UNIVERSIDAD AUTONOMA DE MADRID

Tesis doctoral

KNOWLEDGE FOR INNOVATION IN KIBS

A CASE STUDY ON THE BALANCE BETWEEN EXPLORATION AND EXPLOITATION: LOOKING AT THE ROLE OF THE R&D ORGANIZATION AND THE ROLE OF CONSULTANTS

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Doctorado en Economía y Gestión de la Innovación

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2013

AGRADECIMIENTOS / ACKNOWLEDGEMENTS

Escribir esta tesis ha sido un proceso a la vez duro y enormemente gratificante, que me ha aportado y enriquecido muchísimo tanto a nivel académico como personal. Por ello, me gustaría agradecer a todas las personas que han sido parte de dicho proceso y que me han apoyado a lo largo de estos cuatro años, sin las cuales no habría podido aprender todo lo que he aprendido ni llegar a este momento en el que pretendo compartir los resultados de este trabajo tan especial para mí con todos aquellos interesados en entender algo más del proceso de creación y movilización del conocimiento en la empresa.

En primer lugar, quiero dar las gracias a mi directora de tesis: Prof. Mª Paloma Sánchez. Ha sido un placer compartir todo el camino de la tesis con ella y aprender de una profesional, una profesora y una investigadora excepcional, pero sobre todo de una persona maravillosa. Sus consejos y reflexiones han sido esenciales para la evolución de la tesis desde sus comienzos, y la exigencia y rigor de su trabajo han sido sin duda claves para la calidad de la investigación. Además de ser una referencia y un ejemplo a seguir desde el punto de vista profesional, su apoyo a nivel personal, su paciencia, su amabilidad y su comprensión han hecho que siguiera adelante en los momentos difíciles, que no han sido pocos, y que la Prof. Mª Paloma Sánchez se haya convertido en mucho más que una directora de tesis para mí. No sé cómo agradecer que, en los últimos empujones de la tesis, también en los momentos difíciles para ella, haya seguido ahí, atenta y entregada. Soy muy afortunada de haber tenido la oportunidad de aprender de y con una mujer ejemplar, y espero tener la ocasión de poder seguir trabajando con ella en muchos proyectos futuros.

En segundo lugar, quiero agradecer al Prof. Philippe Laredo los consejos, críticas y sugerencias que ha hecho a mi trabajo desde el momento en el que aceptó formar parte del mismo, durante la estancia de investigación realizada bajo su supervisión en el centro de investigación IFRIS (Institut Francilien Recherche Innovation Société). Las ideas del Prof. Philippe Laredo llegaron en un momento crítico del proceso y han sido claves para la definición de la tesis, tanto desde el punto de vista de la metodología como del enfoque teórico. Además, sus inteligentes, interesantes y enriquecedoras reflexiones han supuesto un reto para mis capacidades y han dado sin duda color y calidad al trabajo final. Quiero agradecer también enormemente la gran involucración del Prof. Laredo en la tesis, el tiempo dedicado a la meticulosa lectura del trabajo, el voto de confianza que me ha dado en todo momento, y el haber aceptado ser uno de los expertos en realizar un informe sobre mi trabajo. *Merci beaucoup pour tout. Cela a été un vrai plaisir de travailler avec lui.*

Asimismo, me gustaría agradecer al Prof. Ian Miles que haya aceptado leer mi tesis y realizar un informe sobre ella. Es un verdadero honor que alguien tan admirable haya conocido mi trabajo y haya dedicado tiempo a darme su visión y recomendaciones. Es algo increíble, y cualquier palabra de agradecimiento se quedaría corta. *Prof. Ian Miles, I am sincerely honored and grateful for your help and support.*

También quiero agradecer a los miembros del tribunal de pre-lectura, a los Prof. José Molero, Jordi Molas y Philippe Laredo, sus recomendaciones y sugerencias para mejorar la claridad del documento final, y muy especialmente al Prof. José Molero por haber asumido la supervisión de los últimos pasos de la tesis, dándome todo su apoyo en unos momentos complicados y delicados.

Otra persona clave en el desarrollo de mi trabajo, sin cuya ayuda no habría podido realizar gran parte de éste, es el Dr. Juan Carlos Salazar. Su ayuda, involucración y consejo en el desarrollo del análisis cuantitativo ha sido enorme. Ha sido un placer poder compartir con él momentos de trabajo, aprender de un experto en la materia, y además todo ello con un toque de humor maravilloso. Gracias por esos momentos de mezcla de trabajo riguroso y risas, que son tan esenciales para sentirse a gusto y disfrutar aprendiendo.

Debo agradecer también enormemente todo el apoyo que he recibido de la empresa que ha servido de estudio de caso, especialmente de las personas que han estado en contacto continuo conmigo, confiando en la investigación y en la colaboración con la universidad, supervisando el proceso, y aportando al mismo: JPM, CJ, CS. Y, por supuesto, a todas las personas de la empresa que han formado parte del estudio, en las entrevistas y en la encuesta, poniendo a mi disposición parte de su tiempo y de sus valiosos conocimientos.

Por lo que respecta al apoyo institucional, quiero agradecer a la UAM la beca FPI recibida durante cuatro años, sin la cuál no habría podido llevar a cabo esta tesis, ni realizar estancias en el extranjero, ni tenido la oportunidad de dar clases. Igualmente, quiero agradecer a la Cátedra de Innovación Accenture-UAM que me haya facilitado en numerosas ocasiones fondos sin los cuáles me habría sido imposible acudir a conferencias internacionales en las que presentar y discutir mi trabajo. También quiero agradecer a las instituciones extranjeras que me han acogido y que me han dado la oportunidad de aprender enormemente de esas experiencias y de los compañeros en otros países, especialmente estoy agradecida al programa ESST y al centro TIK de la Universitetet i Oslo, al programa de circulación de doctorandos EU-SPRI y al instituto IFRIS de la Université Paris-Est, y a la red RedeSist y a la Universidade Federal do Rio de Janeiro.

Hay mucha otra gente que ha aportado su granito de arena en esta tesis y a las que quiero agradecer su ayuda, entre ellas la Prof. Isabel Álvarez y el Prof. Bernard Kahane, por sus consejos en la parte analítica y teórica, el Prof. José Eduardo Cassiolato, por acogerme en la red de investigación RedeSist, María José Funes, por ser paciente conmigo y estar siempre disponible para ayudar con asuntos administrativos y de gestión imprescindibles, y los compañeros con los que he podido compartir momentos de dudas y avances en el trabajo.

Finalmente, quiero agradecer a mi familia, especialmente al *aita* y a la *ama*, por estar siempre a mi lado, y por sus palabras de ánimo y apoyo en los momentos buenos y malos; y a mi pareja y amigos, de aquí y allí, por aguantarme en las crisis y en mi monotemática y ayudarme a desconectar cuando lo necesitaba.

Mayo 2013

INDEX

CHAPTER 1. INTRODUCTION 6
1. INTRODUCTION AND RATIONALE OF THE THESIS: INNOVATION IN SERVICES AND KIBS 6
2. APPROACH OF THE THESIS: GENERAL OBJECTIVES AND METHODOLOGY 10
2.1. Objectives 10
2.2. Methodology: The case study 11
3. STRUCTURE OF THE DOCUMENT 13

CHAPTER 2. PRELIMINARY ANALYSIS: LOOKING INTO THE INNOVATIVE CAPABILITY OF KIBS 15
1. OBJECTIVE 15
2. LITERATURE REVIEW 15
2.1. KM, intangibles and innovation 16
2.2. Management literature 19
3. METHODOLOGY 24
3.1. Data collection 24
3.2. Data analysis 26
4. FINDINGS 27
4.1. Alpha's Innovativeness 27
3.2. Perceptions about Alpha's knowledge system 28
4. DISCUSSION: HOT TOPICS FOR FURTHER ANALYSIS 31

CHAPTER 3. R&D AND INNOVATION ORGANIZATION 34
INTRODUCTION 34
1. OBJECTIVES 34
2. INSIGHTS FROM THE LITERATURE 35
2.1. Organization of R&D and knowledge creation for innovation in services 35
2.2. R&D organization in manufacturing 37
3. METHODOLOGY 39
4. RESULTS 41
4.1. Technology R&D Units 42
4.2. Strategic Centers 47
4.3. Collaboration R&D Centers 48
4.4. Network for R&D Diffusion 50
4.5. Network for Delivery and Implementation 53
4.6. Country-specific R&D and Innovation Programs: The Spanish Subsidiary 55
4.7. Coordination of the R&D and Innovation infrastructure 58
5. DISCUSSION 62
CONCLUSIONS 71

CHAPTER 4. KNOWLEDGE MOBILIZATION 73
INTRODUCTION 73
1. OBJECTIVES 75
2. LITERATURE REVIEW: THE MOBILIZATION OF KNOWLEDGE 77
2.1 Knowledge types and circulation 78
2.2 Internal knowledge sources 80
2.3. Knowledge at the individual level: Knowledge brokers 94
3. METHODOLOGY 97
3.1. Development of hypotheses 97
3.2. Data gathering 101
3.3 Data analysis 105
4. RESULTS 112
4.1. Descriptive analysis 112

4.2. Tests of the hypotheses ... *129*
5. DISCUSSION ... 135
5.1. General insights about knowledge mobilization: Routine versus non-routine sources ... *136*
5.2. Knowledge brokerage and the role of seniors ... *138*
5.3. Mobilization of non-routine knowledge sources ... *144*
CONCLUSIONS ... 146

CHAPTER 5: GENERAL DISCUSSION: MANAGING THE TENSIONS BETWEEN EXPLORATION AND EXPLOITATION ... 148
INTRODUCTION ... 148
1. SOME INSIGHTS FROM THE LITERATURE ... 148
2. EVIDENCE OF EXISTING EXPLORATION-EXPLOITATION TENSIONS AT ALPHA ... 150
3. DISCUSSION ... 152
4. CONCLUSIONS ... 154

CHAPTER 6. LIMITATIONS AND FUTURE RESEARCH ... 155

CHAPTER 7. SUMMARY OF CONCLUSIONS AND CONTRIBUTIONS OF THE THESIS ... 158

RESUMEN Y CONCLUSIONES ... 161
1. INTRODUCCIÓN Y OBJETIVOS ... 161
2. METODOLOGÍA ... 163
3. RESULTADOS Y DISCUSIÓN ... 164
3.1. Organización de la I+D y la innovación ... *164*
3.2. PARTICIPACIÓN INDIVIDUAL EN LA CREACIÓN Y MOVILIZACIÓN DE CONOCIMIENTO ... 170
3.3. SEPARACIÓN ENTRE EL TRABAJO DEL DÍA A DÍA (EXPLOTACIÓN) Y EL TRABAJO ESPORÁDICO RELACIONADO CON LA INNOVACIÓN (EXPLORACIÓN) ... 176
4. CONCLUSIONES Y APORTACIONES DE LA TESIS ... 178
ANEXO METODOLÓGICO ... 181

REFERENCES ... 184

APPENDIX 1: STRUCTURE OF THE INTERVIEWS. ANALYZED ISSUES ... 194

APPENDIX 2: UNITS FOR R&D AND INNOVATION (NON EXHAUSTIVE) ... 196

APPENDIX 3: SURVEY INSTRUMENT ... 197

CHAPTER 1. INTRODUCTION

1. Introduction and rationale of the thesis: Innovation in services and KIBS

A company's ability to steadily innovate is crucial if it wishes to remain competitive, so it is essential to identify and understand the proper working of the variables that will help in this task. Knowledge and other intangibles have been recognized as important sources of innovation (Swan et al. 1999; Sánchez et al., 2000; Guthrie et al., 2003) and, as a result, literature on the effects of knowledge management (KM) and intellectual capital management (ICM) on innovation has increased significantly in recent years (Sánchez et al., 2009), showing how the importance of tangible assets is losing ground to intangibles (Cañibano and Sanchez, 2004; Lev, 2001).

However, most studies that analyze the influence of KM and ICM on innovation concentrate on a single aspect of KM or on particular intangibles and their effects, such as networking (e.g. Capaldo, 2007; Swan et al., 1999), knowledge protection (e.g. Bader, 2008; Hurmelinna-Laukkanen and Ritala, 2010), creativity (e.g. Henard and McFadyen, 2008; Rosa et al., 2008), etc. There are fewer analyses that offer a wider perspective, studying the effects of a broader set of intangibles on innovation (e.g. Hull et al., 2000). Hence, there is still very much a place for new research that develops methodologies to help organizations understand and manage their knowledge and intellectual capital for innovation. In fact, companies often need to combine activities or processes that are at the same time complementary and contradictory, as for example the exploration of new knowledge and the exploitation of the existing knowledge base (Andriopoulos and Lewis, 2009), so it is important to understand how to balance these activities.

Services are playing an even more important role nowadays and innovation is at their core. Although over the last decade services have grown to represent more than 70% of GDP of some OECD countries (OECD, 2000), most research on innovation has focused on the analysis of manufacturing, but interest in innovation in services has been increasing. Over the last decade, research on innovation in services has moved away from the idea that services where a laggard in terms of innovativeness, comparing them to manufacturing (Tether et al., 2006; Miles et al., 2005). Djellal and Gallouj (2001) summarize the historical evolution of the theoretical perception of innovation in services with three words: non-existence, subordination and 'autonomisation', that is, from believing that services did not innovate at all, passing through the understanding of service innovation as dependent on the introduction of technologies developed in manufacturing, to the realization that services are innovative themselves.

In the increasing literature on services innovation, there have been many debates, as summarized by Gallouj and Windrum (2009) in the introduction to a special issue on services innovation in the Journal of Evolutionary Economics. Among these, we can highlight the debate concerning the issue of whether or not the innovation process in services differs to that in manufacturing and, if so, to what extent. In this debate we can find three different viewpoints (Gallouj and Windrum, 2009):

- *Assimilation*: Authors in this viewpoint (e.g. Sirilli and Evangelista, 1998) consider that service activities are generically the same as manufacturing activities and that, as a consequence, the theories and empirical indicators originally developed for manufacturing are equally applicable to services. This viewpoint can be traced back to Pavitt's sectorial taxonomy of innovation (Pavitt, 1984), in which services are generally considered innovation laggards and adopters of innovation and technologies developed in manufacturing.
- *Demarcation*: Authors in this viewpoint (e.g. Gadrey et al. 1995; Den Hertog 2000; Gadrey and Gallouj, 1998) consider that service-specific forms of innovation exist, highlighting the importance of organizational innovation that, in services, go hand-in-hand with product and process innovation. They argue that completely new services-specific theories of innovation are required. Within this viewpoint two types of innovation have been specially studied: co-production and ad-hoc innovation. Co-production thesis suggests that the high degree of interaction between the user and the service provider is a distinguishing feature of services. Ad-hoc innovation refers to the non-reproducible solutions that service companies offer to answer to client-specific problems. Because the conventional definition of innovation requires diffusion, that is, replication in different settings, ad-hoc innovation thesis has been controversial.
- *Synthesis*: Authors in this viewpoint (e.g. Gallouj and Weinstein, 1997; Windrum and García-Goñi, 2008) seek to integrate the insights gained from demarcation studies with the insights gained from manufacturing studies, using a unifying new-Schumpeterian framework that reinvigorates research on organizational, market and input innovation dimensions (previously rather neglected in favor of product and process innovation. These authors aim at re-testing and extending existing theories and models, and at developing new theories, so that they can accommodate both services and manufacturing innovations.

Another important debate has been raised regarding problems in measuring innovation in services where 'traditional' innovation indicators (e.g. patents or R&D expenditures) perform poorly (Gallouj and Windrum, 2009). Djellal and Gallouj (2001) emphasize that R&D is considered to have a weak position in services and their survey confirmed that innovation is rarely organized along specialized departments as more than 80% of the innovative firms considered the R&D department to be an unimportant or not very important modality of innovation organization. This debate has affected the definition of innovation, as

"*much innovation in services is not adequately captured by the technological product and process concept*" (OECD, 2005: 3). The mode of learning and innovation in many services relies on experience-based know-how rather than upon the use of codified scientific and technological knowledge (Corrocher et al. 2009) and, as a consequence, the third edition of the Oslo Manual included non-technological innovation in the concept (OECD, 2005).

There are some typical service characteristics that influence the way innovations in services should be dealt with. Intangibility has been highlighted as a fairly common feature in services, as "*service products typically involve transformations in such entities as the state of material products, of people (and other organisms), and in data*" (Miles, 2008: 116). This means that the physical elements of the product constitute a very small fraction of the overall cost. Intangibility of services makes it difficult to explain a service's qualities to customers before consumption, hinders standardization efforts and makes protection difficult (Hipp and Grupp, 2005). Other characteristic features are customer intensity, meaning that many services require the presence and (active or passive) participation of clients (Miles, 2008), and coterminality, referring to the simultaneous production and consumption of services (Miles, 2008) that impedes the separation of product and process innovations (Hipp and Grupp, 2005). In addition, Hipp and Grupp (2005) highlight that in services the distinction between radical and incremental innovations is questionable because, as service innovations are easily copied, continuous innovation is necessary. Similarly, Lyons et al. (2007: 176) describe how innovation in the investment banking industry has been the culmination of "*hundreds of small advances each month, across many different fronts, that over time become transformative with most improvements to service activities being incremental*" and how intellectual property protection and R&D are strained in this sector.

Services industries still carry the legacy of being considered a residual sector, including all industries that did not produce raw materials or tangible artifacts and, as a consequence, services represent a huge range of industries (Miles, 2008). In fact, this broad category includes services of very different nature, such as: wholesale and retail trade; hotels and restaurants; transport, storage and communication; financial intermediation; real state, renting and business activities; public administration and defense; education health and social work; and other community, social and personal service activities[1]. Because of this reason, many different innovation patterns can be found within the broad category of services[2]. Miles (2008: 117) highlights three ways in which services

[1] These are the groups distinguished in the high-level Statistical Classification of Economic Activities in the European Community (NACE) categorization system.

[2] Within the group of authors that have proposed different classifications of innovation patterns for services, innovation modes have been classified, for example, in terms of the most relevant factors of competitiveness, such as technology adoption, organizational change, service production and external cooperation (Corrocher et al., 2009), the importance of different internal and external drivers (Sundbo and Gallouj, 2000), the role of and linkages between different actors (Den Hertog, 2000), and other variables or dimensions (e.g. Djellal and Gallouj, 2001; Gadrey and Gallouj, 1998).

industries vary: 1) Fundamental processes, referring to what transformation they effect on which types of objects, that are, physical artifacts (e.g. repair and maintenance, warehousing), people (e.g. health, social welfare, personal appearance), and symbols (e.g. financial services, telecommunication, consultancy services), which determine the types of knowledge required for innovation; 2) Knowledge intensity, referring to the extent to which highly skilled service operatives are needed; and 2) Market relations, referring to the type of client they are serving (i.e. consumer, businesses or public sector) and with what level of tailoring versus standardization. These three ways in which services vary significantly affect their innovative activities.

Aiming at better understanding this diversity of innovation patterns and industries in services, many authors have proposed various classifications and taxonomies (Vence and Trigo, 2009), some transferring Pavitt's taxonomy to services (e.g. Miozzo and Soete, 2001), some proposing completely different classification perspectives for services (e.g. Den Hertog, 2000), and some trying to find taxonomies that suit both manufacturing and services (e.g. Castellacci, 2008). Emerging from some of these categorizations, a specific group of services has attracted increasing attention: Knowledge Intensive Business Services. In fact, KIBS have been growing continuously over the last decades and faster than the economy as a whole and than other market services, showing that "*their growth cannot just be driven by the growth of those sectors that are users of KIBS*" (Miles, 2005: 43). Miles et al. (1995: 18) defined KIBS as *'services that involved economic activities which are intended to result in the creation, accumulation or dissemination of knowledge*'. This category of services also includes a number of diverse service sectors that go from computer related activities (e.g. hardware and software consultancy), to R&D and other business activities such as legal activities, accounting, management consultancy or architectural and engineering activities (Miles, 2005) and has been sometimes sub-divided into traditional professional services (p-KIBS) and new technology-based KIBS (t-KIBS).

Research in this field has analyzed the role that KIBS play in innovation and in the economy, showing that, besides being innovative themselves, they provide a wide range of services to their clients, working as intermediaries that help bridging gaps in resources and innovation management capabilities (e.g. by providing expert consulting, experience sharing, diagnosis services), as facilitators, carriers and source of innovation at their clients, and as co-producers of innovation (Den Hertog, 2000). Within the works contributing to the theoretical analysis of KIBS, Toivonen and Tuominen (2009) describe five innovation patterns in KIBS, depending on the degree of formality (increasing from the first pattern to the fifth) and the pattern of external collaboration: 1) Internal processes without a specific project; 2) Internal innovation projects; 3) Innovation projects with a pilot customer; 4) Innovation projects tailored for a customer; and 5) Externally funded innovation projects.

Besides the theoretical analysis of KIBS and their role as a sector, a second phase of empirical research has focused on the analysis of innovation in KIBS and on

answering whether KIBS innovate differently from manufacturing. In an interesting review of the research done in KIBS, Muller et al. (2013) highlight that "*empirical studies on KIBS are still far from being conclusive regarding the distinctive features of innovation in this sector*" but that "*there is recognition that innovative activities in KIBS are distinctive from those in manufacturing*". In general, they recognize that KIBS are less likely to perform internal R&D than manufacturing firms. Similarly, research has also aimed at differentiating KIBS from traditional services, for example by investigating sectorial variety and common patterns (Corrocher et al., 2009).

Many authors have given important steps in the exploration of KIBS "black-box" (Corrocher et al. 2009), shedding light into the internal processes of KIBS. In this sense, some authors have stated that it is the way employees interact socially with internal and external colleagues what determines KIBS' knowledge base (Larsen, 2001) and that, especially in KIBS, innovative efforts target the organizational level, for example aiming at standardizing underlying procedures (Leiponen, 2001). However, Muller et al. (2013) perceive the need of further analyzing the internal driving forces of KIBS creativity and innovation.

Hence, and due to the increasing role that services play in the economy and to the importance of understanding the key intangibles that help these companies innovate, we have devoted this thesis to the analysis of knowledge creation and knowledge circulation for innovation in this sector, adopting a broad or inclusive perspective. In particular, and because of their faster growth and relevance as innovators themselves and as facilitators of innovation in other companies, we will focus on the analysis of KIBS and on the internal driving forces of their innovation. The thesis will also shed new light on the debate regarding whether services, and KIBS in particular, conduct innovative activities that are distinctive from those in manufacturing.

2. Approach of the thesis: general objectives and methodology

As we will explain in the next sub-section, devoted to the description of the structure of this document, chapters 2, 3 and 4 of this thesis have their own specific objectives and research questions, their specific methodology and their specific results and discussion. However, and for clarity purposes, in this introduction we offer an overview of the general objectives and methodology of the thesis.

2.1. Objectives

In this thesis we aim at shedding new light on some aspects of the knowledge creation and mobilization process that are key for innovation in a very specific type of service companies, knowledge intensive business services (KIBS), by adopting an inclusive approach that incorporates both an organizational and an

individual perspective on knowledge creation and innovation and that considers both the technical and socio-technical aspects of these closely related processes. As a consequence we have specified the following objectives:

1. To analyze how knowledge is created and circulated within KIBS, both from an organizational and individual perspective.

   a. From an *organizational perspective* (where the object of analysis is the whole company), we aim at analyzing the (infra)structures available in services for knowledge creation, diffusion, and innovation, in terms of their functions, stability, location etc. with the objective of testing whether these are different from the (infra)structures found in technology intensive large manufacturing and of challenging the traditional theory that says that in services innovation is created mainly ad-hoc and not through formalized or systematic ways. In particular, the research questions we aim to answer are the following:

      i. How are knowledge creation, distribution and innovation organized in KIBS?

      ii. Are KIBS different from technology-intensive manufacturing regarding the organization of knowledge creation and innovation?

   b. From an *individual perspective* (where the objects of analysis are the employees of the company), we aim at analyzing what variables influence individual participation patterns in knowledge creation and circulation, regarding access and contribution to the knowledge base of the company. In particular, the research question we aim to answer is the following:

      i. What variables influence individual patterns of participation in knowledge creation and circulation within KIBS? Or in other words,

      ii. What variables influence individual patterns of access and contribution to the different knowledge sources available in KIBS?

2. To shed new light into how KIBS balance the tension between the exploration of new knowledge and the exploitation of the existing knowledge for innovation.

In order to answer these questions, we have applied different research methods, both qualitative and quantitative, that will be extensively explained in each chapter. However, the next sub-section is devoted to the principal methodology applied in the thesis and its justification as the most adequate for our purposes.

2.2. Methodology: The case study

This PhD thesis is based on a single in-depth case study of a large multinational service company. We have chosen a consultancy company, as this represents the

archetype of KIBS, as these could also be defined as "consultancy" firms in a broad meaning (Muller and Zenker, 2001), in contrast to other type of service companies that are still based in monopolies or strict regulations (e.g. transport, energy) and hold relics from the past (Camacho and Rodriguez, 2005). Hence, analyzing consultancy companies allows further understanding the internal driving forces of innovation in KIBS (Muller et al. 2013).

The company is a global referent in its sector and has more than 200,000 employees worldwide, providing different kinds of business services to over 1,000 clients in more than 50 countries. For confidentiality purposes and simplification of the analysis of results, we will from now on use an invented name for the case study company: Alpha. In 2011, Alpha generated net revenues over US$25 billion. In each geographical division, it provides different kinds of services (i.e. consulting, technological solutions, and business processes outsourcing) for clients in different industries. Besides these ("front-office") divisions, there is a group of personnel that manage the corporate functions (e.g. Finance, CIO, Human Resources, Legal, Marketing) providing services to internal users ("back-office"). Alpha is structured in a matrix, horizontally in terms of the different types of services it provides (i.e. consulting, technology solutions, and business processes outsourcing) and vertically in terms of industries (e.g. financial services, products, public services etc.).

Besides for being a referent in its sector, the choice of Alpha is justified by its wide experience in innovation and in the generation and diffusion of new ideas and knowledge. In fact, Alpha defines itself as an innovative company and has implemented many processes and mechanisms with that objective. In addition, Alpha recognizes to apply a company-wide approach to innovation, as is the case in many service companies (Lyons et al. 2007).

