-272.

- Levinthal, D.A. and March, J.G. (1993). The myopia of learning. *Strategic Management Journal*, **14**, p. 95-112.
- Levitt, B. and March, J.G. (1988). Organizational Learning. *Annual Review of Sociology*, **14**, p. 319-340.
- Levitt, T. (2002). Creativity is not enough. *Harvard Business Review*, **August**, p. 137-144.
- Lewis, M.W. (2000). Exploring paradox: Toward a more comprehensive guide. *Academy of Management Review*, **25**, p. 760-776.
- Lewis, M.W., Welsh, M.A., Dehler, G.E., and Green, S.G. (2002). Product development tension: exploring contrasting styles of project management. *Academy of Management Journal*, **45**, p. 546-564.
- Li, C.R., Lin, C.J. and Chu, C.P. (2008). The nature of market orientation and the ambidexterity of innovations. *Management Decision*, **46**(7), p. 1002-1026.
- Li, Y., Vanhaverbeke, W. and Schoenmakers, W. (2008). Exploration and Exploitation in Innovation: Reframing the Interpretation. *Creativity and Innovation Management*, **17**(2), p. 107-124.
- Lichtenthaler, U. and Lichtenthaler, E. (2009). A Capability-Based Framework for Open Innovation: Complementing Absorptive Capacity. *Journal of Management Studies*, **46**(8), p. 1315-1338.
- Lin, Z., Yang, H.B. and Demirkan, I. (2007). The performance consequences of ambidexterity in strategic alliance formations: Empirical investigation and computational theorizing. *Management Science*, **53**(10), p. 1645-1658.
- Linder, J.C., Jarvenpaa, S. and Davenport, T. (2003). Toward an innovation sourcing strategy. *MIT Sloan Management Review*, **44**(4), p. 42-49.
- Low, M.B. and Mac Millan, I.C. (1998). Entrepreneurship: past research and future challenges. *Journal of Management*, **14**(2), p. 139-161.
- Lubatkin, M.H., Simsek, Z., Ling, Y. and Veiga, J.F. (2006). Ambidexterity and performance in small- to medium-sized firms: The pivotal role of top management team behavioral integration. *Journal of Management*, **32**(5), p. 646-672.
- Lubatkin, M.H., Simsek, Z., Ling, Y. and Veiga, J.F. (2006). Ambidexterity and performance in small- to medium-sized firms: The pivotal role of top management team behavioral integration. *Journal of Management*, **32**(5), p. 646-672.
- Lubatkin, M.H., Simsek, Z., Ling, Y. and Veiga, J.F. (2006). Ambidexterity and performance in small- to medium-sized firms: The pivotal role of top management team behavioral integration. *Journal of Management*, **32**(5), p. 646-672.
- Luo, Y.D. and Rui, H.C. (2009). An Ambidexterity Perspective Toward Multinational Enterprises From Emerging Economies. *Academy of Management Perspectives*, **23**(4), p. 49-70.
- Lüthje, C. and Herstatt, C. (2004). The lead user method: an outline of empirical findings and issues for future research. *R&D Management*, **34**(5), p. 553-568.

Lynn, G.S., Morone, J.G. and Paulson, A.S. (1996). Marketing and discontinuous innovation: The probe and learn process. *California Management Review*, **38**(3), p. 8-37.

## **M**

Malhorta, M.K. and Grover, V. (1998). An assessment of survey research in POM: from constructs to theory. *Journal of Operations Management*, **16**, p. 407-425.

March, J.G. (1991). Exploration and Exploitation in Organizational Learning. *Organization Science*, **2**, p. 71-87.

March, J.G. (1996). Continuity and change in theories of organizational action. *Administrative Science Quarterly*, **41**, p. 278-287.

March, J.G. (2006). Rationality, foolishness, and adaptive intelligence. *Strategic Management Journal*, **27**, p. 201-214.

Marshakova, I.V. (1973). A system of document connections based on references. *Scientific and Technical Information Serial of VINITI*, **6**, p. 3-8.

Martins, E. C, and Terblanche, F. (2003). Building organisational culture that stimulates creativity and innovation. *European Journal of Innovation Management*, **6**(1), p. 64-74.

Maxwell, J.A. (2005). *Qualitative Research Design: An integrative approach*, (2ed). Applied Social Research Methods Series, Vol. 41. Publisher: Sage Publications.

May, K.A. (1991). Interview techniques in qualitative research: concerns and challenges. In: Morse, J.M. (ed.) *Qualitative Nursing Research: A Contemporary Dialogue*. London: Sage Publications.