Taking into consideration the different kinds of business services that Alpha provides, which may be grouped as "management consultancy involving new technology", we could classify it within "new technology-based KIBS" (Muller and Zenker, 2001) but also as a p-KIBS (Miles et al. 1995) related to more traditional "business and management consultancy activities", that is, ISIC 7414 (Freel, 2006). Due to this mixed character, we believe that this choice enables us overcoming some limitations of highlighted in previous literature in relation to the misplacement of p-KIBS in research (Freel, 2006).

Besides representing the archetype of KIBS, the validity of the single case study as research method is justified by the objectives followed in the thesis, as we aim at better understanding how knowledge is created and circulated in these companies, and qualitative methods (Strauss, 1987) have been highlighted as key for exploratory purposes. In terms of the more specific objectives, first, at the organizational level, we aim at challenging the idea that services do not organize the innovation process in a formalized and systematic way. Hence, finding evidence of an organized formal structure for knowledge creation and innovation at Alpha is would enable us claiming for a need for revisiting the generally accepted theory. Second, at the individual level, we aim at analyzing what variables influence on individual decisions about participation in knowledge

creation and knowledge circulation. Our research setting appears an adequate setting to analyze these issues because of different reasons: 1) Mors (2010) defends that processes of knowledge creation are particularly important in consulting firms as these firms mainly sell their knowledge and expertise and that, as a consequence, consulting companies provide an appropriate context for studying knowledge circulation; 2) in KIBS and more intensively in multinational companies, knowledge is widely distributed (Larsen, 2001) and, hence, these types of companies are a particularly interesting context for analyzing how all the accumulated knowledge is put to work to find creative solutions (Gallouj and Weinstein, 1997); 3) according to Maurer et al. (2011), project-based organizations, such as Alpha, are interesting contexts for analyzing knowledge circulation because, in these companies, formal organizational or technological means of facilitating knowledge transfer are often inadequate and, instead, social modes for coordinating knowledge stocks and flows need to be often applied.

As additional support for the choice of our methodology, Miles (2008) states that innovation management in services firms has been studied mainly through case studies and, in fact, limited case studies have been used for analyzing organization of innovation in services (Sundbo, 1997), specificities of project-based firms (Blindenbach-Driessen and van den Ende, 2006), corporate culture (Lyons et al. 2007), or the unintended consequences of innovations (Cañibano et al., 2012).

Before starting with the main body of the thesis, the next sub-section describes the rather unusual structure of the document and explains its rationale.

3. Structure of the document

This document has a rather unusual structure: although it is subdivided into different chapters, they do not follow the expected arrangement starting with an introductory chapter, followed by chapters devoted to the literature, the methodology, results etc. Instead, we have decided to adopt a structure that better reflects the cognitive process followed by the PhD candidate during the research process, over the last 4 years. We believe that this might be interesting to reflect this evolution in the adopted final structure of the thesis, not only because it is a more truthful image of the research process, but because it might be essential to follow the underlying reasoning of the research.

As a consequence, the second chapter of this thesis reflects the departing point of the project, the preliminary analysis, in which we adopted a very broad framework, conducting a comprehensive review of the literature in knowledge management, intellectual capital management and innovation, aiming at identifying the key knowledge management practices and other intangibles to be included in our analysis. In addition, we conducted very broad interviews, obtaining rich information about Alpha's general knowledge system and about the selected KM practices and intangibles. After analyzing and coding the results

obtained in the preliminary analysis, we decided to narrow down the objectives of the thesis to focus on those aspects that emerged as "hot topics" in relation to knowledge creation and circulation for innovation.

Departing from the insights gained in the preliminary analysis, chapter 3 and 4 are devoted to the deeper analysis of knowledge creation and circulation from an organizational, analyzing Alpha's R&D and innovation infrastructure, and from an individual perspective, analyzing employees' patterns of knowledge access and contribution. In other words, while chapter 3 deals with part a) of the first research objective chapter 4 deals with part b). Chapters 3 and 4 have their specific objectives, methodology (more detailed than in the introduction), literature review, results, discussion and conclusions.

In chapter 5 we deal with the second research objective of the thesis, that is, the balance of the tension between exploration and exploitation. In order to shed new light into this topic we draw from the results and insights gained in the previous chapters, summarizing the main findings and offering a general discussion.

Finally, in chapter 6 we highlight some of the limitations of the thesis and reflect on possible further research and in chapter 7 we summarize the conclusions and contributions of the dissertation.

CHAPTER 2. PRELIMINARY ANALYSIS: LOOKING INTO THE INNOVATIVE CAPABILITY OF KIBS

1. Objective

Because we want to adopt an inclusive approach to the analysis of the knowledge creation and mobilization process in KIBS, that includes both an organizational and individual perspective and both the technical and socio-technical aspects of innovation, we have specified the following preliminary objectives:

1. To identify the knowledge management practices and other intangibles that most influence knowledge creation and innovation capabilities.
2. To detect the main barriers that may emerge for knowledge creation, circulation and innovation.
3. To assess at Alpha the level of "stocks" and "flows" (Haas and Hansen, 2005) of the selected key intangibles for innovation, identifying the main problems or issues that need of a deeper analysis.

In addition, because we want to analyze knowledge creation and circulation as important activities and sources of innovation capability, we have also verified whether our case study company has achieved to translate these capabilities into effective innovation results.

The first two objectives have been addressed with a review of the literature on KM, ICM and innovation, on innovation management and on innovation in services, while the third objective and the verification of the innovativeness of Alpha have been addressed through qualitative methods explained in more detail in the sub-section devoted to methodology.

2. Literature review

Contrasting with the paradigms that locate the sources of competitive advantages outside the company or on a privileged market position, we believe that competitive advantage lies within the firm (Teece et al. 1997). Many scholars have recognized firm resources and capabilities as primary sources of innovation and competitive advantage, increasingly focusing on the role of intangibles and, specifically, knowledge, addressing issues such as "*the nature of coordination within the firm, the organizational structure, the role of management, and the allocation of decision-making rights, and the theory of innovation*" (Grant 1996: 110). The topics dealt with are of a diverse kind and, for example, some authors have analyzed the integration of dispersed specialist knowledge (Becker and Zirpoli 2003), others how product innovation contributes to the renewal of the firm through its relations with firm's competences (Daneels, 2002), KM routines

(Collinson and Wilson, 2006) or the role of knowledge and capabilities in born-global firms (Knight and Cavusgil, 2004). Following their example, we have approached our analysis from the resource-based and knowledge-based view of the firm perspectives, aiming at identifying and analyzing the core resources, capabilities and routines that both enable and hamper innovation.

Subramaniam and Youndt (2005) defend that it is now widely accepted that an organization's capability to innovate is closely tied to its intellectual capital or to its ability to utilize its knowledge resources. As a consequence, we have looked into two different streams of research as starting point: literature on intangibles, KM and ICM issues, and innovation management literature. In both cases, we have specifically focused on the specificities of innovation in a service environment, identifying the key intangibles necessary to develop innovation capacity in this type of industry.

2.1. KM, intangibles and innovation

The definitions given to both KM and ICM are numerous since both terms deal with a concept, that is, knowledge, that is very difficult to apprehend, define and measure (Foray, 2004). Some authors have detected a tendency to treat knowledge as being essentially of one kind, privileging explicit over tacit and individual over group knowledge (Cook and Brown, 1999). Trying to avoid this conventional tendency, we are going to adhere to a broad notion of knowledge, understanding it both as something static and used in action, dynamic and relational.

From this perspective, *Knowledge Management* can be defined as any process and practice that aims alt creating, acquiring, capturing, sharing and using knowledge, skills and expertise (Quintas et al., 1996), and in which explicit and tacit knowledge held by individuals, teams and organizations interplay (Nonaka and Takeuchi, 1995). If well managed, KM allows the creation of more knowledge and improves organizational learning capabilities as it harnesses existing intellectual and social capital (Swan et al., 1999).

Literature on KM has traditionally adopted a narrow focus on IT-based tools and systems, as a consequence of assimilating knowledge and information, over-estimating the utility of such tools for delivering organizational performance improvements (Swan et al. 1999). In fact, it is important to recognize that knowledge, and not simply information or data (Miles, 1995), is the primary source of an organization's innovative potential and that KM is about harnessing the intellectual and social capital of individuals in order to improve organizational learning capabilities.

Recognizing this fact, some authors (Swan et al., 1999; Sørensen and Lundh-Snis, 2001) have distinguished two alternative approaches to KM: a) the cognitive network model that emphasizes linear information flows through static

IT-based networks, and b) the community networking model which emphasizes dialogue and sense-making that occurs through active networking.

For the concept of *Intellectual Capital*, we are going to adhere to the MERITUM Guidelines (Cañibano et al., 2002), endorsed by the European Commission (2006) in the RICARDIS Report, which defines it as the combination of the human, organizational and relational resources and activities of an organization (e.g. employees' knowledge, skills, and abilities, R&D activities, routines, Intellectual Property Rights, and all resources linked to external relationships, such as clients, suppliers, R&D partners, etc.). In this definition, KM practices are included within IC. It is interesting to mention that, over the years, a number of models have been proposed that link IC management to value creation (Bontis, 2001). However, Cuganesan (2005) emphasizes that these models do not reflect the unstable relationship between the different aspects of IC and value, which can lead to intellectual liabilities if IC resources are badly deployed.

In our opinion, there are some important differences that emerge from the large amount of literature dealing with both concepts (Sánchez et al. 2009):

1. ICM is a broader concept because it incorporates KM activities together with other routines and practices (e.g. creation of work incentives).
2. Most papers dealing with ICM implicitly or explicitly refer to both "old intangibles" (e.g. trademarks, intellectual property, good will etc.) and "new intangibles" (e.g. human resources management, organizational changes, customer relations improvement etc.). In contrast, most KM literature refers mainly to the latter and seldom to the former.
3. IC management papers have an explicit or implicit external objective, as they aim at revealing the institution's intangibles resources and activities so as to let stakeholders know about them (Sánchez et al. 2000). In fact, IC literature has traditionally focused on measurement, accountability and classification issues (Lev, 2001, 2004). On the other hand, most KM papers have an internal objective regarding the improvement of management to achieve the company's objectives.
4. IC management literature has dealt more often with knowledge "stocks" or level of knowledge assets, suggesting that these are associated with its economic value or performance (Haas and Hansen, 2005). From this approach, knowledge is considered a property of the overall firm rather than of individuals. In contrast, KM literature has dealt more often with knowledge "flows" between employees in organizations, analyzing issues such as the exploitation of lessons learned, the circulation of knowledge, the existence of different types of barriers to knowledge circulation etc. (Ibid).

Finally, we adhere to a broad definition of *innovation*, following the third edition of the Oslo Manual, "*an innovation is the implementation of a new or significantly improved product (good or service), or process, a new marketing method, or a new organizational method in business practices, workplace organization or external relations*" (OECD 2005: 46). Implementation means introducing a new or improved product on the market or bringing a new process,

marketing method or organization method into actual use in the firm's operations. The most established classification of innovation (Subramaniam and Youndt, 2005) distinguishes between incremental innovations (i.e. refine existing products, services or technologies, and reinforce their potential) and radical innovations (i.e. major transformations of existing products, services or technologies, that often make the prevailing ones obsolete).

According to Swan et al. (1999), literature on innovation has also adopted two positions: the structuralist and the process perspective. The former looks at innovation as a "thing" or "blackbox" (for example the concept of "best-practice" is often introduced in this perspective) and has been criticized for playing down how much innovation depends on the social and organizational context. From the process perspective, innovation is the "*development and implementation of new ideas by people who over time engage in transactions with others in an institutional context*" (Van den Ven, 1986). The unit of analysis is extended from the single firm to networks, which involves negotiation among groups with distinctive norms, cultural values, interests, etc. In fact, it is broadly accepted that innovation is not "manna from heaven", but on the other hand, firms need to establish the conditions to facilitate its emergence and take all the scientific, technological, organizational, financial and commercial steps (i.e. the innovative activities) that lead to its implementation (OECD 2005). As a result, the innovative capability of a company is defined as the capability to generate innovations, which is influenced by different aspects of its IC and their interrelationships (Subramaniam and Youndt, 2005). Summarizing, this initial review of the literature provided us with some important insights (Table 1).

Table 1: Insights from the literature. Theoretical positioning

Literature thread	**Confronted positions**	
	Closed	**Broad**
KM	**Cognitive network model**: emphasis on linear information flows through static IT-based networks.	**Community networking model**: emphasis on dialogue and sense-making that occurs through active networking.
ICM	**Accountancy perspective**: Explicit or implicit external objective, aiming at revealing the institution's intangible resources and activities to stakeholders. Mainly focusing on "old intangibles" (e.g. IP).	**Management perspective**: emphasis on "old intangibles" and "new intangibles" (e.g. organizational changes), also with an internal objective.
Innovation	**Structuralist perspective**: looks at innovation as a "thing" or "blackbox". Does not consider how much innovation depends on the social and organizational context.	**Process perspective**: innovation should be seen as "*a complex, time phased, politically charged design and decision process often involving multiple social groups within organizations*" (Swan et al., 1999).

Own elaboration. Partially based on Swan et al. (1999)

Looking at the interrelations between these threads, it seams that there is less literature dealing with the relations between ICM and innovation than that dealing with KM and innovation. This could be because IC literature has traditionally focused on measurement, accountability and classification issues, rather than on the relation between its management and value creation.

In general, this literature focuses mainly on a single aspect of KM or on a few intangibles, such as the creation of internal or/and external networks and communication flows (Moenaert et al., 2000; Cross et al., 2007), the introduction of ICT (Corso and Paolucci, 2001; Sørensen and Lundh-Snis, 2001), or specific knowledge sources (Cillo, 2005), even if they tackle or mention a broader set of important issues. In fact, in the reviewed literature there are very few studies that offer a broad perspective of the influence of KM and IC management on innovation, for example establishing weights to the relative importance of some factors/variables over others (important exceptions are Hull et al., 2000 and Merx-Chermin, 2005), or analyzing their interrelationships (Cuganesan, 2005).

2.2. Management literature

Management literature has provided important insights about the management of innovation. We first highlight some articles that have done valuable advances in analyzing the extent literature on innovation management, elaborating comprehensive frameworks that will enable the accumulation of knowledge on a topic so far absent of a generally accepted holistic framework. Then we summarize some important insights related to several relevant topics that need of special attention.

2.2.1 A comprehensive framework for the management of innovation

Adam et al. (2006) recognize that many scholars have sought to identify the key activities of the innovation management process, but believe that these models are limited from a measurement perspective because there are many competing models, generated in the context of technology (and hence their generalizability is constrained) and that mainly focus on specific activities, failing to take account of the organizational pervasiveness of innovation and its socio-technical connectedness with all aspects of the organization.

Recognizing the criticality of the measurement of the process of innovation and its complexity, Adams et al. (2006) emphasize that literature in this topic is characterized by a diversity of approaches, sometimes confusing and even contradictory. In fact, they state that there is an "*absence of a holistic framework covering the range of activities required to turn ideas into useful and marketable products*". They address the detected gap and develop a synthesized framework of the innovation management process consisting of seven categories: inputs management, knowledge management, innovation strategy, organizational

culture and structure, portfolio management, project management and commercialization. For each of the categories, they establish a number of measurement areas (Figure 1).

Figure 1: Innovation management framework

Framework category	Measurement areas
Inputs	People
	Physical and financial resources
	Tools
Knowledge management	Idea generation
	Knowledge repository
	Information flows
Innovation strategy	Strategic orientation
	Strategic leadership
Organization and culture	Culture
	Structure
Portfolio management	Risk/return balance
	Optimization tool use
Project management	Project efficiency
	Tools
	Communications
	Collaboration
Commercialization	Market research
	Market testing
	Marketing and sales

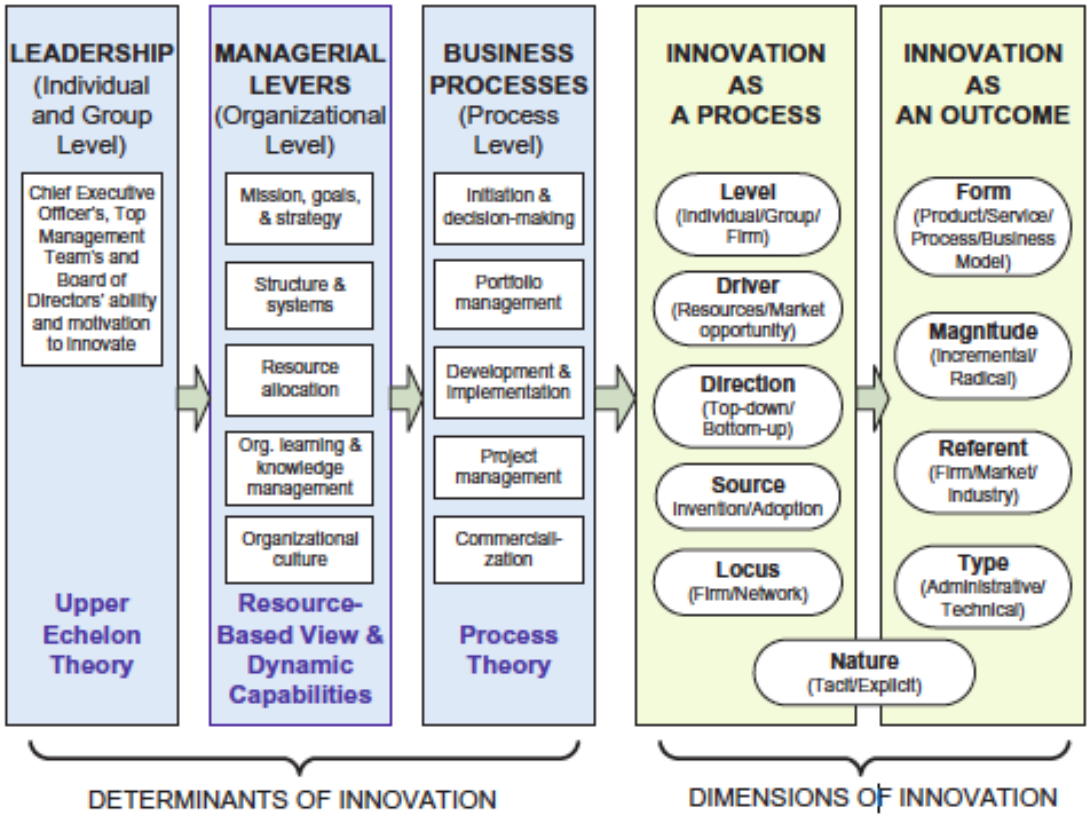
Source: Adams et al. (2006)

Moreover, Adams et al. (2006) highlight a number of important research gaps, such as an over-reliance on financial measures rather than process measures, a reliance on codified knowledge such as patents to the exclusion of more intangible measures such as tacit knowledge, or a technological and new product development (NPD) bias to project management measures and a relative absence of measures for service sectors.

Also aiming at consolidating the state of academic research on innovation, Crossan and Apaydin (2010) make a systematic review of the literature with the objective of synthesizing various research perspectives into a comprehensive framework of organizational innovation (Figure 2). From their review, they emphasize that, although several authors have used mainly a few theories (i.e. resource-based view, knowledge-based view, organizational learning, and network theory), there is still a lack of a coherent and explicit theoretical base. As a response to the detected gap they develop a framework of organizational innovation that comprises three determinants of innovation (leadership, managerial levers, business process) and two dimensions of innovation (innovation as a process, innovation as an outcome).

Looking at these two examples of comprehensive innovation management frameworks it seams evident that the topic we are handling is extremely complex and multi-dimensional. Moreover, these models look at innovation from the perspective of the firm, giving indirect importance to the individuals conforming the company. However, in a company such as ours, where the main resource is knowledge held by employees, the object of analysis should be also set at the individual level.

Figure 2: Multi-dimensional framework of organizational innovation



Source: Crossan and Apaydin (2010).

2.2.2 Organizational and socio-technical aspects of innovation

As it has been already highlighted, the analysis of innovation management has focused on many different issues but has sometimes failed to take account of the organizational and socio-technical aspects of innovation. The following paragraphs are devoted to some articles that have looked into these important issues.

Kanter (2006) analyzes the "classic traps" of innovation emphasizing, among others, the following as the most important: silos, culture clashes, underinvesting in the human side of innovation, and tight controls. She states that "*game-changing innovations often cut across established channels or combine elements of existing capacity in new ways*" (Kanter, 2006: 77) and, as a result, companies that operate in silos may miss innovation opportunities. In addition, she describes how companies sometimes distinguish "*two classes of corporate citizens*": on the one side "*those who have all the fun*", identified as creators, with less rules or revenue demands and "*allowed to play with ideas that don't yet work*"; and, on the other side "*those who make all the money*", expected to follow rules, meet demands, and make money. This culture clashes are a mistake for innovation. Similarly, talking about innovation in services, Lyons et al. (2007: 186) say "*an approach to innovation in services that targets innovation culture to a particular group or groups misses the systemic nature of innovation in services*". Related to

this problem, Kanter (2006) emphasizes that undervaluing the human side of innovation, for example emphasizing tasks over relationships, is a mistake for innovation, as opportunities to enhance the necessary "*team chemistry*" and to build trust and interplay among team members may be missed, making it difficult to embrace collective goals, to communicate and to share tacit knowledge.

The building of trust has been highlighted by many authors as crucial for the mobilization of knowledge resources and innovation. Maurer et al. (2011: 162) define trust as "*positive expectations regarding the goodwill and competence of an exchange partner*" and show that trust has a significant direct effect on the strength of interpersonal ties, which indirectly affects knowledge transfer. However, they believe that the importance of trust might not be as strong for intra-organizational knowledge circulation, as organizations often rely on control mechanisms that support knowledge transfer and mitigate opportunistic behaviors.

Kanter (2006) also emphasizes that "*tight controls strangle innovation*", referring to the tight planning, budgeting and reviews so usual in organizations. Salaman and Storey (2002) make a similar analysis of the problems of "competing priorities" within organizations as, often, they declare having a corporate commitment to innovation while maintaining organizational structures (e.g. financial control regimes) and day-to-day bureaucratic priorities (e.g. meeting deadlines, keeping within budgets) that emphasize traditional attitudes and ways of doing and restrain innovation, indicating that innovation holds a relatively inferior place in the pecking order. Similarly, Vermeulen et al. (2007: 1540) analyze the impact of micro institutional forces (e.g. regulatory forces and normative forces) on innovation and defend that "*if employees are sanctioned for not reaching set targets while simultaneously not being rewarded for efforts in new product development projects, they may experience a lack of legitimacy for incremental product innovation*". In this sense, Ramus (2001) believes that employees want to perceive consistent messages from their organizations.

Similarly, Amabile et al. (2002) looks into creativity processes and their relation to time pressures finding out that "*the more time pressure people feel on a given day, the less likely they will be to think creatively that day, the next day and the day after that, because exhaustion or enduring postpressure cognitive paralysis*" (p.57). Moreover, they state that protected creativity time does not occur naturally in organizations, as time pressures for process checks, high demands and the highly interdependent work roles constrain creativity.

In relation to the mentioned "competing priorities", Salaman and Storey (2002) argue that, for managers, willingness to act with respect to innovation, tackling the obstacles and aspects of organizational decision-making that limit innovation, is not just an issue of individual commitment. In fact, they believe that willingness to act depends on the organizational priorities as perceived by managers. Yuan and Woodman (2010: 327) defend that "*an organization climate for innovation delivers "expectancies" and "instrumentalities" so that organization members understand that being innovative is a desirable image and engaging in innovative behavior will make them look good*". They argue that

people act on the basis of the expected consequences of their behavior and that employees' innovative behavior is explained by expectations for such behaviors to affect job performance and image inside their organizations. As a consequence, perceived organizational support for innovation is key for engagement, as it creates expectancies about the benefits that this engagement will bring. In fact, research on creativity and innovation has shown that if employees do not to perceive this support they are less likely to try initiatives (Ramus, 2001).

In line with this argument, Lyons et al. (2007) defend that leaders play a critical role in informing organizational members about their guiding missions. They argue that innovation and the development of new ideas involve an inherent risk, as they challenge the status quo and attract more intense scrutiny to individuals. In this context, company wide transparent communication from management is critical for decreasing apprehension about the risks of innovation. Similarly, in the context of complex knowledge platforms assimilation in organizations, Purvis et al. (2001) say that senior management support is a key determinant of organizational innovativeness.

Without aiming at being an exhaustive summary of the organizational and socio-technical issues tackled in the management literature related to innovation, Table 2 presents a summary of the main innovation traps and innovations "triggers" detected in our review.

Table 2: Organizational and socio-technical issues

Innovation traps	**References**
Silos (i.e. organizational boundaries)	Kanter (2006)
Culture clashes (i.e. two classes of corporate citizens)	Kanter (2006), Lyons et al. (2007)
Undervaluation of human side of innovation	Kanter (2006)
Competing priorities (e.g. bureaucratic priorities)	Kanter (2006), Salaman and Storey (2002), Vermeulen et al. (2007), Ramus (2001), Amabile et al. (2002)
Innovation triggers	**References**
Trust	Maurer et al. (2011)
Organizational support and leadership	Salaman and Storey (2002), Yan and Woodman (2010), Ramus (2001), Lyons et al. (2007), Purvis et al. (2001)

Own elaboration.

Summarizing, the review of the literature has evidenced that the topic we are handling is extremely complex and multi-dimensional. Very few articles have adopted an integrative perspective to the analysis of innovation, KM and ICM. In fact, we have seen two differentiated threads of the research; literature on intangibles more focused on measurement, accountability and classification issues (Lev, 2001) and literature on KM more focused on the circulation of knowledge in organizations, be it through informal relations or ICT tools,

adopting a more internal vision (Swan et al. 1999). These two views can also be characterized as the "stocks" or "flows" view of the value of a firm's knowledge, respectively (Haas and Hansen, 2005), which have also adopted tow confronted positions: on the one hand a rather closed position, which adopts the cognitive network model of KM and the structuralist perspective of innovation and, on the other hand a broader position, which adopts the community networking model of KM and the process perspective of innovation. Besides, we have seen that most comprehensive innovation management frameworks look at innovation from the perspective of the firm, giving indirect importance to individuals.