McAfee, A.P. (2006). Enterprise 2.0: The Dawn of Emergent Collaboration. *MIT Sloan Management Review*, **47**(3), p. 21-28.

McCain, K.W. (1990). Mapping authors in intellectual space: A technical overview. *Journal of the American Society for Information Science*, **41**(6), p. 433-443.

McDonald, J.B. (1991). Parametric Models for Partially Adaptive Estimation with Skewed and Leptokurtic Residuals. *Economics Letters*, **37**, p. 273-278.

McGill, M., Slocum, J.R., and Lei, D. (1992). Management practices in learning organizations. *Organizational Dynamics*, **21**, p. 5-17.

McLaughlin, P., Bessant, J. and Smart, P. (2005). Developing an organisational culture that facilitates radical innovation in a mature small to medium sized company: Emergent findings. Working Paper at Cranfield University available at: <https://www.som.cranfield.ac.uk/som/research/documents/McLaughlinBessantandSmartDevelopingandorganizationalculturethatfacilitatesradicalinnovationi.pdf>

Medsker, G.J., Williams, L.J. and Holahan, P.J. (1994). A review of current practices for evaluation causal models in organizational behavior and human resources management research. *Journal of Management*, **20**(2), p. 439-464.

- Menguc, B. and Auh, S. (2008). The asymmetric moderating role of market orientation on the ambidexterity-firm performance relationship for prospectors and defenders. *Industrial Marketing Management*, **37**(4), p. 455-470.
- Merton, R. (1973). *The sociology of science*. Chicago: University of Chicago Press.
- Meyer, J.P., Paunonen, S.V., Gellatly, I.R., Goffin, R.D. and Jackson, D.N. (1989). Organizational commitment and job performance: It's the nature of the commitment that counts. *Journal of Applied Psychology*, **74**(1), p. 152-156.
- Miller, D. and Friesen, P.H (1980). Momentum and revolution in organizational adaptation. *Academy of Management Journal*, **23**, p. 591-614.
- Miller, D. and Friesen, P.H. (1982). The Longitudinal Analysis of Organizations: A Methodological Perspective. *Management Science*, **28**(9), p. 1013-1034.
- Miller, D. and Friesen, P.H. (1983). Strategy making and environment: The third link. *Strategic Management Journal*, **4**, p. 221-235.
- Mintzberg, H. (1979). *The structuring of Organizations*. Englewood Cliffs, NJ: Prentice-Hall.
- Mom, T.J.M., van den Bosch, F.A.J. and Volberda, H.W. (2009). Understanding Variation in Managers' Ambidexterity: Investigating Direct and Interaction Effects of Formal Structural and Personal Coordination Mechanisms. *Organization Science*, **20**(4), p. 812-828.
- Morris, S.A. (2005). Manifestation of Emerging Specialties in Journal Literature: A Growth Model of Papers, References, Exemplars, Bibliographic Coupling, Cocitation, and Clustering coefficient distribution. *Journal of the American Society for Information Science and Technology*, **56**(12), p. 1250-1273.

## N

- Nelson, R.R. (1991). Why Do Firms Differ, and How Does it Matter?. *Strategic Management Journal*, **12**, p. 61-74.
- Nelson, R.R. and Winter, S.G. (1982). *An Evolutionary Theory of Economic Change*. Belknap Press/Harvard University Press, Cambridge.
- Nemanich, L.A. and Vera, D. (2009). Transformational leadership and ambidexterity in the context of an acquisition. *Leadership Quarterly*, **20**(1), p. 19-33.
- Nerkar, A. and Roberts, P.W. (2004). Technological and product-market experience and the success of new product introductions in the pharmaceutical industry. *Strategic Management Journal*, **25**, p. 779-799.
- Nicolini, D., Gherardi, S. and Yanow, D. (2003). Introduction: Towards a Practice-Based View of Knowing and Learning in Organisations. In Nicolini, D., Gherardi, S. and Yanow, D. (eds) *Knowing in Organisations: A Practice-Based Approach*, p. 3–31. London: M. E. Sharpe.
- Nonaka, I. and Takeuchi, H. (1995). *The knowledge-creating company*. New York: Oxford University Press.
- Nunally, J. (1978). *Psychometric Theory*. McGraw-Hill: New York.

## O

- O'Connor, G. C. (2006). Open, Radical Innovation: Towards an integrated model in large established firms. In Chesbrough, H.W., Vanhaverbeke, W and West J. (Eds), *Open Innovation: Researching a new paradigm*. Publisher: Oxford University Press; Chp 4, p. 62-81. (<http://www.openinnovation.net/Book/NewParadigm/Chapters/index.html>).
- O'Connor, G.C. (1998). Market Learning and Radical Innovation: A cross case comparison of eight radical innovation projects. *Journal of Product Innovation Management*, **15**(2), p. 151-166.
- O'Connor, G.C., and McDermott, C.M. (2004). The human side of radical innovation. *Journal of Engineering Technology Management*, **21**, p. 11-30.
- O'Leary-Kelly, S.W. and Vokurka, R.J. (1998). The empirical assessment of construct validity. *Journal of Operations Management*, **16**, p. 387-405.
- O'Reilly, C.A. and Tushman, M.L. (2004). The ambidextrous organization. *Harvard Business Review*, **April**, p. 74-83.
- O'Reilly, C.A. and Tushman, M.L. (2008). Ambidexterity as a Dynamic Capability: Resolving the Innovator's Dilemma. *Research in Organizational Behavior*, **28**, p. 185-206.
- Ohja A., Brown, J.L. and Phillips, N. (1997). Change and revolutionary change: formalizing and extending the punctuated equilibrium paradigm. *Computational and Mathematical Organization Theory*, **3**(2), p. 91-111.
- Oldham, G.R. and Cummings, A. (1996). Employee creativity: personal and contextual factors at work. *Academy of Management Journal*, **39**(3), p. 607-634.
- Oliver, C. (1990). Determinants of Interorganizational Relationships: Integration and Future Directions. *Academy of Management Review*, **15**, p. 241-265.
- Oppenheim A.N. (1992). *Questionnaire Design, Interviewing and Attitude Measurement*. Quorum Books, Westport, Conn.
- O'Reilly, C.A. and Tushman, M.L. (2004). The ambidextrous organisation. *Harvard Business Review*, **82**(4), p. 74.
- O'Reilly, C.A. and Tushman, M.L. (2008). Ambidexterity as a dynamic capability: Resolving the innovator's dilemma. *Research in Organizational Behavior*, **28**, p. 185-206.
- Orlikowski, W.J. (2002). Knowing in Practice: Enacting a Collective Capability in Distributed Organizing. *Organization Science*, **13**(3), p. 249-273.

## P

- Patton, M.Q. (2002). *Qualitative Research and Evaluation Methods*, 3rd ed. Sage, London.
- Peat, J.K. and Barton B. (2005). *Medical statistics: a guide to data analysis and critical appraisal*. Blackwell Publishing BMJ.
- Pedhazur, E.J. and Schmelkin, L.P. (1991). *Measurement, Design, and Analysis: An Integrated Approach*. Lawrence Erlbaum Associates, Publishers, Hillsdale, NJ.

- Persson, O. (1994). The intellectual base and research front of JASIS 1986-1990. *Journal of the American Society for Information Science*, **45**(1), p. 31-38.
- Phillips, W., Lamming, R. Bessant, J. and Noke, H. (2006). Discontinuous Innovation and Supply Relationships: Strategic Dalliiances. *R&D Management*, **36**(4), p. 481-491.
- Pilkington, A. and Teichert, T. (2006). Management of technology: themes, concepts and relationships. *Technovation*, **26**, p. 288-99.
- Pittaway, L., Robertson, M., Munir, K., Denyer, D. and Neely, A. (2004). Networking and innovation: a systematic review of the evidence. *International Journal of Management Reviews*, **5-6**(3-4), p. 137-168.
- Podsakoff P.M., MacKenzie, S.B., Bachrach, D.G. and Podsakoff, N.P. (2005). The influence of management journals in the 1980s and 1990s. *Strategic Management Journal*, **26**(5), p. 473-488.
- Poole, M.S. and Van de Ven, A.H. (1989). Using a paradox to build management and organization theories. *Academy of Management Review*, **14**(4), p. 562-578.
- Prahalad, C. K. and Venkatram, R. (2004). *The Future of Competition – Co-creating unique value with customers*. Harvard Business School Publishing.