Adams et al. (2006) believe that "*there is a risk that different operationalizations of the same effect will produce conflicting findings, and that theoretical advances become lost in the different terminologies that resist the accumulation of knowledge*" (p.22). Because of this reason, in this thesis we try to offer an integrative analysis of the issues highlighted as important by the different threads of literature.

3. Methodology

Departing from the insights gained in the literature review and trying to integrate the different theoretical advances, we have adopted the theoretical positions that we have named "broad", emphasizing the social and organizational aspects of innovation, to analyze knowledge creation and circulation in KIBS, as important determinants of their innovative capability. Because of this reason, we have given special importance to the articles offering a broad perspective, which have constituted the starting point for our analysis, supporting the selection of the variables to be analyzed at our case study company: Alpha.

3.1. Data collection

After a documentary analysis, including diverse reports (e.g. innovation and technology reports), videos, information about used tools and technologies, portals and other documents available both in the Intranet and extranet of the company, we conducted various interviews aiming at a deep understanding of the company.

First of all, we designed a structured question schedule, based on the audit tool developed by Hull et al. (2000), validated both in manufacturing and service companies, which analyzes five groups of KM practices (KMP) in companies with specific units for innovation, i.e. R&D departments. According to Hull et al. (2000: 636), KMPs are "*regular, repeated activities which process knowledge in some way*" and encompass a wide range of formal/informal, people-/system-driven activities. The analysis of KMPs has some managerial advantages, as it provides a tangible and auditable framework that allows inter-organizational learning and internal understanding of the role of KMPs in the company's

dynamics (Ibid). In order to offer the pursued "broad" perspective of innovation, including the socio-technical aspects of innovation, we added questions related to other important issues tackled in the literature, such as trust, leadership, organizational structure (e.g. autonomy and decision making), motivation, and culture, strategy (Merx-Chermin and Nijhof. 2005) and financing, as well as questions related to obtained outcomes in terms of effective innovation and both financial and non-financial results (e.g. motivation, work intensification, well-being). Finally, we adapted Hull et al. (2000) model to the evaluation of companies without a specific unit for innovation but with a more company-wide innovation approach, as this is the case of many service companies (Lyons et al. 2007).

Table 3 offers a small summary of the key articles that have been considered as starting point for the qualitative analysis and that have provided the key intangibles to be analyzed in the interviews.

Table 3: Articles used as starting point for a broad analysis of innovation

Article	Objective	Key intangibles
Hull et al. (2000)	Analyzes five groups of KM practices in companies with specific units for innovation (R&D departments)	• R&D management • Knowledge relationships • Human resource management • Management of Intellectual Property • Information Technology management
Merx-Chermin and Nijhof (2005)	Analyzes the factors that influence the innovative power of organizations, using a model consisting of three processes: knowledge creation, innovation, and learning to learn.	• Strategy • Structure (autonomy, centralization) • Leadership (expertise, coaching) • Climate (communication, trust) • Motivation, creativity

Taking into account the introduced modifications, our interviews comprised the four core capabilities that the resource-based view considers that enable innovation, that are employee knowledge and skills, technical systems, administrative systems, values and norms (Daneels, 2002)[3].

We asked interviewees to rate the importance of each analyzed variable for the innovation of the company and the development of its knowledge base, and their satisfaction with the current performance of the specific issue, using a six point Likert scale. Additional commentaries were also requested (see Appendix 1 for the structure of the questionnaire used in the interviews).

Interviews began with employees from the innovation area of the company in Spain and, thereafter, we asked each interviewee to point out at other three colleagues (each from a higher, lower and the same category), achieving a

[3] Interviews also tackled additional topics that fall outside of the objectives of this thesis, such as the analysis of the potential negative effects of the introduction of some innovations for company employees. Results of the analysis of the unexpected and undesired effects of innovation have been developed in a book chapter that serves as a complement to this thesis (Cañibano et al. 2012).

"snowball" effect (Biernacki and Waldorf, 1981). This procedure facilitated a less biased selection process including all employee categories, as some authors state that attitudes of senior managers are not necessarily the only or best measures of the success of any KM system (Soo et al., 2002), and the perceptions of senior managers and their subordinates often differ, for example in terms of incentives and motivation, communication, trust issues etc.

However, due to the selection process, the interviews have leaned towards Consulting and Corporate functions areas, and there is a high representation of the Financial Services industry (employees pointed out to their contacts, usually in the same or close area). Table 4 shows the diverse profiles of the 36 interviewees.

Table 4: Profiles of the interviewees

Category	**Nr. of interviewees**		**Company area**	**Nr. of interviewees**
Senior executives	1		Consultancy	18
Senior managers	13		Corporate functions	16
Managers	16		Technology solutions	1
Analysts and Consultants	6		Business Process Outsourcing Services	1
TOTAL	**36**		**TOTAL**	**36**

We conducted the interviews in two phases, the first one, mainly in the consultancy area, between May and June 2010, and the second one, mainly in the internal services area, between November 2010 and March 2011. The average duration of the interviews decreased from 148 minutes for the first eight interviews, to 90 minutes the last ones, because when we reached theoretical saturation (i.e. when an additional interview resulted in minimal incremental understanding of an specific issue) we stopped collecting information about it, capitalizing the results (Strauss, 1987).

3.2. Data analysis

First, aiming at verify that Alpha is innovative and succeeds in translating its "innovative capability" into effective innovations (Subramanian and Youndt, 2005), we have classified the different innovations following the categories proposed in the Oslo Manual (OECD, 2005), that is, product/service innovations, process innovations, marketing innovations, and organizational innovations. However, literature on service innovation has emphasized that it is difficult for services to make a strict distinction between product and process innovations (Hipp and Grupp, 2005) and, as a consequence, we have analyzed both categories together.

Second, we have determined whether the intangibles (specifically IC management and KM practices) pointed out in the literature as important for

innovation are also important for KIBS, on the basis of the ratings of importance provided through the Likert scales.

Third, we have analyzed the satisfaction of the interviewees with the knowledge system of the company, regarding the current state of the different analyzed intangibles. Besides the satisfaction ratings provided through the Likert scales, we have analyzed the qualitative comments, in order to identify perceptions about the strengths and weaknesses of Alpha's knowledge system focused on analyzing the weaknesses that interviewees perceive regarding the knowledge system of the company. This analysis has allowed detecting the main barriers for knowledge creation, circulation and innovation in the company and to assess Alpha's level of "stocks" and "flows" of the selected key intangibles.

Finally, we have coded the most often mentioned weaknesses or problems, classifying them into six transversal problems.

4. Findings

The following section describes the principal results obtained from the analysis of the interviews: a) a list of examples of the most important innovations developed by the company, according to the interviewees; and b) the perceptions about strengths and weaknesses of the practices of the company.

4.1. Alpha's Innovativeness

Is Alpha innovative at all? The interviews have evidenced that, in fact, the company has been active innovating since its creation, as we have obtained a long list of examples of innovations, both historic and recent or even ongoing, that interviewees consider being the most relevant for the company[4] (Table 5). In fact, we have obtained examples of all types of innovation considered in the Oslo Manual (OECD, 2005).

Indisputably, the existence of different units specifically devoted to R&D and innovation is extremely relevant. In this sense, we have distinguished units that act at the global level and units that are local. For example, at the local level, we have obtained many commentaries about the Spanish Innovation Program, which fosters innovation and creativity, and invites all employees to get involved in the process by providing their individual ideas.

[4] As Alpha is a multinational company, the origin of the examples is sometimes local (in the Spanish subsidiary) and sometimes global, and so is their implementation.

Table 5: Innovation examples

Type of innovation	Main insight	Some examples
Product / Service innovations	New technological tools and services are continuously developed in different areas of the company. Specifically significant has been finding out that there exist R&D and innovation units specifically devoted to these developments.	New technology platforms and tools for insurance companies, eHealth, real state, digital watermarks, e-ticketing for transportation. multishore and offshore services …
Marketing innovations	Alpha has introduced important marketing innovations, adapting to new market circumstances (e.g. the economical crisis) and benefiting of new market trends (e.g. increasing use of social networks, new technologies).	Opening to new market niches (e.g. SMEs), use of social networks, new approach to value billing (sharing benefits with clients), electronic auctions of service proposals, consultancy hours donations to NGOs …
Organizational innovations	Alpha continuously introduces new technologies, tools and methodologies that allow improving internal processes and cooperation, the management of projects, and the management and satisfaction of its human capital. Specifically relevant has been finding out the company is creating new units specifically devoted to innovation at the local and global level.	Creation of local Innovation Programs to foster creativity and innovation, use of new technologies to improve internal cooperation and communication, standardization of processes, introduction of internal services to improve satisfaction (e.g. virtual office support, telework…)

Own elaboration.

Besides all these examples of more radical innovations, interviewees have also emphasized that, in the day-to-day work, the company responds to the needs and demands of its' clients by adding new value in each project and introducing incremental or ad-hoc innovations.

3.2. Perceptions about Alpha's knowledge system

All the analyzed intangibles and knowledge management practices have been rated as being very important for innovation in the company. Showing the same tendency, general satisfaction with the analyzed issues has also been high and interviewees consider that the company is walking in the right direction in terms of innovative capability creation.

We have analyzed the mechanisms, routines and methodologies that Alpha has developed for managing its knowledge, paying special attention to the existing structural capital (e.g. databases, information and communication technologies, formal procedures), but also to other more subtle issues that influence knowledge transfer and new knowledge creation, such as trust, informal communication, and multidisciplinarity. Generally speaking, we can say that the company has a very ample offer of all kinds of databases, ICT tools, and methodologies that facilitate the registration and retrieval of information, for example about projects. Moreover, the available information in the company is huge, and is kept in structured global databases. The ICT infrastructure of the company is very advanced and standardized at the global level, including services such as a corporative Intranet, universal and remote access to the Internet, videoconference facilities, groupware technologies, multiple databases etc. and the general opinion regarding the technology offer is very positive. The formalization of methodologies (e.g. financial-, risks-, quality-, and expectative-compliance-controls) is also high. The following quotation reflects the positive perception that interviewees had about the ICT infrastructure available to them:

> "*If we compare our company with other companies, the introduction of innovations and improvements in the available ICT tools is continuous. We get used have all these technology services and it seams that it is normal to have all this offer available, but it is not; it is a privilege*" (Senior Manager, Corporate Functions)

However, the analysis of the additional commentaries has allowed us qualifying these very positive results, detecting some weaknesses on the existing practices or transversal problems that need to be taken into consideration. These transversal issues are: a) insufficient or ineffective communication of some of the company's initiatives, as for example of the consequences of the innovation strategy for the daily work of employees; b) lack of time; c) uneven participation of the employees in some initiatives; d) complexity of navigation of the huge amounts of information existing in the company; e) some incoherencies between the innovation strategy, which places innovation as a priority, and accountability mechanisms, which have not changed yet to include these issues specifically as, for example, hours devoted to innovation cannot be charged to any client account and, as a result, damage individual key performance indicators, on the basis of which employees are evaluated; and f) existence of some barriers to knowledge transfer, such as the presence of silos or the keeping of knowledge as a power source.

Table 6 shows these transversal problems, ordered in terms of the percentage of interviewees that tackled them, and some examples of their comments.

Table 6: Transversal problems

Problem	**%**	**Quotations from the interviews**
Insufficient or ineffective communication	63	"I am not sure if we have been exactly informed about how innovation is going to be integrated in the strategy of the company and about how the innovation process is going to impact on our every-day work" (9)

		"People have already enough with their every-day work, so all the informative emails we receive are not effective" (21) "There are many people centered in their day-to-day work that do not even know that there exist specialized R&D and Innovation units in the company" (12)
Lack of time	58	"Most employees are motivated to provide their ideas but there is no time for it because the day-to-day work takes it all. Work time is always dedicated to projects and thinking about innovation is something you do from your own personal time" (17). "We have access to many information sources, but no time to systematically use them" (9) "I would be nice to make a final recapitulation of projects, but the daily work is a hustle and bustle. We move on being conscious of the problems rather than documenting them" (28)
Uneven participation	47	"Only employees that know all the right people and that have access to important executive managers have the facilities to speak their ideas for them to be analyzed…this happens usually from senior manager on" (31) "There is some training on creativity, but not everyone has access to them. People are being chosen" (17) "Innovation depends a lot on the kind of supervision you have; some bosses promote it a lot and others do not let you participate because of time shortenings" (25) "(Multidisciplinary encounters) are not organized in every level the same way…for manager up there is more access, but people that need them most may not have access" (31)
Complexity of information	30	***Information overload*** "There is an information overload that impedes us to pay attention to everything…" (12) "We are doing an important effort to synthesize, because we have so much information that, at the end, it becomes disinformation" (21) "There are many web sites, but people know a 60% of what we have available" (7) ***Navigation complexity*** "We have too much information and it is too complicate. Once you enter the (internet) platform you get lost looking for information…you keep jumping from a page to the other and, at the end, you don't even know where you are" (21)
Accountability incoherence for innovation	22	"The accounts to which we charge the hours devoted to innovation projects are not billable and this damages our performance indicators, by which we are evaluated. Hence, a higher participation in the innovation program could damage our career and our individual salary" (2) "Alpha should value time we dedicate to innovation activities, because only time devoted to clients is valued (…) in the evaluation" (17)

Barriers to knowledge transfer	22	***Existence of silos*** "Sometimes the coordination among business units is not very good so, occasionally, there are niches that are not being covered or we get duplicated" (25) "In many areas people continue working as isolated groups and do not share information" (8) ***Keeping knowledge as a power source*** "Confidentiality of information allows you to be better valued in the annual banding and to have a higher salary increases. This competitiveness hinders knowledge transference" (24) "Personal communication is difficult because people keep knowledge for themselves in order not to lose power…it is a way of making yourself indispensable" (20)

Own elaboration.

4. Discussion: Hot topics for further analysis

First of all, we believe it is necessary to make a little commentary about the positive ratings obtained in our interviews, both for the importance of the analyzed issues for innovation in the company and for the satisfaction with the current situation of interviewees. Empirical evidence supports the existence of these kind biases linked to interviewees' personality characteristics, regardless of the analyzed topic (Paulhus, 1991). For example, some people have the tendency to give extreme answers rather than central. Besides, interviewees might also be tempted to give the socially desirable answers or the answer that they think will be most aligned with the interviewer's opinion. Showing the same tendency, general satisfaction with the analyzed issues has also been high and interviewees have a general positive perception about the knowledge system of the company and its efforts in terms of innovative capability building. These results could also be related to a bias known as "impression management" (Johnson et al., 2009), in which the interviewee tries to offer a good self-image, or a good image of its company in this case.

Although justified, the bias of the responses towards the highest rating impedes establishing priorities among the different variables in terms of their importance for innovation in KIBS, which evidences some limitations of the audit tool proposed by Hull et al. (2000) regarding subjectivity. However, the application of the tools has provided us with very rich information and with insights about some qualitative issues and transversal problems that need to be taken into consideration. We have crossed the transversal problems found regarding the knowledge system at Alpha with the insights gained from the literature review, finding out some important "*hot topics*" that need of further analysis. These are the following:

1. **Existence of different units specifically devoted to R&D and innovation**. As it has been evidenced in Chapter 1, literature on innovation in services has highlighted that these kinds of infrastructures

are rare in services (Djellal and Gallouj, 2001) and, hence, it is necessary to dig into this issue as will allow shedding new light to the debate regarding whether KIBS conduct innovative activities that are distinctive from those in manufacturing.

2. **Uneven participation of the employees in some initiatives**. Innovation management literature has emphasized that culture clashes are a trap for innovation (Kanter, 2006), hence, it is important to analyze why participation level differs between employees, specifically regarding knowledge creation and circulation and whether this is related to culture clashes or to the existence of different types of "corporate citizens".
3. **Other problems related to knowledge circulation**, namely:
    a. *Insufficient or ineffective communication* of some of the company's initiatives. We have seen how important effective communication is as means of organizational support and the delivering of expectancies regarding, for example, the desirability of innovation (Yuan and Woodman, 2010).
    b. *Complexity* of navigation of the huge amounts of information existing in the company
    c. *Lack of time* and the need of charging time to build the key performance indicators (*accountability* of time). Literature on innovation management has shown that competing priorities, such as bureaucratic priorities against innovation priorities, are detrimental for innovation (Kanter, 2006; Salaman and Storey, 2002)
    d. *Organizational silos* have also been highlighted as traps for innovation (Kanter, 2006)
    e. Seeing knowledge as a means to retain power can be considered a result of the lack of trust and of perceived *competing priorities*, as sharing knowledge is perceived as socially beneficial but individually detrimental. As Maurer et al. (2011: 174) put it, "*if knowledge provides its holders with benefits in the internal competition among teams or further individual career prospects, knowledge holders will be reluctant to share it*".

    It is important to analyze how these issues or barriers to knowledge circulation affect individual participation on knowledge creation and circulation, that is, how perceptions about the existence of this barriers influence individual decisions about access and contribution to the knowledge base of the company.

Moreover, the analysis of Alpha's innovativeness has evidenced that employees perceive a distinction between: a) the generally *incremental innovations* that emerge from the *day-to-day work* with clients, in which services are improved continuously to adjust to the different needs in an ad-hoc basis; and b) the more *radical innovations* that emerge as a result of *specific initiatives and more sporadic activities*, such as the creation of new technology platforms or tools that are the outcomes of the work done in the specific R&D units or that emerge as a

result of the local innovation programs. For example, within the local programs there are bottom-up initiatives in which employees can provide ideas on different topics that, if selected, are developed and implemented in the market as new services. However, the voluntary introduction of ideas into these local programs is not perceived as part of the day-to-day work but rather as a sporadic activity.

In their day-to-day work employees *exploit* existing knowledge to answer to specific client needs by adding continuous ad-hoc innovations. In the more sporadic activities (e.g. participation into innovation initiatives) new knowledge is *explored*, leading to more disruptive innovations.

Related to this issue, as mentioned in Chapter 1, Hipp and Grupp (2005) questioned the distinction between radical and incremental innovations in services, supporting that in services innovation is rather cumulative. However, we have found that, although the clear division between the two might be problematic, in our company both types of innovation coexist. Hence, it is important to shed new light on the **tensions** between the **day-to-day work and the more sporadic activities,** between the more **incremental and more radical innovations,** and between **exploitation and exploration** of knowledge (O'Reilly and Tushman, 2004).

Hence, our preliminary analysis has provided interesting insights about Alpha's knowledge system, evidencing that it is an innovative company and that it has many KM and ICM procedures, routines and resources that are considered important for building its capabilities for innovation. However, we have also detected some issues that need of deeper analysis and we have devoted the rest of the thesis to the analysis of these issues: Chapter 3 analyzes the detected specialized R&D and innovation infrastructure; Chapter 4 analyzes the uneven participation of employees, trying to find out whether there exist two "classes of corporate citizens" and analyzing the influence of the detected barriers on individual patterns of knowledge access and contribution; and Chapter 5 offers a general discussion in which we analyze the tensions between exploitation and exploration of knowledge, drawing from the insights gained in the previous chapters in terms of the tensions between day-to-day work and sporadic activities and between incremental and more radical innovations.

CHAPTER 3. R&D AND INNOVATION ORGANIZATION

Introduction

In their well-known "An Overview of Innovation", Kline and Rosenberg (1986) claim that there is a need for an adequate and understandable model of innovation that properly reflects the complex and variegated nature of innovation. Evidencing the flaws of the until-then generally accepted linear model that visualized innovation as a smooth and well-behaved process that draw on science, they introduced the chained-linked model as an alternative, which recognized the importance of the demands of the market and its feedbacks as a path of innovation. Hence, their model acknowledges that research and development is indeed a source or path for innovation and, as a consequence, R&D represents an innovative activity (OECD, 2005), but it also acknowledges the existence of different paths for innovation, such as the particularly important feedbacks gained from the implementation in the market of pilots or "beta-phases".

Literature on service innovation has also acknowledged the existence of many different paths of innovation (Gallouj and Weinstein, 1997) but, traditionally, this research has highlighted the importance of co-creation with customers and ad-hoc innovation to adjust to clients' needs (Gadrey and Gallouj, 1998), seldom considering that service firms also draw from scientific and technologic results to innovate (Sundbo, 1997). Hence, literature on service innovation has adopted an approach that is the opposite from the one presented in the linear-model that Kline and Rosenberg criticize, as it has considered the market or users to be the unique or principal source of innovation (Von Hippel, 1988).

Taking these issues into consideration, this chapter aims to shed new light into the organization of the innovation process within KIBS by analyzing the R&D and innovation units found at Alpha (hot topic 1), considering whether R&D activities have a negligible role as some literature in services innovation has suggested. However, it is important to highlight that we are going to take into consideration the process of innovation and the organization of innovation within the company, and not innovation as an outcome (Crossan and Apaydin, 2010), that is, we do not analyze whether the innovative activities conducted by the analyzed units have been translated into effective innovation outcomes.

1. Objectives

The objective of this chapter is to analyze how knowledge is created and circulated within KIBS from an organizational perspective. More specifically the objectives are the following:

a. To analyze the R&D and innovation units found in the preliminary analysis in terms of their functions, stability, location etc.
b. To test whether the R&D and innovation organization found in KIBS is that different from that found in technology intensive large manufacturing.
c. To challenge the traditional theory that says that in services innovation is created mainly ad-hoc and not through formalized or systematic ways.

The specific research questions we aim to answer are the following:

- How is R&D and innovation organized in KIBS?
- What are the characteristics of the different R&D and innovation units regarding their function, objective, stability in time, source of their activity, link to innovation, location, moment of involvement in the innovation process, and role in the diffusion of innovation?
- How are the different R&D and innovation units coordinated?
- Are KIBS necessarily different from technology intensive manufacturing regarding R&D and innovation organization?

However, before analyzing the organization of R&D and innovation at our case study company it is important to conduct a specific literature review on this topic in services, to detect the main gaps in research and try to address them, and in manufacturing, to identify the main characteristics of R&D organization in this sector to allow contrasting it with our findings. The next section is devoted to the literature review.

2. Insights from the literature

It is now conventional wisdom that competitive advantage often depends upon the effective development and leveraging of knowledge. In this sense, the relationship between a firm's organization of its research efforts and the generation and application of such knowledge is important and has received great attention among scholars, mainly in the manufacturing sector. The following sub-sections are devoted to the literature on the organization of R&D and knowledge creation for innovation, first in services and then in manufacturing.

2.1. Organization of R&D and knowledge creation for innovation in services

Research on service innovation has mostly focused on co-creation of innovation with customers and on ad-hoc innovation within projects (Gadrey and Gallouj, 1998), while the existence of specific units for innovation within service companies has been neglected (Sundbo, 1997) or treated as a residual feature or a legacy of their history (Miles, 2005). Hence, even though many authors have analyzed the characteristics of the different patterns of service innovation, their focus is not organizational; in other words, they do not focus on how the creation

of knowledge for innovation is organized within services companies. To illustrate this, Sundbo (1997: 450) says, "*service firms innovate on the basis of quick ideas, not from scientific results, and they develop the innovations in ad hoc organizations, not in permanent R&D departments*". Similarly, Sundbo and Gallouj (2000: 18) stated "*service firms have not been good at organizing the innovation process in a formalized and systematic way and learning from the process*".

As a result, the analysis of the organization of innovation in services such as consultancy, engineering, or design has often been approached from the project-based firms perspective (Blindenbach-Driessen and van den Ende, 2006; Gann and Salter, 2000; Keegan and Turner, 2002), in contrast to the functionally organized firms. Hence, we may say that the organizational aspect of innovation has not been sufficiently addressed in literature on service innovation.

There are, however, some authors that have analyzed some organizational issues related to innovation in services. For example, Djellal and Gallouj (2001) state that innovation is rarely organized along the lines of specialized departments, whether they are R&D departments or (less traditional) innovation departments, and that it is more often organized in flexible modes, such as temporary formal or informal "structures".

Similarly, Miles (2007) highlights that it is atypical for firms in most services sectors to have an R&D department citing Belleflamme et al. (1986), who found that the R&D-like activities that innovative service companies in Belgium did were usually performed by ad hoc groups rather than by stable departments. To illustrate the relevance of this idea, more than 80% of the innovative firms in Djellal and Gallouj's (2001) survey considered that the R&D department was an irrelevant or not very important modality of innovation organization. In this sense, Miles (2005: 61) questions why many KIBS "*do not use conventional R&D management structures as a model for their innovation management*" and wonders whether this situation is a response to the specific circumstances of services or a legacy of their non-technological history. In other words, research on services has focused on the idea that knowledge creation and innovation are produced ad-hoc, in close interaction with clients, overlooking the existence of specific R&D units.

Although conventional R&D management structures seem not to be the general trend, Miles (2007: 250) highlights that "*there is now overwhelming evidence of services' activity in R&D*". However, he emphasizes that many service companies make no clear distinction between "research" and other innovative activities they perform. In fact, it seems that when they use this term it most often refers to scanning the competitive and market environments. In other cases, R&D within services might even go unrecognized because of the complexity and less specificity of its definition (OECD, 2002). In this sense, there have been important critics (Miles, 2007; Djellal et al. 2003) to the traditional implementation of the Frascati definition of R&D, hardly applicable to services as many innovative activities in these sectors involve different types of knowledge (e.g. related to social science and humanities) and transformative

processes other than those in manufacturing. Miles et al. (1995) stress that R&D in KIBS is generally of a wider scope (e.g. including market exploration), and often emerges as knowledge developments that spin-off from ongoing projects, with a high importance of client inputs.

Derived from the above, we may say that services conduct R&D, even though usually not organized in specialized functional units, but that the definition of this activity has a wider scope than the traditional implementation of the Frascati document, including for example research in social sciences and humanities.

2.2. R&D organization in manufacturing

Typically, the analysis of R&D organization in manufacturing has been based on in-depth case studies of large multinational companies (e.g. Kuemmerle, 1996; Zedtwitz and Gassman, 2002; DeSanctis et al., 2002). However, it is important to consider that large manufacturing companies conduct most investment on industrial R&D. In fact, the *2010 EU Industrial R&D Investment Scoreboard* (European Commission, 2010) calculates that the world largest 1000 companies in terms of R&D investment account for 96.3% of the total R&D carried out by the 1400 companies of the study and that the top 100 companies account for well over 50% of the total.

Research on R&D organization in manufacturing has been prolific but, in the context of the analysis of centralized versus decentralized R&D organization in technology-intensive firms, Argyres and Silverman (2004) state that research efforts have mainly focused on the interfirm organization of industrial R&D (e.g. alliances), devoting relatively little attention to the relationship between internal organization structure and innovation outcomes. Consequently, it seams necessary to pay greater attention to the organization of intrafirm R&D.

As emphasized by Kline and Rosenberg (1986), there are two forces that interact and affect innovation: market forces and forces of progress at the technological and scientific frontiers. This tension is reflected in the contested distinction between basic and applied R&D (Mansfield, 1984), the first one with a long-term focus dealing with research of broader potential applications, whose specific uses are yet unknown, and the second one with a shorter-term perspective, focusing on possible specific applications of interest to the market. This tension has been translated to an organizational dilemma related to the organization of R&D. Until the late 1980s, R&D operations were centralized and R&D was viewed as overly scientific and out of touch with the business units and the needs of the market, that is, basic R&D. The weak link of the "ivory towers" with the product lines and the customers was a problem, and parallel to the adoption of the multidivisional structure of the firm (Argyres and Silverman, 2004), some technology-intensive companies started to decentralize R&D activities and moving them closer to business units (DeSanctis et al., 2002), and pursuing shorter-term results serving the needs of the market.

However, both organizational designs, centralized and decentralized R&D, have their advantages and disadvantages that create an organizational dilemma. On the one hand, decentralized structures are more likely to bring more incremental innovation that better respond to short-term business needs. In fact, this superior information about the characteristics of the products and the market is even more important where successful innovation depends on close understanding of user needs (Von Hippel, 1988). On the other hand, centralized structures tend to bring major technology advancements in the long-term, fostering disruptive innovations (DeSanctis et al., 2002) that have greater impact on future technological development and span a broader set of technological domains (Argyres and Silverman, 2004). In this sense, some authors have argued that identifying and building core technological competence is necessary to overcome the "tyranny of the strategic business units" (Ibid).

Consequently, debates about the appropriate organization of research became common amongst technology-intensive firms, giving rise to wider variation in R&D organization structures than overall corporate structures (Argyres and Silverman, 2004). Various authors have classified the different structures into three general models of R&D organization: centralized, decentralized and hybrid. In areas or industries where the close understanding of user needs is a keystone, decentralized R&D organization structures provide more customized knowledge. Focusing on the structures that aim to meet both basic science and product development needs simultaneously, DeSanctis et al. (2002) distinguished the following models: 1) *decentralized models* that support a business orientation of R&D, focusing on current customer needs and emphasizing short-term benefits; 2) *networked models* that link business units to R&D sources inside and outside the organization, allowing basic research at lower cost and matching resources with business needs whenever and wherever they emerge; and 3) *integrated models*, that mix both business and science orientation, linking R&D to the strategic direction of the firm.

Parallel to the process of decentralization, over the last decades, industrial R&D and innovation have been through a process of increasing internationalization (Archibugi and Iammarino, 2003; Archibugi and Michie, 1995), and many authors have focused on analyzing this trend and the factors and strategies behind the process (Zedtwitz and Gassmann, 2002; Nobel and Birkinshaw, 1998). These last two authors emphasized that "*the motivations for internationalizing R&D are many and varied, but typically include access to scientific talent, access to ideas in multiple markets, responsiveness to local needs, responsiveness to host governments and international division of labor*". Summarizing these motives, we can mention two important reasons to establish R&D sites abroad: a) the quest for external science and technology, that is, the will to access technical know-how and expertise available in specific places around the world, and b) the quest for new markets and new products, that is, the access to local customers and lead users and other country-specific advantages such as lower innovation costs (Zedtwitz and Gassman, 2002).

There have been a number of studies that have developed comprehensive typologies of foreign R&D units based on their specific role, achieving high levels of consistency among the proposed typologies. Even though these authors have distinguished different numbers of categories and given them different names, we can differentiate 2 general types of R&D unit roles and 2 general subtypes (Nobel and Birkinshaw, 1998):

1. *Home base exploiting unit* (Kuemmerle, 1996) or adaptors: it applies the existing mainstream technology of the MNC to the local markets, either by:
    a. Helping transferring the technology/product to the local producing or manufacturing unit, or
    b. Enhancing and adapting the technology/product according to local needs and, hence, contributing to innovation of the MNC
2. *Home base augmenting unit* (Kuemmerle, 1996) or creators: it augments the existing knowledge, focusing on research and development rather than on improvement and adaptation, and it often locates specifically to tap into particular market or body expertise. The orientation of these units can differ, as they are oriented towards: a) product development, or b) long-term research.

Summarizing, the main insights from the literature review we can say that: 1) Knowledge and innovation in services are mainly produced ad-hoc, in close interaction or co-creation with clients; 2) Although not organized in specialized functional units, services also conduct R&D with some particularities (i.e. wider scope to include knowledge in social science and humanities); 3) R&D in manufacturing follows different organizational patterns (centralized vs. decentralized); 4) there exist different types of R&D units depending on their more generic or more applied approach and on their role as creators or adaptors of knowledge. It is however important to remember that the insights gained from the literature on R&D organization in manufacturing are drawn from the analysis of R&D organization in large firms.

Taking into consideration these insights, the following sections are devoted to providing answers to our research questions.

3. Methodology

In Chapter 1 we have justified the use of a single case study to challenge the idea that services do not organize the innovation process in a formalized and systematic way. In fact, in the preliminary analysis we found evidence of the existence of several formal R&D and innovation units at Alpha, which challenges the generally accepted theory. Besides, taking into consideration the important role of KIBS in innovation in the current economy (Miles, 2005) and the general recognition found in previous literature regarding the less-likeness of KIBS to perform internal R&D, this company represents a perfect ground for our analysis.

In addition, as we have already mentioned, research on R&D organization in manufacturing has traditionally focused on the analysis of large multinational technology-intensive companies, based on in-depth case studies and often in few cases. Hence, the analysis of a similar company, namely, a large KIBS, allows sensible comparisons between firms of a similar size, i.e. scale-intensive firms, an issue that has been often treated "haphazardly" (Freel, 2006).

To deal with our objectives we have analyzed the different R&D and innovation units found at Alpha, in terms of their functions, rationale for location, type of knowledge created etc. and we have compared our results with the insights gained from the literature in manufacturing.

However, mapping the whole R&D and innovation infrastructure of a large company such as Alpha would require much time and resources and, hence, falls outside of the objectives of this paper. As a consequence, the paper concisely analyses the global R&D and innovation structure and provide a more detailed view of the initiatives and units of one of the geographical divisions of the company, the Spanish subsidiary. The selection of this specific unit is based on the advanced situation of its innovation program, which works as a reference for the rest of the geographic locations of the company and has received prizes, both internally and externally. In other words, on the one hand, the paper maps some of the company's global and common resources for R&D and innovation and, on the other hand, it analyzes the specific resources of the Spanish subsidiary and its integration in the global ecosystem.

As in the mentioned research on R&D in manufacturing, we have collected data through different methods, including documentary analysis, in-depth interviews and frequent discussion with specific informants within the company.

As explained in Chapter 2, first of all, we have conducted a documentary analysis, including diverse innovation reports (global, local, about specific innovation projects), technology reports that show a comprehensive analysis of key technology trends, videos, and other documents available both in the Intranet and extranet of the company. Second, we have held different rounds of semi-structured interviews following the snowball sampling selection process (Biernacki and Waldorf, 1981) and capitalizing the results from previous interviews to the next, in a learning process (Strauss, 1987). Besides topics closely related to the objectives of this chapter, such as the innovation strategy of the company or its organizational structure, the initial interviews tackled other issues (e.g. the importance of different internal and external sources of knowledge, motivation, involvement of employees in innovative activities) that helped gaining a broad insight of the company. To get more specific and deeper insights into the research questions posed in this Chapter, we conducted 3 additional interviews that added to the 36 interviews described in Chapter 2. Hence, over a period of two years (from May 2010 to June 2012), we interviewed a total of 39 employees of different areas and management levels, both at the global and local level (i.e. Spanish subsidiary). Table 1 shows a summary of the conducted interviews.

The interviews and the documentary analysis provided information both about the global R&D and innovation infrastructure (since this is part of the common infrastructure and resources for all company geographies) and about the Spanish subsidiary.

Table 1: Summary of conducted interviews

Period	Number of interviews	Location	Management Level	Area
10/05/2010 – 05/06/2012	39	Spain (38) France (1)	17 High 16 Medium 6 Low	20 Consulting 1Technology Solutions 1 BPO 17 Corporate functions

In terms of the data analysis, it is important to highlight that the codification of the different R&D and innovation units found at Alpha has not been done from scratch, as the company had already somehow classified the different units (although with different names). As a result of our analysis we have re-classified the units to obtain homogeneous categories and increase the clarity of the classification. This has been necessary because the information collected through the documentary analysis was dispersed and confuse, as many of the units had different names but the same characteristics in terms of functions, objectives, etc. Our re-codification has been discussed in the specific interviews and agreed with our company informants.

The next section presents the results of this qualitative analysis.

4. Results

The analysis of the interviews and of the various documents (e.g. innovation reports, technology vision reports, available massive online information…) have confirmed that Alpha has built a complex R&D and innovation infrastructure to support its central activity, which consists in providing consultancy, technology and outsourcing business services. As it has been mentioned in the description of the research setting, the company does not have a centralized approach to R&D and innovation, in a unique R&D department identifiable with that name, but a company-wide approach. However, even with a different name, it recognizes to have a stable team working on cross-industry technology R&D, with more than 200 professionals worldwide, and thousands of professionals working on R&D and innovation with a specific business perspective. Altogether, the company has a network of more than 80 centers devoted to R&D and other innovative activities around the world (Appendix 2), described below.

We have classified the different units into six different categories of R&D and innovation centers that pursue differentiated functions: 1) Technology R&D Units, 2) Strategic Centers, 3) Collaboration R&D Centers, 4) Network for R&D Diffusion, 5) Network for Delivery and Implementation, and 6) Country-specific R&D and Innovation Programs. In this sense, it is important to have in mind that

five out of the six categories of units have a global character, as organizationally they are part of the corporate functions of the multinational company creating resources that are common to all geographies, while the last category is of a local character, depending on a specific subsidiary (Spain) and creating resources that are specific to a particular country.

The following paragraphs are dedicated to the analysis of these categories of units, their functions, the kind of knowledge they produce, and their interactions. It is important to remember that, for confidentiality purposes, we have changed all the names of the described units, programs, and any other recognizable denominations.

4.1. Technology R&D Units

The Technology R&D Units are the hub of the innovation system of Alpha, with 5 physical locations, and around 200 professionals. These are long-term units, the oldest with an existence of around 25 years and the youngest created in 2012. These centers are where technology driven generic (cross-industry) R&D is initiated within the company and their function is "*to explore, prototype, and build solutions using emerging technologies, that have not been commercialized yet*" (internal Report). In this sense, as an interviewee emphasized, "*some of the technologies that the R&D Units develop are dismissed, while others become part of the permanent offer of the company*" (director of IT in the Spanish subsidiary).

> "*We permanently receive new offers that come from the research done in these units…New markets are accessed because of this research, not because you are able to implement another ordinary technological tool when there are other thousand companies that know how to do that*" (director of IT the Spanish subsidiary).

The educational background of most employees in these units is high, with a vast majority of engineers and a relevant proportion of PhD holders. In terms of size, the smallest Technology R&D Unit has around 5 people and the biggest, in the USA, has around 70. However, the unit located in India is expected to grow to 100 people in the coming years.

BOX 1: Technological R&D Strategy

The R&D strategy of the Technology R&D Units is based on a comprehensive analysis of key technology trends that a specific team of researchers within these units present on a yearly basis.

This analysis of key technology trends aims at identifying the emerging IT developments that will have the greatest impact on firms, government agencies and other organization over the next three to five years. In order to get such forecast, researchers follow a planned methodology: 1) collection of several hundreds of hypotheses from the Technology R&D Units scientists, architects

and engineers about their vision of future IT trends; 2) crowd-sourcing of the perspectives on technology change from Alpha's wide range of professionals, who provide the vision of the every day work with clients and see the impact of the new technology trends in their needs; 3) screening of the hypothesis against various other inputs, such as the academic literature, the activity of venture capital funds, the forecasts of IT analysts, and key themes at industry conferences; 4) validation of the hypothesis with Alpha's practitioners, who have the knowledge of the day-to-day implementation of new technologies at company's clients around the globe; and 5) working together with the rest of the R&D groups of the Technology R&D Units to filter and prioritize the hypothesis, as well as testing them against six criteria (e.g. transformational impact of the trends, scale and speed of change, possibility of practical action), in order to obtain the final robust hypothesis.

The mentioned analysis aims at identifying the emerging technology developments that will have the greatest impact on businesses, government agencies and other organizations over the next three to five years. In order to get these forecasts and insights, a team within the Technology R&D Units collects, on the one hand, diverse hypotheses from the scientists, architects and engineers within the Technology R&D Units about their vision of future IT trends and, on the other hand, the perspectives on technology change from the company professionals, who provide the vision of the every day work with clients and see the impact of new technologies. Moreover, in order to make the analysis, other inputs (e.g. academic literature, the activity of venture capital funds, the forecasts of IT analysts, key themes at industry conferences) are also taken into consideration, Besides, the different hypothesis about future technology trends are also tested against various criteria, for example regarding their transformational impact, scale and speed of change, or the possibility of practical action. The insights provided by this analysis follow a double goal: 1) they are used as a basis for the technology R&D strategy of the company in a medium-term perspective, and 2) they are a powerful source of new clients and new projects, as the analysis shows how clients should react over the next years to adapt and get advantage of the technology changes, suggesting specific actions to be taken. Because the company has the necessary knowledge, technology, and people to implement these actions, the analysis works as a source of new contracts with existent or potential clients.

Moreover, the insights provided in this analysis, which is openly published, are a powerful source of new clients and new projects within old company clients, because it shows how the detected technological trends will affect businesses in the near future and how organizations should react to these changes, suggesting actions to take during the following three months. The three-month-plan that the analysis proposes is a source of new contracts and clients, as Alpha proves to have the necessary knowledge, technology, and people to implement it.

These Technology R&D Units base their research on a wide range of technologies (i.e. one of the facilities within the US houses about 200 hundred

different technologies) that are cross-industry. Within the five locations of the Technology R&D Units we can find 8 different sub-units or laboratories that focus their R&D efforts in different key areas or fields that, according to company's research, are critical to achieve high performance businesses; these are, for example, data platforms, enterprise collaboration, digital experiences, and social media. In this sense, two different locations can work on the same field, creating cross-nodes around the world. In other words, the 5 interconnected Technology R&D Units work on different technology fields that can be found in different nodes but not necessarily as a replica:

> "*You won't find every single R&D field in every location, but you will find them where it makes sense from the market standpoint…you have teams spread through several locations*" (Senior Executive, Technology R&D Unit Europe).

BOX 2: Looking closer into the work of the Technology R&D Units

R&D project experiences

Alex is a senior research manager at the Technology R&D Unit in Silicon Valley. Recently, he has been working in the creation of a suite of intelligent tools that helps automating the acquisition, specification, review and visualization of requirements. Among these tools, the analysis tool employs text-processing techniques to identify lexical and structural issues in requirements and to visualize interactions, and has been deployed in diverse projects to identify defects in the clarity and completeness of requirements, hence avoiding rework. This tool has been developed in collaboration by the Technology R&D Units and other areas of the company specialized in tools for delivering, in requirements, and in analysis capabilities. Besides, Alex has also worked in the creation of different research prototypes for deriving business insights from public Web content, by using Web Mining techniques. For example, one of the tools continuously tracks developments in technology areas of interest for a particular client. He has also worked in the exploration of the application of mobile sensors and analytic tools to mobile phones, in order to turn them into a coach that could help monitoring and shaping the user's behavior. For example, they could be deployed to manage time effectively or to alert a diabetic to take food or medication when needed.

Ana is a manager in the Technology R&D Units and is currently working on the development of technologies related to interactive TV services, which allow the creation of new entertaining experiences, in contrast to the traditional passive audiovisual consumption. She explains that the broadband-to-the-home scenario has increasingly been taking into consideration and that most companies in the industry are working on these issues. However, she emphasizes that most efforts in this sense have been focused on TV-only or Web-only approaches. Within the Technology R&D Units, she says, they focus of research is on learning from the Web and the gaming industry in order to blend it into the TV experience. Instead of looking for replication of the lessons from these other industries, Ana says that

the Technology R&D Units are focusing on the extension of capabilities at the level of the consumer experience. Before this interesting project that can potentially benefit clients in different sectors, such as telecommunications, media and entertainment, or consumer goods, Ana has also been involved in other R&D projects related to collaborative spaces, such as the creation of an Outlook add-in to encourage employees to share documents from the beginning of a potential work collaboration in a centralized location, instead of through emails. As a result of this R&D, the Technology R&D Units piloted a tool among 50 people within the company.

Hence, the source or trigger of R&D done in the Technology R&D Units is market exploration and market feedbacks represent an essential input for the activity of these units, as explained in the chain-linked model by Kline and Rosenberg (1986).

As it is evidenced in the examples in Box 2, the Technology R&D Units also work in conjunction with other areas of the company to develop many R&D projects. Sometimes, they collaborate with the industry-focused R&D teams (Strategic Centers described below) to help them tailor the developed general or cross-industry technologies so that they meet industry-specific needs. For example, with the assistance of Technology R&D Units, digital pen and paper technologies have been tailored to the specific needs of financial services or government offices to realize operational cost savings, and sensor telemetry technologies are tailored to industries as varied as transportation, utilities, insurances, and government for increasing efficiency.

In order to translate the developed technologies into effective innovations implemented in clients, the Technology R&D Units have mandates to find internal or even external support for the R&D projects. Thus, they need to present the potential applications and uses of the eventual R&D results to Alpha's senior executives, so that they sponsor the work, by co-investing time, networks, and resources, and finding the right channels (i.e. external clients or internal users) to bed-test the future pilots. In other words, the Technology R&D Units do not start a project out of a certain scale if they do not find this support of a so-called "downstream partner". These partners study whether applications of the developed technologies would be useful for covering the actual or potential clients' needs, and get in touch directly with these clients. In some cases, the "client" may be an internal unit of the company (e.g. internal implementation of the tools developed for distance-work enablement and collaboration). With the involvement of the mentioned "downstream partners", the tools developed within the Technology R&D Units are transferred to the different company business areas, field-tested and implemented in clients and, eventually, converted to innovations (this process is easily identifiable with the "central-chain-of-innovation" described by Kline and Rosenberg, 1986). By definition, this internal support or validation is pre-requisite and, hence, the development of a new technology will only be assumed if there is a market need or a realizable market use (Kline and Rosenberg, 1986).

BOX 3: Case studies of developed prototypes and solutions

Since 2001, the Technology R&D Units have developed many solutions and prototypes in many different technological areas, such as analytics, human-computer interaction, or intelligent devices.

Predictive analytics to forecast problems in public transportation

As a consequence of the work done in the Technology R&D Units, Alpha developed a tool that enables informed decision-making. In order to test the prototype, Alpha partnered with a public transportation company in the US, and installed the developed sensors in the float of buses, to capture data and analyze them, enabling the prediction of equipment performance and the forecasting of problems. Before the introduction of this tool, transportation companies had to choose between replacing pieces when broken or scheduling replacements with a given periodicity. With the tool developed by the group devoted to analytics, the company is able to predict failures days or weeks before they occur. This reduces costs, as the need for spare parts is decreased, and diminishes service interruptions. Moreover, the prototype allows predicting the performance of each bus and comparing current data that comes from a sensor with a model representing normal behavior. With this information, the company is able to make predictions and improve its capabilities over time, as it enables to extend the life of the vehicles.

Tracking of behaviors

Companies in the retail industry are looking for better ways to gather and analyze the data of customer behaviors in their stores. Originally developed to enhance the experience of sport spectators and professionals, allowing event organizers and reporters to combine the real event with a virtual tracking of the movement of players to offer a complete picture of the game, Alpha developed a tool for visual tracking. As an answer to the general need of visualizing and tracking behaviors, the Technology R&D Units have developed a non-intrusive camera tool that creates virtual simulations based on the monitoring of human behaviors. As a consequence, retail companies can improve productivity and customer satisfaction by analyzing what is happening in the stores. For example, cameras can track the movements of individuals, without identifying them, capture the information into a database, and translate this information to 2D or 3D. This would enable the analysis of customer behaviors, tracking reactions to products and promotions, or mapping customer traffic patterns that would allow improving the layouts of products and advertising or seeing how much time employees use with customers. This information is useful not only for the retail industry but also for manufacturing. For example, it could be used in the chemical industry to improve safety, as the tool would allow visualizing the real time movement of employees and tracking the handling and storage of hazardous chemicals. Alpha is also looking for more areas of application, such as retail banking or the health industry.

4.2. Strategic Centers

Alpha has around 40 Strategic Centers worldwide devoted to R&D linked to specific initiatives that arise from the different areas of the company and, hence, have a more applied and industry focused perspective. Regarding R&D, each of Alpha's subdivisions (matrix between types of services provided and industries) and specialized groups may create a new Strategic Center that answers to a key initiative, in response to their business needs.

The Strategic Centers *create* new tools, knowledge, etc. that are linked to specific industries or users and, as a consequence, R&D developed in this centers is short- or medium-termed, depending on the market needs and the duration of the interest of the initiative.

> "*These centers look at R&D from the purely business point of view, in terms of products, processes, people etc., rather than from the starting point of technology, as we do in the R&D Technology Units"* (Senior Executive, Technology R&D Unit Europe).

These Strategic Centers are located in different places around the globe and, sometimes, two or three centers are devoted to developing the same key initiative. Some of these centers have been around for several years but, due to the strategic character of the research done in these centers, linked to business needs, the creation, evolution, and disappearance of the centers is highly dynamic. This dynamism is evidenced by the high amount of new centers that have been created between the end of 2009 and 2012 (Appendix 2).

The link between R&D done in these Strategic Centers and the provision of innovative services by the company is the same as the one described above, for the case of the Technology R&D Units. That is, all R&D projects need to have the support of a "downstream partner", who works as a link or intermediary with company clients, where a pilot of the developments may be tested and implemented.

BOX 4: Looking closer into the work of the Strategic Centers

R&D for informed decision-making

In the last trimester of 2011, Alpha inaugurated a new Strategic Center for research in sophisticated techniques in analytics for the supply chain, aiming at aiding its clients with the complicated task of analyzing large amounts of information. These capabilities are also known as business intelligence, which enable better and faster decision-making based on real facts. The importance of adequately processing large amounts of information in the current economy is obvious as it is evidenced, for example, by the fact that Google processes a petabyte of information per hour. In relation to this problem, a senior executive of the company emphasized, "*clients look for ideas and opinions about their clients that allow them to launch more profitable promotional campaigns, to*

reduce the rotation of clients, and to create more personalized relationships" (documentary analysis).

R&D activities in this sense involve research in econometrics, statistics, and mathematics, in order to develop both descriptive and predictive analytical models. As a result of this internal R&D and of the recent acquisition of a firm leader in this sector, Alpha has the capabilities needed to offer very specialized and innovative services in analytics.

Examples of the innovative services coming out from R&D in business analytics are text mining and big data analytics, tools for analyzing social networks and enabling better access to target groups, or tools that enable predicting future demand.

R&D in Social Media

Also in 2011, Alpha opened a Strategic Center dedicated to the development of innovative social media solutions. Referring to this, the Technology chief executive emphasizes that "*social media is redefining the way businesses interact with their customers and employees*" and that that the developed solutions aim at helping clients leveraging social media internally and externally. Internally, solutions will support collaboration, reduce cycle time and create online work teams. Externally, they will help business-to-business and business-to-consumer companies improve marketing, sales, service and operations interactions.

The young Strategic Center is based in the Technology R&D Unit in Silicon Valley and works with providers of social media tools to develop and deliver first-to-market solutions and capabilities. Moreover, it hosts workshops with clients, both on-site and via-satellite, to help them create a value-driven vision for social media.

4.3. Collaboration R&D Centers

Similarly to the Strategic Centers, in Collaboration R&D Centers Alpha conducts research in collaboration with other companies and technology alliances, tailored to the interests of the specific treaty. For example, in 2011, and based in a long-lasting existing alliance, a new laboratory was created in collaboration with a telecom company, and hosted at this company's facilities, to develop business-oriented cloud computing innovative solutions for clients. These types of Collaboration R&D Centers leverage the knowledge and expertise of the participating companies, providing mutual benefits. These mutual benefits are highlighted by the Chief Technology Officers of the two companies in a press article:

> "*Supported by our partners' global leadership in this type of solutions, the new Collaboration R&D Centre improved our capabilities (…) in the future, it will help us develop the best possible services for our clients"* (Chief Technology Officer of the telecom company).

"The Collaboration R&D Centre was the next logical step to (…) support the local development of these services in the country, which is a proven early adopter of technology and an ideal place to establish the facility. The Collaboration R&D Centre will allow us to introduce globally uphold solutions to (the country) rapidly, it will also assist our joint clients continue at the front of innovative practices" (Alpha's Chief Technology Officer).

As it was the case for the Strategic Centers, Collaboration R&D Centers follow a strategic objective and, as a consequence, have a varying longevity depending on the interest of the key initiative in which they focus, but in general, we can say that they have a medium-term life. However, in contrast to the Strategic Centers, which conduct applied research but targeted to specific industries but in broader areas (e.g. analytics), Collaboration R&D Centers conduct tailored research on more narrowly specified issues (e.g. analytic solutions for clients using the technology platform supplied by the alliance partner).

The Collaboration R&D Centers demonstrate first-hand the *created* cutting-edge solutions that joint clients can adopt, and they offer a vision of how the developed technologies can improve clients' business performance. This way, R&D done in the Centers is potentially translated into effective innovation in clients.