## **R**

- Raisch, S. (2008). Balanced Structures: Designing Organizations for Profitable Growth. *Long Range Planning*, **41**(5), p. 483-508.
- Raisch, S. and Birkinshaw, J. (2008). Organizational ambidexterity: Antecedents, outcomes, and moderators. *Journal of Management*, **34**(3), p. 375-409.
- Raisch, S., Birkinshaw, J., Probst, G. and Thshman, M.L. (2009). Organizational Ambidexterity: Balancing Exploitation and Exploration for Sustained Performance. *Organization Science*, **20**(4), p. 685-695.
- Ramos-Rodríguez, A.R. and Ruíz-Navarro, J. (2004). Changes in the intellectual structure of strategic management research: A bibliometric study of the Strategic Management Journal, 1980-2000. *Strategic Management Journal*, **25**(10), p. 981-1004.
- Riccaboni, M. and Moliterni, R. (2009). Managing technological transitions through R&D alliances. *R&D Management*, **39**(2), p. 124-135.
- Rothaermel, F.T. (2001). Incumbent's advantage through exploiting complementary assets via interfirm cooperation. *Strategic Management Journal*, **22**, p. 687-699.
- Rothaermel, F.T. and Alexandre, M.T. (2009). Ambidexterity in Technology Sourcing: The Moderating Role of Absorptive Capacity. *Organization Science*, **20**(4), p. 759-780.
- Rowlands, I. (1999). Patterns of author co-citation in information policy: Evidence of social, collaborative and cognitive structure. *Scientometrics*, **44**(3), p. 533-546.
- Rowe, W.G. (2001). Creating wealth in organizations: the role of strategic leadership. *Academy of Management Executive*, **15**(1), p. 81-94.

## S

- Sandström, U. and Sandström, E. (2009). Meeting the micro-level challenges: bibliometrics at the individual level. *Proceedings of the 12th International Conference on Scientometrics and Informetrics*. Rio de Janeiro: BIEREME/PAHO/WHO, p. 845-856.
- Scarbrough, H., Swan, J., Laurent, S., Bresnen, M., Edelman, L. and Newell, S. (2004). Project-based learning and the role of learning boundaries. *Organization Studies*, **25**(9), p. 1579-1600.
- Schildt, H.A. (2002). *SITKIS: Software for bibliometric data management and analysis v0.6.1*. Helsinki: Institute of Strategy and International Business. Available at [www.hut.fi/~hschildt/sitkis](http://www.hut.fi/~hschildt/sitkis).
- Sharfman, M.P. and Dean, J.W. (1991). Conceptualizing and Measuring the organizational environment: a multidimensional approach. *Journal of Management*, **17**(4), p. 681-700.
- Sidhu, J., Commandeur, H. and Volberda, H.W. (2007). The Multifaceted Nature of Exploration and Exploitation: Value of Supply, Demand, and Spatial Search for Innovation. *Organization Science*, **18**, p. 1-19.
- Sidhu, J., Volberda, H.W. and Commandeur, H. (2004). Exploring exploration orientation and its determinants: Some empirical evidence. *Journal of Management Studies*, **41**, p. 913-932.
- Siggelkow, N. and Levinthal, D.A. (2003). Temporarily divide to conquer: Centralized, decentralized, and reintegrated organizational approaches to exploration and adaptation. *Organization Science*, **14**, p. 650-669.
- Siggelkow, N. and Rivkin, J. (2006). When exploration backfires: Unintended consequences of organizational search. *Academy of Management Journal*, **49**, p. 779-796.
- Simsek, Z. (2009). Organizational Ambidexterity: Towards a Multilevel Understanding. *Journal of Management Studies*, **46**(4), p. 597-624.
- Simsek, Z., Heavey, C., Veiga, J.F. and Souder, D. (2009). A Typology for Aligning Organizational Ambidexterity's Conceptualizations, Antecedents, and Outcomes. *Journal of Management Studies*, **46**(5), p. 864-894.
- Sirmon, D.G., Hitt, M.A. and Irelland, R.D. (2007). Managing Firm Resources in Dynamic Environments to Create Value: Looking Inside the Black Box. *Academy of Management Review*, **32**, p. 273-292.
- Small, H. (1973). Co-citation In Scientific Literature - New Measure Of Relationship Between 2 Documents. *Journal of the American Society for Information Science*, **24**(4), p. 265-269.
- Smith, W.K. and Tushman, M.L. (2005). Managing strategic contradictions: A top management model for managing innovation streams. *Organization Science*, **16**(5), p. 522-536.
- Snyder, N.T. and Duarte, D.L. (2003). *Strategic Innovation - Embedding innovation as a core competency in your organisation*. Publisher: Jossey-Bass.
- Stevens, J. (1999). *Applied multivariate statistics for the social sciences*. Lawrence Erlbaum Associates.