BOX 5: Looking closer into the work of the Collaboration R&D Centers

Cooperation for the development of solutions in analytics

In an increasingly complex environment, where the need for real time information analysis is creating new organizational challenges, it is important for companies providing enterprise services to offer packaged or standardized applications that answer new business demands. In this business sphere, Alpha has a long history of collaboration with a partner providing advanced enterprise technology platforms (SAP). With the objective of answering to the described challenges, this long-term relationship has resulted in the creation of a new center devoted to R&D in analytics, located at the partner's development headquarters. At this center, specialist from both companies work side by side, bringing together their distinct capabilities and assets. In this sense, the partner brings technology platform powering capabilities (e.g. business intelligence, in-memory analytics, mobility, or information management) and a state-of-the-art infrastructures (e.g. in the cloud production implementations), while Alpha brings industry-specific analytics solutions, for example for retail, telecommunications, healthcare etc. As a result of this R&D collaboration that brings together specific technology expertise and deep industry insight, the center creates new industry-specific solutions for the technology platform provided by the partner, and deployed in many companies worldwide.

The missions of this Collaboration R&D Center are various: collaborating to develop the next generation of enterprise services architectures and solutions

(e.g. composite applications); generating fresh ideas to help companies realize the potential of these tools; formalizing architectures, tools and best practices and building out proofs of concepts; and creating market-leading skills and expertise through collaboration. In order to show the potential of these analytics tools to clients of both companies, the center offers brainstorming sessions, technology demonstrations, and different workshops in topics such as cloud, value discovery, or technology strategy.

Cooperation for the development of digital merchandising

Alpha has established collaboration with a brewer' merchandising leading company to develop a pilot of an innovative digital merchandising service. The service, a customizable solution, will provide brewers point of sale data about placement and product presence, by providing continuously collected and monitored digital pictures of products, key performance indicators and other valuable information that will allow reduction of stock products, improved compliance by retailers and improved product sales.

The pilot is taking place in more than 50 different stores in Russia and, as a result, the alliance company is gaining insights into the possibilities provided by digital merchandising. Collaboration in this pilot emerged as a result of the visit of the cooperating company to one of Alpha's customer goods and retail centers of its Network for R&D Diffusion, analyzed below. Alpha is delivering its work for this project both from the centers of the Network for R&D Diffusion and from its subsidiary in this country.

4.4. Network for R&D Diffusion

Alpha has created a network of physical and virtual sites, whose function is to make use of advanced tools and technologies in order to help clients develop innovative solutions to any of their business challenges. In contrast to the other Units described so far (i.e. Technology R&D Units, Strategic Centers, Collaboration R&D Centers), rather than conducting R&D themselves, the Network for R&D Diffusion draws both from company's internal resources, such as the Alpha's industry experts or the Technology R&D Units, and from other innovation partners (i.e. technology providers). The main role of these units is to offer end-to-end experiences for clients in many different areas with the objective of helping them *adapt* the different available solutions and tools to their specific needs. To achieve this, the network delivers: a) Workshops in different topics (e.g. leadership development, provider/client joint planning sessions, strategic planning); b) R&D done in other units of the company; and c) other activities related to innovation management, concept development, implementation of pilots etc. The following quote evidences the importance of these activities for company clients:

"*It is refreshing and interesting to see the solution demos running live. This gives better credibility to Alpha's competency and capability on the*

ground" (Executive of a global telecommunications company, documentary analysis)

The underlying philosophy is the creation of showcases that offer visitors and customers real life examples of the use of developed solutions, helping them understand their application to different industries and scenarios. In other words, these units work as expositors of the new technology prototypes and innovation developed at Alpha, diffusing innovation in a "small scale" by closely interacting with the customers that visit the centers. For example, it is interesting to highlight that, every year, 150 global organizations attend the technology workshops that are held at the different centers. For one or two days, Alpha hosts executives of client companies for applied-technology programs where participants are immersed in discussions and showcases of new tools and prototypes.

Often co-located with the Technology R&D Centers and the Strategic Centers (see the example of R&D in Social Media in Box 3), they also have a close relation to these other units. As a consequence of this interrelation, the evolution and life span of this network is similar to the evolution of the key initiatives to which they are related, appearing when the business need is detected and disappearing when they are perceived as unnecessary.

Besides, the activity of these units is a very important source of new ideas, as these are often sparked when customers explore with different technologies, brainstorm with members of the Technology R&D units and the Strategic Centers and gain first-hand experience with the showcased prototypes.

BOX 6: Looking closer into the work of the Network for R&D Diffusion

End-to-end experiences in information management services

Alpha is very aware of the value for organizations of developing the ability to access, share and use timely information and, as a response to this need it has created a center dedicated to innovation in information management. At this center, company clients see first hand, through demos on touch-screen monitors and over-sized flat screens, conversation with technology experts, and a view into project delivery activities, the innovative solutions that Alpha has developed, sometimes in conjunction with alliance partners, to effectively manage data. Through these showcases, clients experience technology innovations at work, learning how these solutions and methodologies can help them gather and analyze the right data.

Over the last seven years, the team dedicated to information management services in Alpha has created more than 100 solutions, kits of tools and pre-packed capabilities, focusing in projects related to business intelligence and analytics, to data management and architecture, and to content management. As a consequence, the showcases demonstrate clients how these solutions can help them doing diagnosis and predictions, analyzing customer relationships, integrating systems and data, managing content and portals, etc.

Moreover, at the center clients can also interact with Alpha's alliances in these issues, such as leaders in platform support and end-to-end business intelligence solutions, in performance management solutions, participatory online experiences etc. In other words, the Network for R&D Diffusion showcases not only the solutions coming from internal R&D, done in the Technology R&D Units and in the Strategic Centers, but also the tools and services developed jointly in the Collaboration R&D Centers and that are implemented in clients through joint offerings.

Showcasing innovation in the global payment industry

In 2008, Alpha opened a new facility, co-located at the Technology R&D Unit Europe, devoted to the demonstration of R&D and innovation in all spheres of the payment industry, which include areas such as mobile communications, bank-to-corporate connectivity, biometrics, or security and regulations. At this facility, Alpha combines its industry expertise with its technological knowledge and demonstrates how the developed prototypes and solutions can help its clients face the challenges of the business which, in the words of an Alpha's senior executive in the financial industry are, among others, bigger competition, new regulation, decreasing revenues and greater need of technology and information. Some of the showcased prototypes are, for example, tools for biometric identification, mobile banking, and mobile payments provisioning.

End-to-end experiences in manufacturing

Within the Network for R&D Diffusion, Alpha has created three centers dedicated to innovation in manufacturing. At these centers, clients have the opportunity of learning how technology solutions can enable superior visibility and performance, for example through business intelligence and analytics tools. However, the offering of workshops and showcases, tailored on-demand for each client, is not only focused into technology innovation. Workshops also include strategic and managerial topics and can involve the definition and refining of manufacturing strategies, for example by working in issues such as operating model, portfolio optimization, supply chain strategy, stocking strategy etc. Moreover, the workshops can also be directed towards creating a culture of continuous improvement, showing approaches such as Six Sigma and capabilities for change management and workforce empowerment in a manufacturing environment.

At the workshops, Alpha also shares the results of its research in key manufacturing trends and demonstrates the solutions and prototypes developed by the Technology R&D Units. Research done in this area include market insights from executives worldwide and successful cases are presented to clients through case studies. Additionally, the workshops include interactive discussions that cover topics such as global network optimization or operational excellence. Finally, in order to offer tangible value from the workshops that go beyond the gained ideas and insights, the center helps its clients and visitors to create roadmaps and define action plans, with the assistance of Alpha's experts and the use of online diagnosis tools.

End-to-end experiences in consumer goods and retail

Many Alpha clients are firms in the industry of consumer goods and retail (e.g. companies in agribusiness, fashion, food…) and the company is aware of the importance for these clients of innovating and being at the forefront of processes and technological developments. Because of this reason, Alpha has created three facilities that aim at helping these clients being innovative.

Among the activities that this network conducts we find market research on new global and local trends, the on-demand streaming of videoconferences about different topics, the identification and co-development of pilots of innovative ideas within clients, the organization of fairs and events with speakers from the industry, and the organization of workshops to explore new trends and best practices, and demos of latest customer-facing technologies developed both internally and in conjunction with company alliances. An example of market research shown at workshops, Alpha has conducted a survey in 13 countries about the use of Internet through mobile devices to find out trends in the digital consumer's behavior. The findings of such analysis are of interest for many industries, such as telecommunications, media, technology, and also retail or utilities, highlighting the challenges and opportunities they face.

4.5. Network for Delivery and Implementation

Finally, the company considers part of the global R&D and innovation infrastructure a network of large offshore centers, sometimes outsourced, whose objective is to deliver and deploy the developed technologies in each client, once an agreement or contract for this development has been signed. This Network for Delivery and Implementation brings together Alpha's industrialized assets, that is, the technologies, processes, methods, tools, architectures, analytics and metrics that have been already tested, proved and integrated in the service portfolio of the company. Besides delivering already proved standardized and industrialized solutions, the Network for Delivery and Implementation also leverages the work done at the different centers analyzed above, implementing the new solutions coming both from internal R&D and from the capabilities that emerge from technology alliances. However, in contrast to the work done by the Network for R&D Diffusion, the diffusion of innovation done in the Network for Delivery and Implementation is of a larger scale, because they deploy solutions that have been already tested and approved in pilots in other company clients or early adopters (Rogers, 1995).

Additionally to the delivery of technology, both standardized and emerging, this network also provides business process outsourcing services, including function-specific services (e.g. supply chain, human resources, finance, learning) and services focused in specific industries (e.g. utilities, insurance). In this sense, the Network for Delivery and Implementation also creates innovation by defining new outsourcing services and standardizing them.

What is important to have in mind is that the diverse solutions and services offered by this network are always fitted and further developed to offer customized services that adjust to the specific needs of each client. Hence, the Network for Delivery and Implementation could be described as the last step in the "central chain of innovation" process (Kline and Rosenberg, 1986), where the developed technologies are applied to clients and *adapted* to their specific needs. In this customization and further development of the technologies new incremental innovation emerges.

The role of this Network for Delivery and Implementation is coupled with the existence of new or standardized technologies to be implemented in new or existing clients, adjusting the technologies to clients' specific needs. As a consequence, the Network has a permanent character and has been growing organically over the years. For example, some of the centers were created more than 25 years ago (e.g. Philippines) while others are more recent (e.g. the center in Mumbai was created in 2001).

The main goal of the network is to enable Alpha to offer services to its clients any time (for that purpose it counts with more than 50 centers worldwide: 15 in North America, 9 in South America, 26 in Europe, 16 in Asia and 4 in Africa), and from anywhere with the same quality standards (for that purpose every center uses the same blueprints, standards, training, processes and tools). Moreover, in order to lower the delivery costs, most centers delivering outsourcing services are located in developing countries and in countries with cost advantages, such as South Europe (12), Eastern Europe (4), India (4), China (3), Philippines (2), and Argentina (3). However, the size of the centers differs importantly from country to country (e.g. almost 80.000 professionals in India, almost 30.000 in the Philippines and around 5.000 in China versus smaller centers in other countries). It is interesting to notice that, in some cases (e.g. in India), these centers have exerted an attraction power for the creation of the new Technology R&D Units focused on fields such as software engineering or security, which have been located at the heart of these large platforms of system developers.

BOX 7: Looking closer into the work of the Network for Delivery and Implementation

Transformation of the HR operations of a financial company

The client, a large financial group devoted to commercial banking in the US, had grown rapidly and particularly since its purchase of regional bank. This growth posed a challenge to the processes and technology of the group and the company decided to perform a transformation of its human resources (HR) infrastructure and technologies. Because Alpha had previously worked with the group to increase employee performance levels it was chosen to spearhead the transformation and an aggressive timeline was set. The transformation project started in April 2004.

Alpha mobilized a multidisciplinary team that took an industrialized approach to leverage the resources, methodologies and tools of the Network for R&D Delivery and Implementation. Personnel based at centers in Atlanta, Georgia, and Manila, were involved in the customization of the applications to the specific HR processes of the financial group. Moreover, Alpha trained the client's personnel in the use of the implemented new HR application software. The first implementation was completed within the tight timeframe of six months, with a later second phase.

As a result of this project, the financial group realized a $500,000 annual reduction in its overall HR costs, an important improvement in efficiency and a 90 percent reduction of payroll-related call center volume. Moreover, the improvement of the business processes and technology resulted in a 40 percent reduction of personnel required for payroll processing.

4.6. Country-specific R&D and Innovation Programs: The Spanish Subsidiary

It is important to have in mind that all the categories of units described so far provide new knowledge and innovative technologies that nurture the company worldwide and are part of Alpha's global organization. However, besides these capabilities of the multinational, Alpha also counts with different country-specific R&D and Innovation Programs. In this section we are going to analyze the case of the Spanish subsidiary because it is the most advanced country-specific initiative within the company and because of the internal international relevance it has gained.

In the Spanish subsidiary, Alpha launched an Innovation Program in 2008 that aimed to transform the internal culture regarding innovation and creativity and to develop specific innovative services for its clients. This program has not been translated into an organizationally formalized innovation department, following the standard structure of other internal departments. However, a "de facto" innovation department has been created, directed by a senior executive and with a total of 4 employees full time[5]. This unit is not a "standard" department within the company, as it pursues both "front-office" and "back-office" objectives, that is, on the one hand it develops new innovation projects for company's customers, finding new business ideas and developing them following a standard project methodology and, on the other hand, it pursues internal objectives, for example

[5] It is important to have in mind, as the main responsible of the Spanish Innovation Program emphasizes, that additionally to the employees that work full time in the Program, the company counts with the sporadic participation of employees in other areas that use part of their time to give innovative ideas in a bottom-up basis, and the employees that participate in the implementation of the innovative projects arising from the Program. This characteristic of the R&D organization, which involves participation of employees and a "diffused" approach to innovation, different from its closure into functional units is specific for services and has been highlighted in the literature (Lyons et al., 2007).

directed to the enhancement of the innovation culture or to the creation of new alliances with universities and the fostering of new research projects in innovation. Hence, although it can be considered a specific innovation department, in order to avoid confusion we are going to refer to it as the "Innovation Program".

The Innovation Program follows three main functions: 1) internal cultural transformation; 2) business creation; and 3) external image.

Regarding the first objective, the Innovation Program has launched a bottom-up initiative that provides incentives to all employees in the Spanish subsidiary to give their ideas about new products and services, internal processes and improvements of the workplace. Additionally, it has introduced trainings in creativity and is spreading these lessons among employees.

The second objective aims at the creation of new services for local company clients, in other words, the program creates solutions that are tailored to specific local or regional needs. To achieve this, the Innovation Program identifies, commercializes and puts into economic value R&D and innovative ideas independently of their source, both internal (e.g. drawing from the technologies developed globally within the Technology R&D Units and the Strategic Centers, and from other sources such as the ideas developed through the local bottom-up initiative) and external (i.e. through collaboration agreements with local companies). The process followed to implement a solution (developed by a provider or internally) in a client is similar to the process followed for the implementation of the technologies developed in the Technology R&D Units. That is, in order to be able to access a client account, first it is necessary to have the full support of a company partner that will intermediate and sponsor the product and its implementation.

Last but not least, the Innovation Program aims at creating an external innovation image for the company and becoming an important actor in the local environment, engaging in initiatives that answer to local needs and support innovation in the region.

BOX 8: Looking closer into the work of the Spanish Innovation Program

Cultural transformation (bottom-up function)

The Spanish Innovation Program has established a mechanism by which ideas are selected, analyzed, prototyped, validated and marketed, integrating employees in the development of their own ideas.

The mechanism is based on a technology platform that enables mass collaboration, which is completed with a built-in business process to transform group-generated responses to problems into execution-ready solutions. As a result of this initiative, around 4000 employees have been involved and almost 1000 ideas proposed since the creation of the program.

An important incentive that has helped fostering the internal innovation culture and participation has been the use of rewards based on life experiences (e.g. visits to the Technology R&D Units around the globe) for the employees with higher participation in the initiative.

Besides, the Program has implemented creativity trainings with the objective of spreading specific methods and techniques to employees both in an online and offline basis. In fact, employees that have already received the training are themselves the teachers for other colleagues and even clients, applying the learned contents and techniques and following cascade training.

Business creation: Leveraging external knowledge (absorptive capacity)

In order to mobilize external knowledge and R&D, the Innovation Program collaborates with a large list of organizations, such as universities, business angels, entrepreneurs, investors and more than 30 start-ups and research groups in various topics. As a consequence, the program has already detected many innovative companies (operating mainly in Spain), signed various collaboration agreements, and implemented a number of pilots with company clients. For example, it has detected and started business activity with companies that develop tools and methodologies to trigger a new way of thinking and creativity, text-mining tools, real-time tele-presence technologies, content-analysis technologies for assisting in decision making, automatic asset-appraisal services, etc.

As the Director of the Innovation Program describes it, the program works as an intermediary between the small innovators (i.e. entrepreneurs, start-ups and research groups that the program detects) and the big corporations (i.e. company clients). In order to do so, the Director of Innovation and other employees in the "department" meet weekly with small entrepreneurs and listen to their innovative ideas and products. The Innovation Program helps these small companies and start-ups in many ways. First, based on the broad experience of the company as a business service provider working in many and diverse industries, it offers new insights regarding additional application areas for the presented innovations (e.g. a product that has been developed by a research group in aeronautics for this industry could be useful for financial risk assessment or a voice biometric tool envisaged for the security industry could be used by a call center to improve its services). Second, the Innovation Program provides a business vision that the small companies may lack, checking the utility of the proposed products and seeing whether they match the needs of the market. This vision of the market needs is crucial for putting the new products into value and to assess their viability. Third, the program works as an intermediary between the providers of the new product, usually small companies with fewer resources, and the big corporations, already part of the company's client portfolio. This way, the Innovation Program adds the capabilities of these small start-ups and innovators to the capabilities of the company.

This way, the relationship that is created between the Innovation Program and the small innovators is a win-win relationship: on the one hand, through these kind

of relationships the company continually increases its portfolio and creates differential and innovative offers that match the needs of its clients; on the other hand, the small entrepreneurs get access to big corporations and to their resources, which would be hard to reach without the support and guarantee of a respected company at their back, and gain new insights about additional applications for their products and services. In other words, the Innovation Program works as an agent, not only a broker that enforces and develops the relational capital of the small companies. In this sense, the Innovation Program focuses its attention on innovations that show a great potential for the future of the company. For that purpose, it concentrates in those technologies or areas that have been globally detected as strategic, in the annual analysis done by the Technology R&D Units, but also in the trends and needs detected in the national market, following a local strategy.

External image (local responsiveness)

Since 2008, the Spanish Innovation Program has established new collaboration mechanisms with some of the most important Spanish Universities, supporting R&D on innovation by sponsoring PhD and Master thesis, and helping in the creation of new start-ups by providing training and mentoring. It has also organized encounters and conferences with clients, professionals and experts in innovation. This "leg" of the Program not only helps the company build an innovative image, becoming a reference for entrepreneurs and other organizations regarding innovation, but also increases its number of "listening posts" in the market, enriching the sources of R&D and new knowledge that may nurture business creation.

Additionally, results have shown that the Spanish Innovation Program is becoming increasingly international and is looking at business opportunities outside Spain and expanding its radar outside national boundaries. The search for international opportunities is not reduced to the detection of innovative products and services coming from abroad, but also to the expansion of the initiative to other countries. In this sense, it is important to say that the case of the Spanish Innovation Program has attracted attention within the company, from countries such as the US, Argentina or South Africa, which have contacted the team in charge of the Program in Spain in order to access the gained know-how and learn from their experience.

4.7. Coordination of the R&D and Innovation infrastructure

The existence of all the units analyzed in the previous epigraphs reflects the importance that the company gives to the existence of a infrastructure specifically devoted to R&D and innovation that nurtures Alpha with new knowledge and technologies that is available worldwide and that also fits the specific country needs. Table 2 presents a summary of the functions that these units have and the link to the innovative services provided by Alpha.

Table 2: Functions of the Units and links to innovation

Name of the unit	Function	Link to Alpha's innovative services
Technology R&D Units	Generic R&D. Objective: Produce new Technologies. Long-term units. Sources: Market exploration.	The eventual applications of R&D results are presented to company partners. They study the actual or potential clients' needs for which those applications would be useful and get in touch directly with the client. In some cases the "client" may be an internal unit of the company.
Strategic Centers	Applied R&D. Objective: Produce new knowledge and technologies linked to specific initiatives. Short-/medium- term units depending on market needs. Source: Initiatives from any department or unit.	
Collaboration R&D Centers	Tailored R&D. Objective: Development of solutions tailored to the needs of the alliance. Short-/medium- term alliances depending on agreements. Source: Alliance between internal company units and external partners.	The partners of the alliance exploit the applications of the R&D results according to the agreement.
Network for R&D Diffusion	"Small scale" diffusion of R&D. Objective: Diffusion of R&D results to actual or potential customers. Short-term activities usually linked to Strategic Centers. Source: All units	They diffuse the uses of the new technologies and associated innovative services.
Network for Delivery and Implementation	Larger implementation of R&D. Objective: Deployment and further development of accepted technologies to suit specific client needs. Activities linked to already sold implementation projects. Source: All units.	They deploy the developed technologies in customers, creating incremental innovations to suit their specific characteristics and needs.
Country-specific R&D and Innovation Programs	Tailoring of internal and external innovations to local needs. Objectives: 1) internal culture of innovation and creativity (bottom-up participation), 2) business creation (absorptive capacity), 3) image and local-responsiveness. Long-term unit. Source: Market exploration.	They increase the local absorptive capacity of the company, by integrating external capabilities and articulating bottom-up ideas, to answer to local client needs.

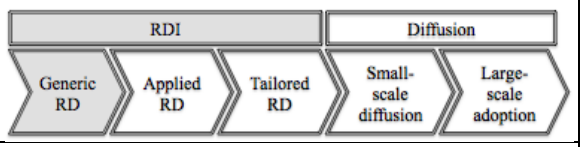
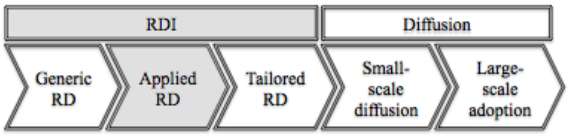
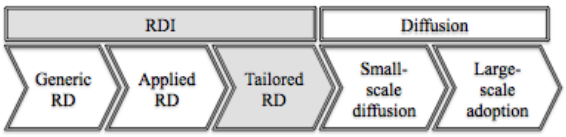
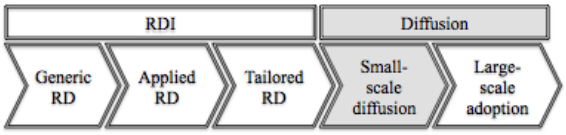
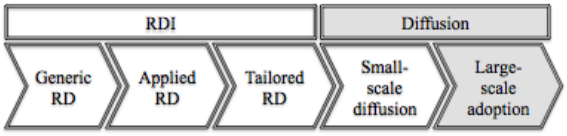
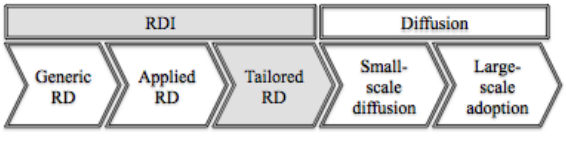
Own elaboration.

As the Director of the Innovation Program in Spain pointed out, given the characteristics of the company, with high workforce rotation, mobility of employees between projects and no allowance for unused capacities, it is difficult to know the exact number of employees working in the different R&D and

innovation units described above. In this sense, only the workforce in the Technology R&D Centers is stable (around 200 people), but there is no information about the workforce working in R&D and innovation in the centers linked to specific and strategic initiatives associated to business needs.

Table 3 shows a summary of the different R&D and innovation that compose both the global infrastructure (of the multinational) and the local architecture (the case of the Spanish Subsidiary), emphasizing the moment of the innovation process in which they get involved (i.e. generic-R&D, applied-R&D, tailored-R&D, small-scale diffusion, large-scale adoption). As it is evidenced, the global units are dispersed mainly over America and Europe, but also increasingly in Asia (with the exception of the Network for Delivery and Implementation that has been present in this continent for a longer time).

Table 3: Different units of the global R&D and innovation infrastructure

Name of the unit	Nr. and location	Nr. in Spain	Moment of involvement in the R&D and innovation process
Technology R&D Units	5 (2 US, 1 EU, 2 Asia)	0	
Strategic Centers	20* (7 US, 6 EU, 7 Asia)	1	
Collaboration R&D Centers	13* (2 US, 2 EU, 8 Asia, 1 Africa)	N/A	
Network for R&D Diffusion	7* (2 US, 4 EU, 1 South America) + Strategic Centers	1*	
Network for Delivery and Implementation	+50 (workforce mainly in Asia)	7	
Country-specific R&D and Innovation Programs	Nr. not available.	1	

Own elaboration. *Number of units detected. The exhaustive number and location of the strategic and collaboration centers and of the units of the network for R&D diffusion are not available due to the high dynamism regarding the creation and evolution of these units.

Because the analysis has also taken a country focus and we consider it important to see the distribution and impact of the global units from a specific country perspective, Table 3 highlights whether any of the units of the global infrastructure are located in Spain. However, it is important to keep in mind that wherever the global units are located, the subsidiary benefits and draws from all knowledge generated in the multinational.

BOX 9: Why such locations?

We have described the different categories of R&D and Innovation Units found in the company and mentioned some of their locations and reasons for selecting a placement or the other. A Senior Executive of the Technology R&D Unit in Europe provided interesting comments in this regard, that serves as an illustration of the complexity of reasons that lay behind such choice. In fact, he emphasized that location plays no single role, as it sometimes is a matter of being closer to the market, to the vendors, to technology alliances and partners, to specific institutional conditions etc. To illustrate this he provided some examples:

"*We stay in Silicon Valley because, in the North American continent this is from the technology innovation perspective where a lot of the action happens. We choose Bangalore for anything related to software, engineering, data platforms etc. because it is very close to our data centers, as the Network for delivery and implementation is highly concentrated in Bangalore, and people working in R&D in these issues need to be very close to this network. We decided to locate our cyber security unit in Washington because a lot of the work and interest in these issues is concentrated in government agencies so to be very close to the customer or client is a primary condition (…)".*

But how are these units managed and coordinated? A senior executive of the global executive team is in charge of making sure that the new knowledge created within the company, for example a new technology, is leveraged across the firm. By means of new collaboration tools and regular meetings, this coordinator makes sure that the different units are aware of what is done in other areas or geographies of the company, both at the global and local level, avoiding reinventing the wheel. Moreover, she looks at both technology and industry trends, making sure that research done in the different units is aligned with those trends. In this sense,

> "*There is a formal research program that happens at different parts of the organization, but our growth and strategy are overseen from a global R&D agenda, not in the strict sense of the management of all the funding, deliverables etc. but in terms of the capturing and synergizing of all these innovations at a central location*" (Senior Executive, Technology R&D Unit Europe).

However, in this sense, while the Technology R&D Units follow the particular trends envisaged in the analysis of the technology trends that they annually develop (i.e. corporate level), the Strategic Centers follow the agenda set by the specific company group that sponsorships the specific strategic initiative (i.e. business unit level) and the Country-specific R&D and Innovation Programs follow local requirements (i.e. country level). As a consequence of these regular meetings, information is exchanged and the different levels of action are harmonized. On the one hand, the Country-specific R&D and Innovation Programs become aware of what is done in the global units. This is important for channeling the local innovative activities towards areas that are important for the global business and as a tool for reaching clients with better credentials, showing a global innovative image. On the other hand, the exchange of information helps the global R&D and innovation team fostering the most successful local initiatives in other geographies, which at the same time gain visibility and recognition in the company.

> "*It may sound as a mess, but it is more a manner of finding the right approach to innovation for such a large company, so that there are no silos or isolated initiatives…at the end of the day there are synergies and collaboration*" (Senior Executive, Technology R&D Unit Europe)

It is important to emphasize that, so far, there is no hierarchical relation between the global and local initiatives regarding autonomy, strategy, funding, reporting etc. In this sense, Country-specific R&D and Innovation Programs get funding through the national budget and report their activity to local partners.

Summarizing, the different units analyzed, both at the global and local level, follow their own but coordinated strategies, focusing in areas that have been detected as being of strategic interest of Alpha in relation to market evolution. Although, formal structures and hierarchical relations between units play a small role in terms of local-global coordination, this is achieved mainly in a rather informal way, through regular meetings and updates, avoiding isolation and duplication of efforts.

5. Discussion

The previous section has analyzed the different categories of R&D and Innovation of units found within the company and their specific functions (Table 2).

In this sense, first of all, it is important to highlight that the analysis has evidenced the existence of some units that mirror the units found in R&D in manufacturing and the presence in the company of specific networks that are unique for services.

On the one hand, we have found four categories of units that mirror the types of R&D units found in manufacturing. In this sense, while the *Technology R&D Units* focus on R&D in general technology trends, whose long-term potential has

been detected in carefully developed prospective analyses (mirroring operational R&D units), the *Strategic Centers* and the *Collaboration R&D Centers* focus on the development and application of those technologies and new knowledge in specific industries and markets (mirroring functional R&D units), as a result of key initiatives coming from different departments or areas of the company or in the areas specifically agreed within the collaboration contracts with the different alliances. These findings show that the company's R&D organizational strategy tries to deal with the tension between emphasizing research and long-range thinking, on the one hand, and development and the immediate needs of the market, on the other hand (Argyres and Silverman, 2004). In other words, it applies the mixed model of R&D design previously described for manufacturing (DeSanctis et al., 2002).

Additionally, Alpha has also created *Country-specific R&D and Innovation Programs* whose aim is to respond to local or country, that is, to provide "local responsiveness" (mirroring country centers of R&D). Basing the analysis on the specific case of the Spanish subsidiary, we have seen that these country-specific centers actually pursue similar functions to those found traditionally for country centers in manufacturing: 1) increasing the local absorptive capacity (Cohen and Levinthal, 1989) and the capacity of integrating and using new knowledge in the company, by looking at the R&D developments pursued by local companies and integrating their capabilities in Alpha's local innovation portfolio, 2) fostering participation of employees through bottom-up initiatives and training in creativity, and 3) answering to the local environment by engaging into activities that link technology and customers, such as the creation of start-ups (Daneels, 2002). In fact, the importance of bottom-up idea generation, creativity and absorptive capacity has been widely addressed in the literature on innovation management (Adams et al., 2006; Ramus, 2001). Moreover, we may say that the Spanish Innovation Program follows an expanded-enterprise network model (DeSanctis et al., 2002), that is, it looks for new knowledge and ideas wherever they might be located, expanding the sources of new business potential outside the company boundaries.

On the other hand, we have also found that some of the categories of units involved in the innovation infrastructure of the company are specific or more important for services, as their role is to customize the solutions to specific customer needs in a more ad-hoc perspective. These are the *Network for R&D Diffusion,* which offers end-to-end experiences for clients, diffusing the uses of the new technologies and aiming at adapting them to the specific customer needs, and the *Network for Delivery and Implementation,* which deploys the developed technologies in customers creating incremental innovations that suit the specific customer needs. These types of units for the customization of R&D and innovation, in which implementation of innovations requires a more direct interaction with clients and in which ad-hoc innovation plays an important role, are rare or uncommon in manufacturing (Den Hertog, 2000).

However, if we classify the different categories of units analyzed at Alpha in terms of their general roles, we may distinguish the same two general subtypes of

units distinguished in the literature on industrial R&D organization, that is: whether creating new knowledge and technology - *home base augmenting units* - or exploiting and applying the existing knowledge by adapting it to the specific needs of the clients - *home base exploiting units* - (Kuemmerle, 1996).

In this regard, the *Technology R&D Units*, the *Strategic Centers*, and the *Collaboration R&D Centers* are creators of new technology and knowledge (Nobel and Birkinshaw, 1998); the first with an emphasis on long-term research and focusing on the future needs of the organization, and the other two with an emphasis on applied R&D and the development of the technologies focusing on product developments that answer the specific needs of different markets or industries. Similarly, the *Country-specific R&D and Innovation Programs* also aim at augmenting the existing knowledge of the company, but focusing on accessing the scientific knowledge and technology that exists in the region (e.g. from local Universities and local companies) and the ideas of employees internally, to answer to the specific local needs and clients. By this means it increases the company's local absorptive capacity, creating the capabilities that allow the subsidiary to identify, assimilate and exploit knowledge available in the environment (Cohen and Levinthal, 1989). All these units are ***home base augmenting units*** that aim at creating (or accessing) new knowledge that increases the company's technological capabilities and absorptive capacity.

On the other hand, the *Network for R&D Diffusion* and the *Network for Delivery and Implementation* are adaptors of existing knowledge to the specific market and customer needs, showing how a developed technology or innovation can be used and how it can add value to different industries. In other words, they are ***home base exploiting units*** that help transferring the developed technologies, by enhancing or adapting them, to the local needs.

Moreover, Table 3 has shown that the different units conform a global network that benefits from the scientific and technological knowledge available in specific places around the world (e.g. Silicon Valley as location of a *Technology R&D Unit*), from the markets and led users located in specific regions (e.g. Detroit as a led market for the automotive manufacturing industry, or Washington for cyber security as locations of *Strategic Centers* and centers of the *Network for R&D Diffusion*), from the specific cost advantages and high quality of technology training of the workforce in some regions (e.g. some Asian economies), and from the singular mixture of characteristics of the different regions or countries (e.g. both access to local universities and local partners). Hence, we can say that the creation of this international network of specialized units follows a strategy that mirrors the one adopted by large technology-intensive industries, where there is no one single reason for choosing a location for the different units, but often a mix of reasons regarding access to technology and knowledge, access to led users, specific markets conditions, vendors, partners, technology alliances etc. (Zedtwitz and Gassman, 2002).

In fact, the reasons for choosing a particular location for a unit may also evolve over time. For example, the initial reason for establishing some of the centers of the *Network for Delivery and Implementation* in developing countries, mostly in

Asia, was the access to cost advantages, evidencing a parallelism with the dynamics found in industrial R&D (Zedtwitz and Gassmann, 2002). They focus on deploying and adapting existing technologies to the market and customers benefiting from good quality human resources at lower wages, hence reducing the cost of innovation. In this respect, Kuemmerle (1996) described how in the past companies from industrialized countries located manufacturing facilities abroad to benefit from lower wages and how, with time and the increasing complexity of the activities done in such facilities, new R&D units were created in those locations, in order to improve necessary interactions and speedy transfer of technology and trials. Similarly, in our case study company, we have seen that offshore locations that in the past attracted mainly system implementation and deployment facilities, have recently evolved and attracted R&D facilities, giving birth to new *Technology R&D Units* that work in close interaction with the *Network for Delivery and Implementation*. We could hence acknowledge an evolution of the initial cost reduction reasons towards an objective of entering new emerging countries with increasingly prepared human capital.

In other words, combining the main role of the different R&D and innovation units found in Alpha and the main reason for their location, we may classify the different units in three general typologies:

1- Home base augmenting units whose location mainly aims at accessing **science and technology resources - Technology R&D Units**: The function of these units is to explore, prototype, and build solutions using not yet commercialized emerging technologies. Focused on long-term research, the generic technologies created within these units are transmitted to the rest of the company, expanding its technology offer and the knowledge base. These units are located in global sites of widely recognized S&T resources, such as Silicon Valley and other technopoles such as Sophia Antipolis.

2- Home base augmenting units whose location mainly aims at accessing specific **markets and led users - Strategic Centers, Collaboration R&D Centers,** and **Country-specific R&D and Innovation Programs**: These units play a more applied R&D role, developing new tools, knowledge etc. that are targeted to specific key areas, following the strategy of the different business units. The units of a global reach are located in regions where they can access led users in the specific areas of interest (e.g. Detroit for automotive, Washington for security) and the *Country-specific R&D and Innovation Programs*, as it is evident, in the specific regional subsidiary, where they can access specific local S&T (i.e. local Universities) but mainly market capabilities (i.e. local companies and partners).

3- Home base exploiting units whose location is selected to better respond to **local markets' and clients' needs** and to exploit country specific advantages that allow the reduction of innovation costs **– Network for R&D Diffusion** and **Network for Delivery and Implementation:** As it is widely acknowledge, in services, the close understanding of user needs is a must for successful performance and innovation. Because of this reason, the decentralization of the R&D organization structures is a keystone as it allows tapping into the specific

market needs (Argyres and Silverman, 2004). As a consequence, Alpha has created two different networks of units that aim at enhancing, adapting and deploying company technologies in an ad-hoc fashion and that are spread all over the world with this purpose.

Table 4 summarizes the results of the analysis of the different typologies of R&D and innovation units found at Alpha, using a framework that emerges from the literature on R&D organization in manufacturing.

Table 4: Typologies of R&D units found in the case study company

	Main reason for international location of R&D (Zedtwitz and Gassman, 2002).	
Main role (Kuemmerle, 1996)	Access to **SCIENCE** and **TECHNOLOGY**	Access to **MARKET** and **LED USERS**
Home base augmenting units	*Technology R&D Units* → Focus on technological long-term research	*Strategic Centers* & *Collaboration R&D Centers & Country-specific R&D and Innovation Units* → Focus on business needs
Home base exploiting units	Not found.	*Network for R&D diffusion* & *Network for delivery and implementation* → Focus on enhancing, adapting, and deploying the developed technologies

Own elaboration.

But, are consultancy companies different from large technology oriented firms?

Summarizing so far we have seen that, in many aspects, consultancy companies mirror the patterns and organizational structures found in industrial manufacturing. In particular, at the analyzed consultancy company we find that:

a) There is a tension between an emphasis on long-range thinking and research on the one hand (i.e. Technology R&D Units) and an emphasis on market needs and short-term business developments on the other hand (e.g. Strategic Centers) that is reflected in a mixed R&D organization (as in Argyres and Silverman, 2004; DeSanctis et al., 2002);

b) The main reasons for choosing locations of the decentralized R&D units are access to superior information, both related to S&T and to market needs (as in Zedtwitz and Gassman, 2002);

c) We can distinguish two categories of units depending on their general main role (as in Kuemmerle, 1996; Nobel and Birkinshaw, 1998): the *home base augmenting units* that aim at creating or accessing new knowledge (i.e. Technology R&D Units, Strategic Centers, Collaboration R&D Centers; and Country-specific R&D and Innovation Units) and the *home base exploiting units* that aim at deploying and adapting the existing knowledge and technologies to specific clients and market needs (i.e. Network for R&D Diffusion, and Network for Delivery and Implementation).

d) There exist also Country-specific R&D and Innovation Programs that pursue functions whose importance has been broadly discussed in the literature on innovation management, namely, increasing local absorptive capacity (Cohen and Levinthal, 1989), bottom-up participation and creativity (Adams et al., 2006; Ramus, 2001), and local responsiveness. These Programs "expand" the boundaries of the organization, looking for new ideas, R&D and knowledge wherever their source (DeSanctis et al., 2002).

These are the main findings of this research, which claims for a reconsideration of the traditional view of services, as lacking from a specific organization for R&D and innovation.

However, as we have also mentioned, some of the analyzed units, namely the *Network for R&D Diffusion* and the *Network for Delivery and Implementation*, have some features that are uncommon in manufacturing. Although their main role is the exploitation of existing knowledge, and hence have been classified within this typology also found in manufacturing, these units further develop the existing technologies ad-hoc. That is, these units do not limit their role to the deployment of the knowledge coming from the home base augmenting units.

The main reason for this difference is that in consultancy companies the role played by the interaction and co-creation between consultants and the clients is crucial (Gadrey and Gallouj, 1998), opening the way to the creation of ad-hoc innovative solutions that answer client-specific needs, found more rarely in technology-intensive manufacturing. In industrial manufacturing, the outcomes and innovations that emerge from R&D units are generally converted or incorporated into products that are sold to clients with a lower degree of individualization. In the case of services, the created solutions must fit perfectly with the specific needs of the client and, as a result, the outcomes obtained from the R&D units need to be applied ad-hoc to each industry and specific client, increasing the importance of the role played by the creativity of the consultants in direct interaction with customers.

About this broadly acknowledged distinction between dealing with services or with other non intangible goods, a commentary made by an interviewee was very illustrating "*You cannot sell a client that you are going to walk his dog if he does not have any, but maybe you can sell him a leash if it is beautiful*" (Manager, Consulting). Hence, the existence of these units reflects the findings of prevalent literature on the importance of client participation and co-creation in the innovation process in services (see Chapter 1). This is the first and main difference we find between R&D and innovation organization in manufacturing and in services.

Second of all, the analysis of the functions of the R&D and innovation units existing in Alpha has allowed us to see that they intervene in different moments of the innovation process (Table 3). In this sense, while the *home base augmenting units* are devoted to R&D, be it generic, applied or tailored, and irrespective of internal (i.e. the Technology R&D Units and the Strategic Centers) or in collaboration (i.e. the Collaboration R&D Units and the Country-

specific R&D and Innovation Programs), the *home base exploiting units* are devoted to the diffusion of the developed solutions and services, first in a small-scale, to limited clients visiting the centers that offer end-to-end experiences (i.e. Network for R&D Diffusion), and then in a larger-scale, once adopted as new solutions in Alpha's service portfolio (i.e. Network for Delivery and Implementation). These findings allow us to question whether the model of diffusion of new knowledge and innovation within service companies is similar to diffusion in manufacturing.

Rogers (1995) developed a widely used theory of the diffusion of innovation within social systems, defining an "innovation-development process" that consists of all decisions and activities that occur from recognition of a need or problem, through research, development, and commercialization of an innovation, through diffusion and adoption of the innovation by users, to its consequences. This process is divided into 2 different stages and 5 phases: a) an *initiation stage*, in which: first, the problem is defined and a need for an innovation is perceived (i.e. agenda setting phase); and then, a conceptual feasibility test is designed and conducted to see how well the innovation fits the problem (i.e. matching phase); and b) an *implementation stage*, in which: first, the innovation is redefined to accommodate the organization's needs and organizational structures are altered to fit the innovation (i.e. redefining and restructuring phase); then, the innovation is put into more widespread use in the organization to show its relevance to organization's members (i.e. clarifying phase); and finally, it is incorporated or adopted into the regular activities of the organization (i.e. routinizing phase). It is important to emphasize that, after the initiation stage, a decision is taken regarding the adoption or rejection of the innovation

Taking this theory into consideration, we have compared the phases of the diffusion process described by Rogers (1995) with the moments of the innovation process in which the different R&D and innovation units found in Alpha predominantly intervene, and we have found an important match or coincidence between them. First of all, as we have described, among the functions of the *Technology R&D Units* a group of experts defines the global technological R&D strategy of the company (see Box 1), basing this agenda on the analysis of emerging social problems and trends which deserve research. This function clearly relates to the agenda-setting phase of the initiation stage of the diffusion process. Second, the *Technology R&D Units* themselves, the rest of *home base augmenting units* (see the Boxes looking closer into the work of the Strategic Centers, Collaboration R&D Centers and Country-specific R&D and Innovation Programs) conduct generic, applied and tailored R&D to create solutions that match the detected needs (i.e. matching phase). However, the continuation of this phase and the development of a prototype to be tested in a first client are subject to the decision of a company partner (i.e. downstream partners) to support the project. This decision makes a divide between the initiation stage described until this point and the implementation stage.

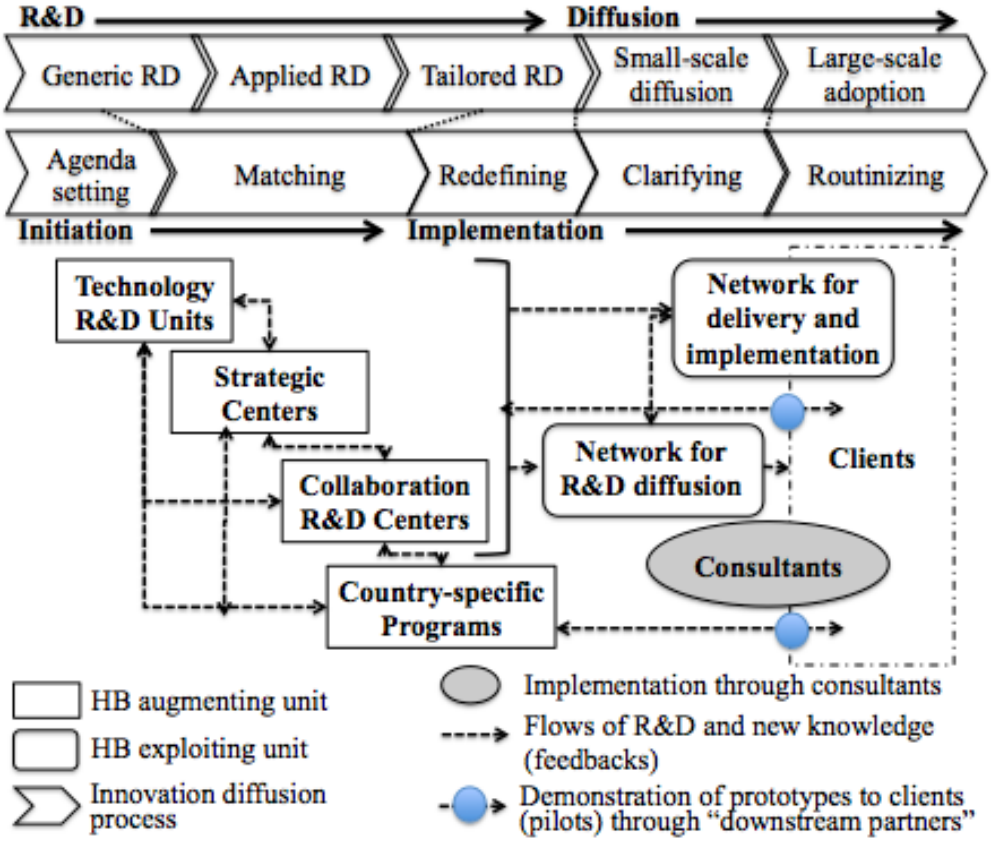
Once organizational support is found, the "downstream partner" uses its network to find a suitable client in whom the prototype will be tested and the innovative solutions are modified to fit the needs and the specificities of the client (i.e. redefining/restructuring phase). In Alpha, this phase is done in co-creation or close collaboration with customers, answering to the specificities of innovation in services. Once the innovative service has been tested with different clients (see examples of pilots in Box 3 and 5) that provided important feedbacks about the service, this is put into more widespread use in the organization by means of the *Network for R&D Diffusion*. The units of this network show the relevance of the developed solutions and innovative services to a wider number of clients (what we have called "small-scale diffusion"), as they visit the available facilities. Additionally, through this initial "small-scale diffusion" the relevance of the innovation is also clarified for internal organization's members (i.e. clarifying phase). Finally, once the relevance and applicability of the developed service is clear internally, the solution becomes part of the portfolio of the company and gets routinized and widely deployed all over the world (i.e. routinizing phase) by means of the *Network for Delivery and Implementation*.

Hence, and summarizing this second general insight, we find that not only do the R&D and innovation units in Alpha mirror the units found in technology-intensive manufacturing, in terms of their focus and functions, main role and reasons for location, but their functions also fit into the different phases of Roger's innovation diffusion theory, widely adopted in manufacturing literature.

However, it is extremely important to keep in mind the main difference with manufacturing, that is, that the implementation of developed solutions in Alpha cannot take a purely routinized or standardized approach, as clients' needs and problems differ from case to case. This particularity of services calls for an ad-hoc implementation and further development of solutions that may lead to incremental innovation (Hipp and Grupp, 2005). This is precisely the role of the consultants, be it within the *Network for Delivery and Implementation* or within any of Alpha's business units, as their work is developed face-to-face with clients, providing deepest knowledge of specific customer needs. Hence, innovations are not diffused as uniform packages to potential adopters but, on the other hand, the role of clients is active, as they participate in the co-creation of the solutions that fit their needs. This is the customer intensity signaled by Miles (2008) as a typical service characteristic.

Figure 1 offers a match between Roger's (1995) diffusion process and the functions of the different R&D and innovation units in Alpha as described in Table 3. Additionally, it illustrates the flows of R&D and innovation between the units and the role of downstream partners as demonstrators of the innovations in clients, and the role of consultants and of the Network for Delivery and Implementation in ad-hoc implementation and co-creation with clients (illustrated as the overlapping of Alpha's capabilities and clients).

Figure 1: Roles the R&D and innovation units in the diffusion process



Own elaboration.

It is important to keep in mind that, although Figure 1 includes a linear representation of phases that go from generic R&D to large-scale adoption of innovations, this only aims at simplifying and clarifying the role of the different units in the innovation diffusion process and does not mean that the innovation process in Alpha is linear. As a consequence, the figure does not reflect all the feedback loops that exist between the different units and from the market to each of them throughout the innovation process, although these feedback loops are pervasive in all the different phases (Kline and Rosenberg, 1986). To put just some examples of feedback loops mentioned in the analysis, we have seen that: a) the research agenda developed by the Technology R&D Units on an annual basis not only draws from the visions of Alpha's practitioners working with clients on a daily basis but is also validated by them (see Box 1) and is triggered by market exploration and market feedbacks; b) the Technology R&D Units often work in conjunction with other areas of the company that provides feedbacks related to special knowledge areas (see Box 2); c) all the home-base augmenting units need of "downstream partners" that look for specific clients in which field-test the innovations and this support from the market is a pre-requisite to continue with the research project; and d) showcases and demonstrations done to clients by the small-scale diffusion networks are important sources of new ideas, as these are often sparked when customers explore with the different technologies and brainstorm with company members. These are only some examples among the ones mentioned in the analysis, but are

enough to evidence: 1) the importance of the feedback loops coming from the market for the development of innovations at Alpha, and b) the importance of the feedbacks and knowledge flows existing between the different R&D and innovation units.

Finally, it is necessary to highlight another key difference of the R&D and innovation infrastructure found at Alpha, in addition to the existence of the networks for small-scale and large-scale R&D diffusion and to the important role of consultants in the ad-hoc implementation of innovation. A second important difference, compared to R&D organization in manufacturing, is the high dynamism of Alpha's R&D infrastructure regarding the creation, evolution and dissolution of new units (see Appendix 2).

In the time span of three years, at least 13 new *home base augmenting units* have been created and that, with the exception of a couple of units (e.g. Technology R&D Centers in the US and in Europe created more than 20 years ago), all units have emerged since 2006. However, with the fast changes in the business environment the underlying initiatives may lose their market sense and, as a result, evolve into something new or disappear, always answering to emergent business needs[6]. This high dynamism is an important difference with the more stable R&D structures found in manufacturing. A possible explanation would be that in manufacturing the higher fixed costs related to the required high investments in machinery and other tangibles make any evolution slower (Lyons et al. 2007). Another possible explanation is that what we have found at Alpha is and R&D and innovation infrastructure in the making, where few units have existed for more than 20 years. This last possibility, where a "de facto" structure is still emerging, explains the previous findings of the literature regarding innovation in services, which neglected the existence of specialized units for R&D and innovation (Djellal and Gallouj, 2001; Miles, 2005), and provides further support for the need to revisit this generally accepted beliefs.

Conclusions

This analysis covers a gap on the service innovation literature by addressing the organizational aspects of innovation in a large multinational consultancy company. Without aiming to neglect the importance that co-production of knowledge with clients and ad-hoc innovation play in services, this research evidences that it is necessary to reconsider the theory that overlooks the existence of specific R&D units for innovation within services.

Based on a single case study, the results of this research show that large knowledge-intensive companies do have specialized and dedicated R&D and innovation units and, in fact, reveals a complex global and local infrastructure dedicated to innovative activities. Moreover, drawing from the literature on R&D organization in technology-intensive manufacturing, this paper compares the

[6] Information about the disappearance of R&D and innovation units is not available.

R&D and innovation infrastructures found in the consulting company with those found in industrial companies. In this sense, we have found that the roles accomplished by the different units in the company mirror those found in manufacturing: creators of new knowledge and technology (*home base augmenting units*), and adaptors of existing knowledge to the specific client needs (*home base exploiting units*). Additionally, results evidence that within services there is also a tension between long-term research and applied R&D to accommodate to the immediate needs of the market. Moreover, the case study evidences that the reasons for the internationalization of R&D units in services are similar to the ones found in manufacturing, that is, access to science and technology and to markets. Finally, we have found that the functions assumed by the different R&D and innovation units, regarding the circulation of created solutions in the company, perfectly adjust to the phases of Roger's (1995) widely used diffusion theory.