- Steiger, J.H. (1990). Structural model evaluation and modification: an interval estimation approach. *Multivariate Behavioral Research*, **25**(2), p. 173-80.
- Stone, E. (1978). *Research Methods in Organizational Behavior*. Glenview, IL: Scott, Foresman and Co.
- Suarez, F.F. and Oliva, R. (2005). Environmental Change and Organizational Transformation. *Industrial and Corporate Change*, **14**, p. 1017-1041.
- Sutcliffe, K.M. and Huber, G. (1998). Firm and industry as determinants of executive perceptions of the environment. *Strategic Management Journal*, **19**(8), p. 793-807.
- Swink, M. (2006). Building collaborative innovation capability. *Research Technology Management*, **March-April**, p. 37-47.

## I

- Tabachnick, B.G., and Fidell, L.S. (1996). *Using multivariate statistics* (3rd ed.). New York: Harper Collins.
- Tahai, A. and Meyer, M.J. (1999). A Revealed Preference Study of Management Journals' Direct Influences. *Strategic Management Journal*, **20**(3), p.279-296.
- Taylor, A. and Greve, H. R. (2006). Superman or the fantastic four? Knowledge combination and experience in innovative teams. *Academy of Management Journal*, **49**(4), p. 723-740.
- Taylor, A. and Helfat, C.E. (2009). Organizational Linkages for Surviving Technological Change: Complementary Assets, Middle Management, and Ambidexterity. *Organization Science*, **20**(4), p. 718-739.
- Teece, D.J. (2007). Explicating Dynamic Capabilities. The Nature and Microfoundations of (Sustainable) Enterprise Performance. *Strategic Management Journal*, **28**, p. 1319-1350.
- Teece, D.J., Pisano, G. and Shuen, A. (1997). Dynamic capabilities and strategic management. *Strategic Management Journal*, **18**, p. 509-533.
- Tennenhouse, D. (2004). Intel's open collaborative model of industry-university research. *Research Technology Management*, **July-August**, p. 19-26.
- Thomke, S.H. (2001). Enlightened Experimentation: The New Imperative for Innovation. *Harvard Business Review*, **79**(2), p. 67-75.
- Thomke, S.H. (2003). *Experimentation matters: Unlocking the potential of new technologies for innovation*. Publisher: Harvard Business School Press.
- Thomke, S.H., and Von Hippel, E. (2002). Customers as innovators: A new way to create value. *Harvard Business Review*, **April**, p. 74-81.
- Thompson, J.D. (1967). *Organizations in action*. New York: McGraw-Hill.
- Thurstone, L.L. (1947). *Multiple-factor analysis*. Chicago: Univ. Chicago Press.
- Tidd, J., Bessant, J. and Pavitt, K. (2005). *Managing Innovation: Integrating technological, market and organisational changes* (3rd ed). Publisher: John Wiley & Sons, Ltd., UK.

- Tiwana, A. (2008). Do bridging ties complement strong ties? An empirical examination of alliance ambidexterity. *Strategic Management Journal*, **29**(3), p. 251-272.
- Tranfield, D., Denyer, D. and Smart, P. (2003). Towards a Methodology for Developing Evidence-Informed Management Knowledge by Means of Systematic Review. *British Journal of Management*, **14**(3), p. 207-222.
- Tushman M.L., Romanelli, E. (1985). Organizational revolution: a metamorphosis model of convergence and reorientation. *Research in Organizational Behavior*, **7**, p. 171-222.
- Tushman, M.L. and Anderson, P. (1986). Technological discontinuities and organizational environments, *Administrative Science Quarterly*, **31**, p. 439-65.
- Tushman, M.L. and O'Reilly, C.A. (1996). Ambidextrous organizations: Managing evolutionary and revolutionary change. *California Management Review*, **38**(4), p. 8-30.

## U

- Ulwick, A.W. (2002). Turn customer input into innovation. *Harvard Business Review*, **January**, p. 91-97.
- Ulwick, A.W. (2003). Do you really know what your customers are trying to get done?. *Strategy and Innovation*, **March-April**, p. 3-5.
- Ulwick, A.W. (2005). *What Customers Want: Using outcome-driven innovation to create breakthrough products and services*. Publisher: McGraw-Hill Publishing Co.
- Uotila, J., Maula, M., Keil, T. and Zahara, S.A. (2009). Exploration, exploitation, and financial performance: analysis of S&P 500 corporations. *Strategic Management Journal*, **30**(2), p. 221-231.

## V

- Van den Bosch, B., Saatcioglu, A. and Fay, S. (2006). Idea Management: A Systemic View. *Journal of Management Studies*, **43**(2), p. 259-288.
- Van Dijk, C., and den Van, E. (2002). Suggestion system: transferring employee creativity into practicable ideas. *R&D Management*, **32**(5), p. 387-395.
- Veebek, A., Debackere, K., Luwel, M. and Zimmerman, E. (2002). Measuring progress and evolution in science and technology – I: The multiple uses of bibliometric indicators. *International Journal of Management Reviews*, **4**(2), p. 179-211.
- Velicer, W.F. and Jackson, D.N. (1990). Component analysis versus common factor analysis: Some issues in selecting an appropriate procedure. *Multivariate Behavioral Research*, **25**, p. 1-28.
- Vermeulen, F. and Barkema, H.G. (2001). Learning from Acquisitions. *Academy of Management Journal*, **43**(3), p. 457-476.
- Volberda, H.W. (1996). Towards The Flexible Form: How To Remain Vital in Hypercompetitive Environments. *Organization Science*, **7**(4), p. 359-387.

- Volberda, H.W. (1998). *Building the Flexible Firm: How to Remain Competitive*. Oxford University Press, Oxford.
- Von Hippel, E. (2001). Perspective: User toolkits for innovation. *The Journal of Product Innovation Management*, **18**, p. 247-257.
- Von Hippel, E. (2005). *Democratizing innovation*. Publisher: The MIT Press.
- Von Hippel, E. and Katz, R. (2002). Shifting innovation to users via toolkits. *Management Science*, **48**(7), p. 821-833.
- Voss C., Tsiriktsis N., Frohlich M. (2002). Case research in operations management. *International journal of Operations and Production Management*, **22**(2), p. 195-219.

## W

- Wallin, M.W. (2008). The bibliometric structure of spin-off literature. RIDE/IMIT Working Paper No. 84426-020.
- Wang, C.L. and Ahmed, P.K. (2007). Dynamic Capabilities: A Review and Research Agenda. *International Journal of Management Reviews*, **9**, p. 31-51.
- Webb, D. and Pettigrew, A. (1999). The Temporal Development of Strategy: Patterns in the UK Insurance Industry. *Organization Science*, **10** (5), p. 601-621.
- Weick, K.E. (1982). Management of Organizational Change Among Loosely Coupled Elements. In Goodman P.S. and Associates (Eds.), *Change in Organizations: New Perspectives in Theory, Research, and Practice*. San Francisco, CA: Jossey-Bass, p. 375-408.
- Weick, K.E. and Quinn, R.E. (1999). Organizational change and development. *Annual Review of Psychology*, **50**, p. 361-386.
- Westerman, G., Iansiti, M. and McFarlan, W. (2006). Organization design and effectiveness over the innovation life cycle. *Organization Science*, **17**(2), p. 230-238.
- White H.D., Griffith, B.C. (1981). Author co-citation: a literature measure of intellectual structure. *Journal of the American Society for Information Science*, **32**, p. 163–171.
- Winter, S.G. (2000). The Satisficing Principle in Capability Learning. *Strategic Management Journal*, **21**, p. 981-996.
- Winter, S.G. (2003). Understanding dynamic capabilities. *Strategic Management Journal*, **24**, p. 991-995.

## Y

- Yin, R.K. (2003). *Applications of case study research* (2<sup>nd</sup> ed.). Thousand Oaks, CA: Sage.
- Yin, R.K. (2003). *Case study Research: Design and Methods* (3rd ed.). Publisher: Sage Publishing, Beverly Hills, CA, USA.
- Yin, R.K. (2009). *Case Study Research: design and methods* (4<sup>th</sup> ed.). Applied Social Research Methods Series, Volume n° 5. SAGE Publications.

## Z

- Zahra, S.A. Ireland, R.D., and Hitt, M.A. (2000). International expansion by new venture firms: International diversity, mode of market entry, technological learning and performance. *Academy of Management Journal*, **43**, p. 925-950.
- Zhao, D., Strotman, A. (2008). Author bibliographic coupling: Another approach to citation-based author knowledge network analysis. *Proceedings of the American society for information science and technology*, **45**(1).
- Zollo, M. and Winter, S.G. (2002). Deliberate Learning and the Evolution of Dynamic Capabilities. *Organization Science*, **13**, p. 339-351.