However, it is important to have in mind that the analysis has also revealed important differences between R&D and innovation organization within services and manufacturing. Results have revealed the high importance of an ad-hoc implementation of the created solutions, so that they properly adjust to the needs of the clients. In order to achieve this purpose, the company has created two different networks that are not common in manufacturing (i.e. a network for small-scale diffusion of innovation and a network for large-scale diffusion) and it counts with the expertise of thousands of consultants and professionals around the globe, within these networks and in the different business units, that customize the created solutions to client needs. In this sense, our research goes back to the importance of co-creation with clients and of ad-hoc innovation in the day-to-day work within service companies. Last but not least, another key difference of the analyzed infrastructure is its high dynamism regarding the creation of new R&D and innovation units, possibly explained by the need for services to adapt to rapid changing market needs, but also probably by the "on the making" character of the analyzed organizational structure. This emerging character of the structure would provide explanation for previous findings of the literature on innovation in services that neglect the existence of specific R&D units.

Considering both the finding regarding the existence of a specialized R&D and innovation infrastructure in services that mirrors that found in manufacturing and the emerging character and dynamism of the infrastructure, it seams clear to us that there is a need to reconsider the traditional and generally accepted understanding of innovation in knowledge intensive business services.

CHAPTER 4. KNOWLEDGE MOBILIZATION

Introduction

In Chapter 3 we have seen that our case study company has a decentralized R&D and Innovation infrastructure specifically devoted to the creation of new knowledge and new technologies. However, and in line with the literature on service innovation, "*in KIBS and particularly in consultancy companies, all the accumulated knowledge is put to work to find creative solutions that answer clients' needs*" (Gallouj and Weinsten 1997). Hence, the mobilization of the knowledge base of the company and of professional knowledge represents an undoubtedly important source innovation.

Some authors have suggested that there is a need to further analyze the effects that the different patterns of knowledge sharing have on performance, measured in different metrics, such as innovativeness (Haas and Hansen, 2005). In this line, Tsai (2002) argues that intra-firm knowledge sharing is an interesting variable as an indicator of organizational capability, which predicts various outcomes such as business unit innovation. Similarly, Subramaniam and Youndt (2005: 459) state that "*communication, fluid diffusion of information, and the sharing and assimilating of knowledge are vital elements of innovative capabilities, irrespective or their type*", referring hence both to incremental and radical innovation capabilities: the first type requiring the reinforcing of prevailing knowledge and the second the transforming of prevailing knowledge. Hence, it is important to find a balance between the exploration of new knowledge that emerge from formal units, such as the R&D and Innovation infrastructure, and the reinforcement of prevailing knowledge, produced between consultants and within different communities (Cohendet and Simon, 2008).

Because of these reasons, in this Chapter we are going to analyze the mobilization of knowledge by consultants. However, one problem of research in this field is that the literature has introduced multiplicity of terms that clearly have large areas of overlap in meaning, although with different emphases (Levin, 2008). For example, we can find analysis of knowledge transfer, knowledge circulation, knowledge mobilization, knowledge leverage, knowledge exchange, knowledge utilization, knowledge sharing, knowledge brokering etc. We are going to use the term *knowledge mobilization,* defined as "*getting the right information to the right people in the right format at the right time, so as to influence decision-making"* Levin (2008), because this concept emphasizes the multidimensional and often political nature of knowledge and includes dissemination, knowledge transfer and knowledge translation.

In contrast to other concepts such as knowledge transfer that have a rather linear view, knowledge mobilization does not include a linear emphasis. Besides, knowledge mobilization emphasizes an objective of the mobilization process, that is, its focus on putting available knowledge into active service to obtain a benefit or reach an objective. Because this chapter aims at analyzing individual knowledge mobilization, as a means of answering to client needs in new and creative ways, we believe that this emphasis is adequate. In addition, knowledge mobilization also includes an emphasis on knowledge translation to the "right format" so that it assimilated by its recipient, although the meaning of "right" in the definition is difficult to pin down. In contrast, for example the term knowledge circulation makes more emphasis on the flows or exchanges of knowledge without the mentioned stress on the need of translation.

We consider these two concepts, knowledge mobilization and circulation, and the concept of knowledge leverage to be very close from one another, only with slight emphasis differences and, hence, we sometimes use them as quasi-synonymous along the document. However, in terms of their specific emphasis, we apply knowledge circulation in a rather "impersonal" way without emphasizing the actor that uses it, knowledge leverage with an emphasis on the purpose and effects of the knowledge use, and knowledge mobilization with an emphasis in both the actor and the purpose/effect of its use.

Given the confusion that the use of so many different in the literature can cause, we agree with Levin (2008) in the need for a terminological agreement. Terminological issues aside, within the concept of knowledge mobilization we include the analysis of knowledge sharing through interpersonal ties, knowledge transfer through codified means, social production of knowledge through communities, and of knowledge brokering.

In this chapter we analyze individual knowledge mobilization patterns specifically focusing on two dimensions: the access to knowledge and the contribution to the knowledge base of the company by consultants. Related to this topic, many scholars (e.g. Burt, 1992; Cillo, 2005; Hargadon and Sutton, 1997) have acknowledged the importance of "knowledge brokers", individuals in a unique position in the company for obtaining knowledge and ideas from a part of the organization and disseminating it.

Regarding the access of knowledge, and similarly to Hansen and Lovas (2004), our primary concern is not whether consultants decide to acquire new knowledge or competences but, to the extent that they do, *where* they are likely to go within the company for acquiring them. There are a variety of resources that a consultant can mobilize when facing a problem: he/she can mobilize codified knowledge embedded in the systems of the company or knowledge embedded into personal networks and communities. However, the variety of available resources, such as sets of knowledge and techniques, is important (Gallouj and Weinstein, 1997) but not sufficient for knowledge mobilization, and conditions of access are a key issue to be taken into consideration as, in fact, the consultant or the team "*may not be aware whether and where such knowledge exists in the organization*" (Maurer et al., 2011: 174).

Mobilization of resources is not random, because different problems require different types of knowledge and, for example, the knowledge mobilized in the day-to-day routine work and praxis, which reinforces prevailing knowledge, may differ from the more disruptive knowledge mobilized in non-routine learning, which transforms prevailing knowledge (Subramaniam and Youndt, 2005), but also because the mix of resources a consultant is able to mobilize depends on his/her experience, network of contacts etc. In fact, often in order to access the knowledge of others there is a need of reciprocity, that is, if you want others to help you, you need to help others (Bouty, 2000), or in other words, if you want to access knowledge you need to offer knowledge to others and anticipate to problems to arise. Additionally, if the quality of the provided service is essential in the relationships with the clients and trust plays a central role in legitimating the tacit knowledge included in the service (Sundbo and Gallouj, 2000: 17), the same dimensions play an important role when accessing the knowledge and experience of colleagues within a company. That is, the used source of knowledge must be trusted (Abrams et al., 2003).

Taking all these issues in consideration, we have seen in the preliminary analysis that consultants at Alpha: a) have an uneven participation in (the initiatives of) the company, and b) have different perceptions about problems related to knowledge circulation in the company. Hence, it is important to analyze why participation level differs between employees, specifically regarding knowledge creation and mobilization and whether this is related to the existence of culture clashes, because innovation management literature has emphasized these are a trap for innovation (Kanter, 2006). In fact, in services "*creative thinking among only a subset of individuals is likely insufficient to fully capitalize on the opportunities for growth and change*" Lyons et al. (2007: 176). In this context, managerial support becomes essential for activating the distributed responsibility for innovation. As a result, it is important to analyze how perceptions about the existence of this support and of barriers influence individual decisions about access and contribution to the knowledge base of the company. This chapter is devoted to shedding new light on these issues.

1. Objectives

The objective of this chapter is to analyze how knowledge is created and circulated within KIBS from an individual perspective and to shed new light to the internal driving forces of innovation in KIBS, answering to the need highlighted in the literature (Muller et al. 2013). More specifically the objectives are the following:

a. To analyze what variables influence the (uneven) individual participation patterns on knowledge mobilization, in terms of access and contribution to the knowledge base of the company.

b. To analyze the influence of the perceptions about the knowledge system of the company, regarding the existence of barriers and incentives to

knowledge circulation, on the patterns of individual knowledge mobilization.

The specific research questions we aim to answer are the following:

- What variables influence the patterns of access to knowledge resources in KIBS by consultants?
- What variables influence the patterns of contribution to the knowledge base of the company by consultants?
- What variables influence individual decisions about the mobilization of the different knowledge sources available for consultants?

In addition, in Chapter 3 we have seen that Alpha has created (or is creating) a network of R&D and innovation units that acts both globally and at a local level. However, interviews in the preliminary analysis have also evidenced that many of these resources are not well known by an important part of company employees and that not only do consultants not use them but many employees do not even know of their existence. The following quotes illustrates this reality:

> "*There are many people centered in their day-to-day work, and they are not aware of the research done in the specialized R&D and Innovation units or even of their existence*" (Interview 12, Director, IT)

> "*There exists a gap on how these innovations* (referring to R&D, new technologies…developed globally) *are translated to local capacities…there are many fronts for innovation in the company, but I don't know how much of this effort we make the most of…I am not sure of how we are affected by the developments done in the Technology R&D Units*" (Interview 1, Spanish Innovation Program).

In Chapter 3 we have provided a possible explanation for this lack of awareness: the "on the making" character of the analyzed R&D organization and the consequent lack of general perspective provided yet to most employees. In this Chapter we aim at analyzing a possible alternative explanation for this lack of awareness: an organizational explanation related to the division of the company into "two classes of corporate citizens" (Kanter, 2006): juniors, or qualified workers in a "factory", and seniors, for which a different structure for generating and circulating knowledge is made available (e.g. the knowledge of the R&D and innovation infrastructure). Hence, we wonder whether "seniority" is the main variable that determines differences in the patterns of access and contribution to the knowledge base of the company. As a consequence, we add the following research questions:

- Is "seniority" the main variable that determines differences in the individual patterns of access and contribution to the knowledge base of the company?
- Are seniors at KIBS the main knowledge brokers?

- Are the different R&D and innovation units analyzed in Chapter 3 knowledge sources or channels that are only mobilized by seniors? Can they be seen as "exclusive" channels?

The following sections are devoted to answering these questions, which have been translated into explicit hypothesis in the methodological epigraph.

2. Literature review: The mobilization of knowledge

It has been widely recognized that the use of a variety of knowledge sources is critical for innovation, both in manufacturing and in services. However, Lyons et al. (2007) make five key distinctions between innovation in services and innovation in manufacturing: 1) innovation in services is distributed throughout the organization, 2) it is fluid and continuous in pace, 3) it is far more relevant to hiring and promotion decisions, 4) it is influenced by formal reward systems and culture at the firm-wide level, 5) it is strongly influenced by leaders' behavior. Similarly, Gallouj and Weinsten (1997: 552) state that in services "*the capacity for innovation depends on the ability to explore and mobilize an extended set of knowledge and techniques. This has major implications for the role of the social forms of the flow and appropriation of information and knowledge*". In fact, as in KIBS knowledge is widely distributed, when an individual or a team faces a new problem, they might not hold all the necessary competences to find the creative solution (Larsen, 2001) and will need to tap into the competences and skills of other colleagues or company experts. Hence, although some authors have questioned the knowledge intensity of KIBS or of "*at least some large-scale knowledge intensive companies offering relatively standardized services*" (Alvesson, 2001), we may say that in KIBS, and particularly in consultancy companies, all the accumulated knowledge is put to work to find creative solutions that answer clients' needs (Gallouj and Weinstein, 1997).

But, is the base of knowledge mobilized the same when facing all types of problems? No. In fact, different types of problems require different categories of knowledge. For example, if a consultant finds a problem when addressing a specific client, because he/she lacks the knowledge about its organization, the specificities of its activity, problems encountered in previous projects etc. then he/she will need to access knowledge about all these issues that involve the specific client, be it through the databases or through a colleague that has worked with the client. To put another example, if the consultant is an engineer and encounters a legal problem when facing a project, he/she will need to access specialized knowledge in law.

In this sense, literature offers a wide variation of classifications of different categories of knowledge.

2.1 Knowledge types and circulation

The distinction between tacit and codified knowledge, proposed by Polany (1966), is the most widely used categorization of knowledge (e.g. Hall and Andriani, 2003; Duguid, 2008; Gertler, 2003; Nonaka and Takeuchi, 1995), but other authors distinguish, for example, between analytical, synthetic and symbolic knowledge bases (Gertler, 2008). According to Gertler (2008), analytical knowledge includes the "*know-why*", that is, scientific and deductive knowledge where specific laws and models can be applied, with strongly codified and abstract content of universal application. This type of knowledge is highly important in industries where scientific knowledge is key, such as pharmaceuticals. Synthetic knowledge is the "*know-how*" that enables novel combinations of existing knowledge to give answer to specific problems of customers, often created inductively and through interaction with them, and with a strong tacit and context-specific component. This type of knowledge is very important in industries such as advanced machinery that needs to be shaped to fit the specific needs of the industry and the regulatory environment. Finally, symbolic knowledge, or the "*know-who*", is linked to the creative process and the interpretation of symbols, images, or cultural artifacts, and hence distinguished by its aesthetic and semiotic nature, and a strong context-specificity. This type of knowledge is important in cultural industries such as advertising or design.

Regarding the use of these different forms of knowledge, Gertler (2008) states that "*just as all innovation processes make use of both tacit and codified forms of knowledge, so too do many industries draw significantly upon analytical, synthetic, and symbolic forms of knowledge, through perhaps to varying degrees*" (p.216). In fact, he states the dominant type of knowledge may change over the life of projects.

On the contrary, Fleck (1997) distinguishes between six different components or knowledge categories:

- *Formal knowledge*: theories, formulas etc. usually embodied in codified theories and acquired through formal education;
- *Informal knowledge*: rules of thumb, tricks of the trade etc. learnt through interaction within a specific milieu, and embodied in verbal interaction;
- *Tacit knowledge*: rooted in practice and experience, embodied in people and transmitted by training or learning-by-doing;
- *Contingent knowledge*: specific to the particular context and embodied in it, distributed and acquired on-the-spot;
- *Instrumentalitie*s: knowledge embodied in the use of tools and instruments and learnt through practice, that often require informal, tacit and contingent knowledge for its effective mobilization;
- *Meta-knowledge*: general cultural and philosophical assumptions, values, goals etc. that are embodied in the organization and are acquired through socialization.

As Gertler (2008) explains, all these different categories of knowledge are rarely found isolated from one another and, more often, we find them intertwined in a complex mix. Moreover, for example regarding the distinction between tacit and explicit knowledge, some authors have emphasized that this dimension of knowledge is not necessarily a dichotomy, but may be more effectively interpreted as a knowledge spectrum that moves from the tacit to the explicit (Hall and Andriani, 2003).

Literature has widely acknowledged the importance of knowledge circulation for innovation (Gallouj and Weinstein, 1997) and commercial performance (Allen et al., 2007). In fact, organization scholars have built on the notion that innovations are novel combinations of existing information and work practices (Mors, 2010). In this sense, Mors (2010) states that to be able to innovate, consultants need not only to access diverse information, knowledge and practices, but also to successfully integrate them. Acknowledging the importance of knowledge circulation for innovation, firms have invested in the development of numerous sources of knowledge, often dispersed and locally rooted, and in the creation of a context that enables knowledge mobilization, including management devices, organizational arrangements, logistics, and communication networks (Amin and Cohendet, 2003). Hence, there are a variety of resources that a consultant can mobilize when facing a problem, from codified knowledge embedded in the systems of the company to knowledge embedded in personal ties.

However, the circulation of knowledge differs from the circulation of information, because a) tacit knowledge is sticky and difficult to move, and b) circulation of knowledge implies a knowledge transfer from the individuals to the collective, and this requires a context that enables learning, dialogue, and experience-sharing (Amin and Cohendet, 2000). Hence, different types of knowledge will be mobilized differently, or through different means. In relation to this, Faulconbridge (2006) emphasizes the need to recognize two different epistemologies of organizational knowledge leverage: a) *knowledge transfer*, in the form of best practice that creates a body of common knowledge, and b) the *social production of new knowledge*, that promotes diversity and collaboration between individuals with different cognitive capabilities. These epistemologies play complementary yet differentiated roles in organization and have differing spatial reaches. Some authors (Amin and Cohendet, 2003; Wenger, 1998) have recognized that the "social production of knowledge" and socially embedded relations allow learning to occur in spatially stretched cognitive spaces. In fact, literature dealing with the concept of Communities of Practices highlights that, besides being part of a project group or a functional division of a company, individuals are also part of diverse communities and, moving from on to the other, they carry a bit of each as they go around (Wenger, 2000).

In addition to demonstrating the importance of knowledge circulation for innovation, literature has also evidenced the existence of many different barriers that hinder knowledge circulation within companies (Haas and Hansen, 2005). For example, studies of informal networks have revealed how the structure of organizations can impede knowledge flows between national boundaries,

organizational divisions and functions (Allen et al., 2007). Moreover, although most literature has emphasized the positive effect of knowledge circulation, for example regarding innovation and performance, there are also some authors that have found that some strategies of knowledge circulation can be detrimental, mainly because of the costs in terms of time and effort that knowledge mobilization entails (Haas and Hansen, 2005). Haas and Hansen (2005) found that it is not always better to obtain and use more knowledge, be it codified or personal, since utilizing knowledge hurts task performance in some situations.

Moreover, Reagans and McEvily (2003) defend that, when mobilizing knowledge, it is important to select the most efficient channel or source, because not all kinds of knowledge are as difficult to transmit. Their results show that it is easier to transfer all kinds of knowledge through strong ties (i.e. personal ties with a strong emotional attachment or frequent communication that helps develop trust), but that strong ties are much more difficult to develop and require greater investment of time and, as a consequence, it is inefficient to use strong ties to transfer codified knowledge.

Taking all these issues in consideration, the following paragraphs are devoted to the description of the available different knowledge sources, the benefits and problems that each of them entail for companies, and the particularities of knowledge mobilization through them, highlighting existent organizational barriers and important incentives to trigger their use.

2.2 Internal knowledge sources

Mobilization of knowledge resources first requires a search for relevant knowledge (Maurer et al., 2011), be it internally or in external sources.

However, before focusing in the internal sources available for consultants, it is important to keep in mind that, in the rapid-changing environment in which companies nowadays compete, it is important to identify external knowledge opportunities that will complement the capabilities developed within the organization, leading to superior innovation performance (Frenz and Ietto-Gillies, 2009). Because, knowledge diversity is key for innovation, organizations are increasingly relying upon external partners and alliances (e.g. start-ups, competitors, universities, consumer groups) to access new knowledge wherever its source (Kirschbaum, 2005). In this sense, the important role of clients as sources of knowledge and innovation in services has been also widely acknowledged. As it has been analyzed in Chapter 2 and 3, various authors have emphasized that, in professional business services, it is at the client/provider interface that ad hoc innovation is mainly produced (Gallouj and Weinsten, 1997). As a result, clients play a crucial role not only as sources of knowledge, but as partners in the collective creativity process.

However, Mors (2010) defends that clients will not be as helpful as internal sources and internal social networks in helping consultants (specifically company

partners) integrating diverse information, for two reasons: 1) clients will be looking to consultants for advice rather than assisting them and, 2) much of the information that consultants are exposed to, particularly if it is novel information, is confidential and therefore it cannot be shared with other clients. In addition, Blindenbach-Driessen and Van Den Ende (2006) found that customer involvement is relatively less important for project-based firms as close collaboration with clients is typical and, hence, it does not provide differential innovativeness.

Because of these reasons, while acknowledging the crucial role played by external knowledge sources for innovation in KIBS, and due to the character of our research objectives, we are going to focus on Alpha's internal sources, distinguishing between the sources related to the transfer of codified knowledge and the sources related to the social production of knowledge (Faulconbridge, 2006).

2.2.1 Knowledge transfer: Knowledge Management Systems

Successful knowledge transfer is complex for any organization, but project-based organizations represent a particularly challenging context, as formal organizational or technological means are often inadequate for coordinating their knowledge stocks and flows and, instead, this type of organizations often apply social modes (Maurer et al., 2011). However, KM systems and knowledge platforms enhance and complement firms' knowledge integration capability, and significant value can be derived from their use if properly assimilated by individuals and teams (Purvis et al., 2001). Hence, it is important to analyze the use and assimilation of Information and Communication Technologies (ICT) and other codified KM systems in the organization.

Over the last decades, multinational companies have spent billions into the creation of information systems for managing knowledge (Abrams et al. 2003), investing not only money but also considerable time and effort in the capture and codification of individual knowledge. By storing knowledge generated in past projects and experiences, these systems intended to make the organizations' knowledge base accessible for employees, making it possible for them to solve the problems they face in a project individually (Hargadon and Bechky, 2006).

However, research has shown controversial results about the effects of these investments, generating an extensive debate (Cañibano et al. 2012) and some authors argue results are inconclusive (Robey and Boudreau, 1999). On the one hand, some studies show a positive effect regarding the better accessibility and reusability of knowledge (Hargadon and Bechky, 2006), process efficiencies, better 'visibility' of work, etc. (Oliner and Sichel, 1994; Brynjolfsson, 1993; Gardner et al., 2003). On the other hand, other studies defend that the systems are often misused and people tend to rely in personal ties and networks (Abrams et al., 2003). In fact, often knowledge management schemes have failed because they have only focused on making resources available without considering the

development of other competences and processes necessary to make their use successful (Beckett, 2004).

In this sense, Gripenberg (2005) states that research on the impact of technologies on organizations and workers has been simplistic and somewhat uncritical, often characterized by technological determinism, assuming that the right technology leads to the desired results. In an interesting analysis of the unintended effects that some organizational innovations have in KIBS, Cañibano et al. (2012) defend that the impacts of ICT and other KM systems on work and on the patterns of knowledge mobilization are complex and contingent on a broad set of socio-technical factors, interpretations (Orlikowski, 2000) and even emotional aspects (Ciborra, 2004). In fact, potential users of a technology or knowledge platform may experience ambiguity about the value that using such technologies brings to their work and about how they need to re-conceptualize their work process to effectively use the technology (Purvis et al., 2001).

Hargadon and Bechky (2006) believe that the failure of the implementation of KM systems is related to the importance people give to personal interaction and to the possibility that it creates of reconsidering old ideas in new contexts (i.e. reflective reframing) as an element of the collective creativity process. Hence, their research shows that rather than searching on their own through codified knowledge, "*problem solvers relied on those social interactions that helped them recognize nonobvious connections between the organization's knowledge and their current projects*".

In fact, Cross et al. (2006) say that, because of the type of complex and ill-defined problems that knowledge workers often need to solve, it is no surprise that databases did not supplant people as a key source of information. Moreover, considering the quality of the content which databases provide, Duguid (2008) doubts whether codified knowledge is equivalent to the tacit knowledge it comes from. Additionally, Haas and Hansen (2005) find out that relying on codified knowledge can have negative consequences in some cases, as it increases the risk of relying excessively on past work and prevents forward thinking.

However, Falconbridge (2006) states that best practices, often embedded in knowledge management tools and systems, play a key role in providing a common ground or shared understanding that is necessary for the social production of knowledge between distant units, in order to diminish ambiguity and confusion. Social production of knowledge occurs when individual's cognition is enriched in social practices and new knowledge and visions are created, through the reinterpretation of ambiguous knowledge. Falconbridge emphasizes that, generally, these practices are part of an international strategy where a best practice from one part of the organization is implemented in another or in the whole organization (in contrast to social learning, where everyone learns from one another). Hence, best practices and other codified methodologies embedded in tools relate to "macro-level similarities" or globally standard approaches and elements that increase the cognitive convergence and cohesion across the different units that conform a multinational company, facilitating learning (Amin and Cohendet, 2000).

Consequently, the conversion of knowledge into explicit and its diffusion in the organization in the form of lessons learned or best practices is not only a way of formalizing project-learning, and hence distinguishing ad-hoc innovation from other service transactions (Gallouj and Weinstein, 1997), but also a necessary complement to the social production of new knowledge in organizations (Faulconbridge, 2006). Moreover, through the diffusion of common values and the creation of a common knowledge base (e.g. standard operating procedures) it becomes easier to integrate information across the organization, which is necessary for innovation (Mors, 2010). In this sense, Merx-Chermin and Nijhof (2005: p.138) say that "*explicit knowledge has an innovative and exclusive function for organizations as a collective good*".

Duguid (2008) acknowledges that when the practices and knowing-how of two communities are different, productively sharing knowledge becomes more challenging and codification is not enough to overcome cognitive barriers. In other words, the transfer of knowledge through the implementation of best practices is not always straightforward, as it is also "impregnated" of culturally and institutionally sticky practices. In this sense, Faulconbridge (2006) addresses that, in global advertising professional service firms, the most successful knowledge transfers are related to generalizable management practices rather than to locally specific advertising knowledge.

Two additional important problems of KM systems are ignorance of the source and complexity of their use. Regarding the first problem, when knowledge is dispersed in many sources there is a problem of "opaqueness", that is, individuals may lose the overview of the available alternatives (Becker and Zirpoli, 2003). First of all, regarding available information, often there are so many different knowledge management systems within a company (sometimes even with duplicated information) that it is very time-consuming for employees to find out what they are looking for. Haas and Hansen (2005) highlight that, when there are large quantities of documents available, individuals need to spend a lot of time scanning them to identify the useful pieces of information and to read and synthesize them. In fact, results from our interviews have provided similar results:

> *"We have too much information and it is too complicated…once you enter into the (internet) platform you get lost looking for information…you keep jumping from a page to the other and, at the end, you don't even know where you are (…) We are doing an important effort to synthesize, because we have so much information that, at the end, it becomes disinformation*" (Interview 21, Manager, Technology Solutions)

Regarding the second problem, Hargadon and Bechky, (2006) explain that databases codify and store knowledge making it easily accessible by using specific keywords. As a result, when problems are properly limited and well known, keywords provide effective access to the solutions. On the other hand, finding nonobvious links between ideas is much more difficult. Hence, "*databases rely on individuals who know what they want to do, where they want*

to look, and what they want to find" (p.496). However, this is not always the case, and even less frequently when trying to find creative and innovative solutions.

Besides the described problems for accessing knowledge through codified knowledge systems, there are also some barriers that hinder codification, or in other words, that hinder the increasing of the knowledge base of the company through this source. In this sense, the time required for translating tacit knowledge into explicit is probably the most important. This problem increases in knowledge intensive project-based companies because of the importance of deadlines and milestones in project work (Scarbrough and Swan, 2008). Scarbrough and Swan (2008) highlight that these time-shortages induce project members to leave optimal performance and abandon established organizational practices (e.g. formal post-project reviews, formalization of lessons learned in the company database) in favor of "more urgent" practices or strictly obligatory practices (e.g. formalization of budget and times devoted to a project). As a consequence, the rich potential of projects as a source of learning is often neglected. In the interviews described in Chapter 2 we also obtained commentaries that illustrate this problem:

> *"I would be nice to make a final recapitulation of projects, but the daily work is a hustle and bustle. We move on being conscious of the problems rather than documenting them"* (Interview 28, Manager, Corporate Functions)

Moreover, Hargadon and Bechky (2006) state that sometimes codification is not reinforced in the organization, as there is not credit given to the person that has spent time putting information into the database. Because of this reason, some people prefer to put only enough information into the database to tease colleagues into calling them directly, and this way acknowledging the present value of their previous experiences.

Summarizing, knowledge management tools and codified knowledge have positive effects in organizations, for example regarding the increase of the cognitive convergence and cohesion. However, these systems do not provide reflections or make unexpected connections that are necessary for the social production of knowledge or collective creativity. As a consequence, these systems need to be complemented with rich social interactions and knowledge embedded in personal ties.

Table 1 offers an overview of all the issues tackled in this sub-section:

Table 1: Knowledge mobilization through KM systems

Topics	KM systems, ICT and codified knowledge
Knowledge mobilization	Knowledge transfer (Faulconbridge, 2006)
Main literature and debates	Introduction of ICT in companies, controversial results and unintended effects (Cañibano et al., 2012), technological determinism (Gripenberg, 2005; Orlikowski, 2000)
Benefits	Accessibility, reusability and visibility of knowledge; increased process efficiencies; enables shared understanding and works as collective good.
Limitations	No personal interaction and rethinking, ambiguity on quality issues, relies on past experiences.
Incentives for use	Reinforcing behaviors, rewards
Barriers for use	Ignorance of the existence of the source or its utility, complexity, time-consuming activity, no understanding of social processes.

Own elaboration.

2.2.2 Social production of knowledge: personal ties

The "practice-based view" of knowledge considers that knowledge is closely intertwined with social practices and, hence, learning is inseparable from organizational practices and social relations (Scarbrough and Swan, 2008). Hence, it is necessary to look closer into the social production of knowledge, be it through dyadic and group relations or through specific communities.

Allen et al. (2007) emphasize the evidence found in KM research about the failure of many managers to comprehend the informal exchange of knowledge that happens within their organizations and the crucial distinction between the existent formal organizational structures created for knowledge transfer and the complex informal social networks through which knowledge flows in practice. These social networks are the essential structures upon which communication is based and are constituted by a myriad of personal ties that can extend outside organizational boundaries, through which knowledge and information disseminate, and are crucial for the firm's ability to innovate (Ibid).

Hargadon and Bechky (2006) highlighted that employees prefer informal interactions to solve their problems rather than individual efforts (e.g. generating a solution alone or searching the organizational database). But, in order to participate in a problem solving or knowledge creation process, individuals need to be somehow "invited", be it through formal means (e.g. brainstorming meetings or weekly scheduled meetings) or through informal or unstructured means (e.g. hallway conversations, ad-hoc meetings, personal networks). But who do people access when they need help? And to whom do people give their help? And why? Many researchers have looked into different issues that influence these decisions and, for example, while research in economic

geography has highlighted the importance of proximity, space and territorial embeddedness (Amin and Cohendet 2003; Gertler, 2003), social network analysis has focused on the different features of informal networks (Mors, 2010), such as the density, range, strength or cohesion of informal ties (Reagans and McEvily, 2003; Burt, 1992) or the position of a unit within the network (Tsai, 2001). As a result, social network analysis has helped determine crucial individuals and peripheral figures in informal networks and has often evidenced the peripheral nature of senior managers within informal networks (Allen et al., 2007).

As we have already mentioned in the previous sub-section, people give a lot of importance to personal interactions and to the possibility that they create for new learning and reflective reframing necessary for innovation (Hargadon and Bechky, 2006). In addition, Mors (2010) defends that in homogeneous contexts, such as the one found in a same firm and geography, the main challenge for innovation is to access diverse information and knowledge. As a consequence, accessing personal ties, individuals will benefit from a network where the different contacts provide access to distant spheres of knowledge. However, the prolific and diverse literature on the topic evidences that properly understanding the mobilization of knowledge embedded in personal ties is a complex issue, as it is influenced by innumerable psychological, physical and emotional variables.

For social production of knowledge to succeed it is important that individuals involved in the reflective reframing share a minimal common understanding or cognitive background that enables the necessary integration of information (Mors, 2010). In this sense, research in economic geography has highlighted the importance of proximity (Amin and Cohendet 2003), both spatial and relational. Amin and Cohendet (2003) have related the concept of relational proximity to the concept of "ba" suggested by Nonaka et al. (2000), which can be physical (e.g. office), virtual (e.g. e-mail) and mental (e.g. shared experiences, ideas, ideals). For example, Hansen and Lovas (2004) find that, for R&D teams, the negative effects of distance are mitigated by formal and mainly informal proximity, as established relations become "*taken-for-granted channels through which competencies can be accessed*". In fact, they state that "*teams may contact someone they know rather than someone who knows*" (p.806). But the decision to ask someone for help is influenced many issues, such as the expectations about that person having time and inclination to help. In fact, Hargadon and Bechky (2006) found that people often decided to ask someone less experienced but with more time and willingness to participate, than an expert with a tighter calendar.

Bouty (2000) analyzed the influence of interpersonal relations and interaction on the decision to share resources, information and services among R&D scientists, arriving to the conclusion that friendship ties and social networks influence on these decisions. She proves that "*the fact that a resource can be exchanged (a possibility exists) does not mean that a scientist is ready to exchange it (availability exists)... acquaintance, mutual trust, and competition emerged from the interviews as discriminant criteria*". In this sense, she makes a distinction between: a) "profitable exchanges", that is, there is no free help, the exchange is

a barter and reciprocity and immediacy are central; and b) "equitable exchanges", that are simply about helping a partner when he or she requires it, and receiving help in return when you need it. In this case, reciprocity is potential (it can exist if a need emerges later) and delayed. Summarizing, she describes each decision about help giving as a complex three-step, filtering-down process: starting with potential exchanges (i.e. not confidential and at hand), filtering down to exchangeable resources, depending on acquaintance, mutual trust, and competition with the partner, and finally depending on the interaction logic and type of exchange (i.e. profitable or equitable).

A key element related to the decision of asking someone for help is interpersonal trust, based on confidence about: a) the benevolence of a colleague, which allows help-seeker to pose a question without fearing that his/her reputation will be damaged, and b) the competence or sufficient expertise of the help-giver (Abrams et al., 2003). Cross and Parker (2004: 16) reflect in their study of a distributed R&D group that despite the attempts to promote collaboration by the company involved, "*people still relied upon those that they know and trusted, and not a database of self-proclaimed experts*". Bouty (2000) analyses the effect of time and recurrent exchanges on the development of trust between people. She says quoting Blau (1964: 94) that "*processes of social exchange…generate trust through their recurrent and gradually expanding character*" and explains that after an initial mutual test, acquaintance and mutual trust develops in a virtuous cycle. Similarly, Allen et al. (2007) affirm in relation to R&D workers that they "*tend to build very strong trust relationships with the peers with whom they collaborate and they are likely to turn to them, and not to an alternative source, be it personal or data, for assistance when it is required*". Hence, according to this credibility cycle, claiming to have a capability it is not enough to gain status, influence and power but, on the contrary, it is necessary to demonstrate that capability successfully, so that credibility and recognition of expertise are achieved (Fleck, 1997).

There is, however, an important negative side to the mobilization of knowledge embedded in personal ties: the time investment necessary to develop such relations and to access relevant knowledge. Haas and Hansen (2005) defend that it is not only the access of codified knowledge that is time consuming, and that seeking information and advice from colleagues also involves search costs, first in terms of finding the right expert and second in terms of waiting for the help. In fact, slow responses may cause delays in the development of projects or proposals. Related to the time cost that contacting people implies, Hargadon and Bechky (2006) state that the emphasis on collective processes, such as the social production of knowledge, may come at the cost of accomplishing work on time or reinventing the wheel. In this sense, these authors acknowledge that bureaucratic processes of accounting of the time spent in the exchange of information constrain spontaneous responses and impede effective help giving.

This is even more problematic in project-based firms, since strict project evaluation criteria and tight time constraints, together with the desire of efficiency and minimization of resources applied to a project (Keegan and

Turner, 2002), make accountability of time spent working for another team or manager a common issue. In this respect, Cohendet and Simon (2008: p. 235) say that "*if the hierarchy exercises strict control over the timing of a project, it can exclude significant feedbacks, and thus also stifle creativity by restricting the micro-inputs of creativity*". Moreover, although looking at individual creativity processes, Amabile et al. (2002) add to this idea by proving that time pressure not only decreases creativity on the given moment or day when it is exerted, but on the next day and the day after that, as a consequence of the *"exhaustion or enduring post-pressure cognitive paralysis*" (p.57). In fact, these authors highlight that "time famine" is even a bigger problem for knowledge workers, such as workers at Alpha. Interviews held in the preliminary analysis provided some examples that evidence that this problem can be also found in our company:

> *"Most employees are motivated to provide their ideas but there is no time for it because the day-to-day work takes it all. Work time is always dedicated to projects and thinking about innovation is something you do from your own personal time*" (Interview 17, Manager, Consulting).

Moreover, not all types of knowledge are easily shared, depending on issues such as confidentiality or the nature of knowledge. It seams evident that confidential information will find high difficulties to be mobilized (Bouty, 2000). However, regarding this topic, Bouty (2000) states that personal judgments can differ between individuals regarding confidentiality appreciation and, in fact, "*certain 'secrets' can be common knowledge in a community, although they officially are confidential*" (p. 54). Additionally, inter-organizational and interpersonal competition is negatively associated to the likelihood of exchanging a wide rang of resources, and the exchange of such resources in a situation of competition will depend on how strategic the knowledge is considered. Reagans and McEvily (2003) highlight that the influence of competition on knowledge transfer happens in two directions: 1) intense competition between different units restricts the transfer of knowledge between them; and 2) knowledge transfer can increase the competition between the source and the recipient because, as they share their knowledge, the two individuals become more redundant inside the organization.

Besides, knowledge is often sticky and context-specific (e.g. in synthetic and symbolic knowledge) and, hence, transferring it represents a cost to the sources of knowledge in terms of time and effort helping others to understand (Reagans and McEvily, 2003), as its meaning and interpretation could vary substantially by location and among organizational boundaries. In this sense, organizational silos have been accused of hindering the exchange and mobilization of knowledge (Allen et al., 2007), as they diminish relational proximity, increase cognitive distance, and increase complexity of interactions. Some of these effects of silos can be illustrated with examples from the interviews at Alpha:

> *"In many areas people continue working as isolated groups and do not share information"* (Interview 8, Senior Manager, Consulting)

However, the effects of projects that span organizational boundaries and involve members of multiple communities are ambivalent (Scarbrough and Swan, 2008). On the one hand, organizational divisions create significant opportunities for new learning within projects as members of different practices work together to overcome their differences in the accomplishment of tasks but, at the same time, increased cognitive distance may also constrain learning making it difficult to assimilate lessons. In order to support the joint production and sharing of knowledge and to overcome the frictions of geographical separation and reduce cognitive distance, multinational companies rely on things such as cultural and experiential commonality, corporate organization and practices, ICTs supporting virtual interaction, and travel to support face-to-face meetings (Gertler, 2008).

In fact, collaboration and social production of knowledge can be facilitated through different mediums (Cross et al., 2006) and moments of collective creativity more often sprout of hallway conversations and other informal ad hoc interactions (Hargadon and Bechky, 2006). Consequently, rather than forcing collective creativity moments, it is important for companies to create the environment in which these will sprout informally and spontaneously. In this context, corporate culture works as an important facilitator, mainly if it promotes collaboration and Gertler (2008) states that "*if corporate cultures are strong enough to pervade the overseas branches of the global firm, two people working for the same firm in different countries may still enjoy a significant degree of social affinity with one another, to the extent that they are able to work collaboratively in the joint production and exchange of knowledge*" (p.211).

In addition, Hargadon and Bechky (2006) describe the importance of reinforcing behaviors, both coming from: a) individual positive experiences with past collective creativity moments, and b) organizational shared values and beliefs that support help seeking, help giving and reflective reframing, for example by creating awareness of the importance of this processes, offering rewards and credit etc. Henard and McFadyen (2008) also recognize that some employees need incentives to engage themselves in knowledge sharing, as this activity falls beyond their functional responsibilities.

Table 2 offers an overview of all the issues tackled in this sub-section.

Although the described barriers and incentives for knowledge sharing and creation between individuals are important, Duguid (2008) states that "*if we want to understand individuals' capacities and motives for sharing knowledge, we need to look not just at the knowledge, but at the communities in which their knowing-how was shaped*" (p.80). Moreover, knowledge is often not held by a single individual, but rather distributed across a collective and their shared artifacts. Hence, it is also important to consider the flow of practice and mobilization of knowledge within organizational communities.

Table 2: Knowledge mobilization through personal ties

Topics	Personal ties
Knowledge mobilization	Social production of knowledge (Faulconbridge, 2006)
Main literature and debates	Importance of informal structures and social ties versus formal structures (e.g. Burt, 1992; Mors, 2010) and of relational proximity versus geographical proximity (Amin and Cohendet 2003).
Benefits	Allows for interaction and reflective reframing, provides opportunities for new learning, and access to diverse knowledge.
Limitations	Requires trust and cognitive proximity, and high investments of time for building and maintaining the networks and for looking for knowledge.
Incentives for use	Corporate culture, reinforcing behaviors and mechanisms to build trust (e.g. face-to-face encounters)
Barriers for use	Confidentiality, interpersonal and inter-organizational competition, silos, accounting of time

Own elaboration.

2.2.3 Social production of knowledge: communities

Although personal ties are important for knowledge circulation within organizations, these types of interactions alone do not explain the development of organizational knowledge over time, and there is a need to analyze the cumulative effects of individual and group learning (Amin and Cohendet, 2000). In the 90s, Lave and Wenger (1991) introduced the concept of Communities of Practice (CoPs) that emerged as a theory of learning, to define a dynamic system of relationships between people, activities, and the world, in which learning was not the process of replicating what others think. Rather, learning involved deploying available cognitive, material and social resources, through practice, to participate in society (Duguid, 2008).

From the organizational point of view, CoPs group together workers with common interests to collaborate and share their knowledge and experiences, either physically or by making use of information technologies (Allen et al. 2007). In this sense, Amin and Cohendet (2000) state that "*every organization is made up of many communities of practice in which learning is not a matter of conscious design or recognizable rationalities and cognitive frames, but a matter of new meanings and emergent structures arising out of common enterprise, experience and sociability – learning in doing*". Wenger (1998, 2000) argued that three factors of CoPs could be considered as key sources of organizational learning: 1) Mutual engagement, through the encouragement of joint activity and sustained relationships; 2) Joint enterprise, based on a shared sense of place, purpose and identity; and 3) Shared repertoire (e.g. shared stories, tools and artifacts, inside jokes) that enable the reconciliation of differences (Amin and Roberts, 2008).

One of the most important controversies regarding CoPs has been related to the application of the concept by some authors. For example, in the prologue to the book by Amin and Roberts (2008) called "Community of Practice then and now", Duiguid criticizes the simplistic readings that see CoPs as something that can be created and replicated successfully from one place to another and doubts about the usefulness of the concept as a management tool. Similarly, Allen et al. (2007) find support for the claims in research on knowledge networks about the lack of managerial understanding of how best to use informal networks within organizations.

Duguid (2008) argues that, as a result of joint endeavor and engagement with others in a common project, CoPs can increase the "ethical commitments" of employees and their willingness to contribute and share knowledge rising above self-interest, that is, even in those cases when personal incentives are negligible, and there is no expectation of future rewards. In fact, many organizations have promoted the creation of CoPs to improve knowledge sharing (Abrams et al., 2003).

However, literature about CoPs makes a distinction between people's willingness and their ability to share knowledge. In this sense, there are two important problems or barriers that inhibit knowledge mobilization within and among communities. First of all, in order to be able to productively share knowledge within a CoP, individuals need to become knowledgeable[7] partners and engage in shared practices (Duguid, 2008). In other words, if an individual wants to access the knowledge of a community then he/she needs to participate and contribute to it, anticipating to his/her future needs, becoming "insiders". Second of all, Duguid (2008) emphasizes that when the practices and knowing how of two communities are different, productively sharing knowledge becomes more challenging and epistemic barriers emerge, which cannot be solved through codification. Nevertheless, this second problem is at the same time diminished by the interaction between communities and projects within an organization.

In project-based organizations, learning from past projects is extremely important for the success of new projects, organizational learning and innovation. However, as it has been already mentioned, even though organizations make important efforts to capture lessons learned from projects these efforts have often limited success. In this sense, Scarbrough and Swan (2008) make an important distinction between the "learning within project teams" and "learning from projects to the wider organization". In order to convert the lessons learned from projects into reusable explicit knowledge, many organizations introduce bureaucratic forms of control and other incentives that promote codification. However, we have seen that codified sources have some problems and barriers that disincentive their use and, hence, their effect regarding learning from projects to the wider organization is often limited. Because of this reason,

[7] (Lave, 2008: 292) says that "*to speak of "knowledgeability" rather than "knowledge" implies that whatever it is, knowledge is always knowledge in persons in practice*".

regarding the spreading of lessons learned within the organization, CoPs play an important role.

Scarbrough and Swan (2008) highlight that projects typically lack the community-building effects, as they are entities that generally involve highly time-bound social interaction, discrete forms of non-repeated activity, formal objectives, and one-off tasks. In this sense, Cohendet and Simon (2008) emphasize that individuals within knowledge intensive firms have a dual identity, as they are at the same time members of a given project and members of a given community. Hence, as members of different communities interact within a project, they bring the knowledge and practices gained from their own community. Additionally, when each member of the project turns to their own communities they will also bring the knowledge gained in the projects that entail practices from other communities. In other words, moving from one to the other they carry a bit of each as they go around (Wenger, 2000).

As a consequence, the cognitive distance between these communities is reduced step-by-step and, as new ideas are continuously introduced, the potential for innovation and creativity increases. In this sense, Mors (2010) arguments that actors that are members of the same community are exposed to the same ideas and knowledge and that they will benefit from open networks that connect into different knowledge domains.

Besides increasing potential for innovation, Abrams et al. (2003) state that CoPs promote efficiency, as they help avoiding re-creation of work already done in distant part of the organization, and also improve quality and innovation by enabling the firm to bring its best expertise to bear. Additionally, Reagans and McEvily (2003) say that networks that span multiple CoPs can help their member conveying complex ideas to diverse audiences. Hence, it is in the daily practice of interaction between individuals and their environment that learning and innovation occur, as these interactions allow finding a balance between replication of lessons learned (i.e. path dependency) and introduction of new ideas that allow diversity and organizational renewal (Amin and Cohendet, 2000).

Amin and Cohendet (2000) highlight that management by design of learning in distributed communities is not sufficient and that the real challenge for organizations to leverage knowledge in these cases is the creation of a shared context and common purpose that enables the emergence of learning and innovation as the product of daily practices. In other words, they describe the need to create a "soft infrastructure for learning".

Regarding individual barriers for the "use" of communities as knowledge sources, we have already highlighted that, in order to be able to participate in the CoP and share the knowledge available in the community, individuals need to gain recognition (Duguid, 2008) or, in other words, "*learning essentially involves becoming an insider*" (Cillo, 2005: 406).

Table 3 summarizes the benefits and limitations that the mobilization of knowledge through communities provide and the different incentives and barriers that foster and limit their use.

Table 3: Knowledge mobilization through communities

Topics	Communities
Knowledge mobilization	Social production of knowledge (Faulconbridge, 2006)
Main literature and debates	Communities of Practice (Amin and Cohendet, 2000; Wenger, 2000) and simplistic readings of the concept as a replicable managerial tool (Amin and Roberts, 2008).
Benefits	Promote organizational learning through the creation of mutual engagement, joint enterprise, and shared repertoires. Can increase willingness to contribute and share knowledge above self-interest. They contribute to the spreading lessons learned within the organization (learning from projects to the wider organization) and spreading knowledge. Increase the diversity of knowledge and, hence, the potential for innovation and creativity. Promote efficiency by avoiding re-creation.
Limitations	When practices of two communities are different, sharing knowledge is challenging (epistemic barriers).
Incentives for use	Creation of a shared context and common values and purposes. Culture of proactivity and participation
Barriers for use	To mobilize knowledge within CoPs individuals need to become knowledgeable partners, that is, the ability to share knowledge depends on membership.

Own elaboration.

Summarizing, we may say that the mobilization of knowledge through any of the analyzed sources brings many benefits but, at the same time, their use also has some limitations that may be solved by complementing and balancing the use of the different sources. Moreover, in order to overcome the challenges that the use of each knowledge source poses, organizations need to create incentives and manage the barriers that may hinder their effective use.

When facing problems in their day-to-day work, individuals need to take many decisions related to the mobilization of knowledge, for example about where to look for the needed knowledge, how much time to invest into searching for knowledge or contributing with it, which type of knowledge to shared and which not, etc. In fact, as the mobilization of knowledge is very time-consuming, finding the right balance between the mobilization of knowledge that fosters innovation and accomplishing the objectives and deadlines of the day-to-day work is a difficult task. Because employees in KIBS take these decisions on a daily basis, it is necessary to analyze these issues at the individual level.

2.3. Knowledge at the individual level: Knowledge brokers

Larsen (2001) suggest that internal driving forces of KIBS' creativity and innovation are closely related to their "distributed knowledge base", which is intrinsically linked to the knowledge of their employees. This means that "*the knowledge of the company is situated in many different places and no single actor could possibly know of it all*" (Larsen 2001: 84). As the following quote illustrates, this is exactly what we have found out in our exploratory analysis, that not all Alpha's employees know of all available knowledge resources and that many of them lack a global overview:

> *"There are many web sites, but people know a 60% of what we have available"* (Interview 7, Consultant, Consulting)

Hence, we could say that this is not an isolate case. As a consequence of this generalizable situation, Muller et al. (2009) consider that the individual level (i.e. consultants) plays a crucial role, although this has been "*so far totally neglected in the investigations related to KIBS and innovation*" (p.3). These authors wonder *who* is primarily adding value within KIBS and point at "knowledge brokers", that is, individuals that link different knowledge sources by mediating between supply and demand, as the key actors.

The key role played by knowledge brokers in organizations and networks, as conduits of information and knowledge, has been long acknowledged in the literature. However, these key actors have adopted many different names, namely boundary spanners (Tushman and Scanlon, 1981), gatekeepers (Allen 1977), knowledge angels (Muller et al. 2009), etc. In fact, these knowledge brokers form the bedrock of Burt's network theory of structural holes, which argues that brokers bridging otherwise disconnected parties add value by making parties aware of each other's interests and difficulties, transferring best practices, drawing analogies between groups, or identifying new behaviors by synthesizing elements from multiple parties (Burt 2004: 355). Similarly, according Muller et al. (2009), knowledge brokers: a) act as intermediaries between units or parties previously unrelated, b) diffuse existing knowledge in new contexts, as a consequence of their "in between" position, and c) bridge different communities by translating and adapting knowledge from a context to another.

Knowledge brokers may exploit their position in external networks (e.g. clients) to access external knowledge and solutions from different industries and translate it to their organizational memory (Hargadon and Sutton, 1997), or may transfer and integrate knowledge among groups at the firm's level (Cillo, 2005). In this sense, we can connect the role of knowledge brokers to the concept of Communities of Practice developed in the previous section, as knowledge brokers act as intermediaries among these communities transferring and translating knowledge from one to the other (Cillo, 2005). However, successfully transferring and translating knowledge between communities is a difficult task, as the knowledge broker needs to be able to access the necessary resources and

bridge distant cognitive and cultural distances[8]. Additionally, we can expect individuals not to transfer only the knowledge available in their community, but also the knowledge they have gained by accessing and using the knowledge management systems and the personal ties described in the previous section.

Besides, knowledge brokers need to be capable of articulating problems and conceiving appropriate solution (Dobbins et al. 2009). As a consequence, Muller et al. (2013) highlight some necessary preconditions that individuals need to fulfill in order to be a knowledge broker: to have a profound anchorage in the company, to have good social and communicative skills, and to be acquainted, recognized and trusted among colleagues in order to be able to bridge cognitive distances.

Moreover, for the knowledge transfer to be successful and create value, Leonardi and Bailey (2013) defend that knowledge brokers need to be able of recognizing "good ideas" and "selling" them. In order to *recognize a "good" idea* worth passing along, individuals need to have the experience that allows them to determine which is the idea or knowledge that provides greater value. These authors emphasize that the literature has provided two non mutually exclusive possibilities for how brokers do this judgment: 1) they presume that all ideas are potentially good if used in the right situation, so they do not reject any outright (Hargadon and Sutton, 1997), and 2) they evaluate which among the available ideas is the best, which ideas are bad in a specific context, and which are bad no matter what the context (Burt, 2004).

However, the two possibilities highlighted in the literature have some unresolved issues: the first does not clarify how accumulated ideas are abstracted from their context in order to be applied to a new one, and the second does not clarify how ambiguity about the judgment of the best idea is confronted. Leonardi and Bailey (2013) state that most studies provide no details of how brokers recognize value and, instead, tend to make general statements, for example implying that senior managers employ their expertise to make evaluations (Burt, 2004). The analysis of the music industry done by Lingo and O'Mahony (2010) is an exception to this general trend, as they analyze how producers apply diverse techniques to diminish the ambiguities related to the selection of the songs to be included in a new album, by mixing *tertius iunges* (i.e. connecting the different parties to build trust and asking them for their opinions about which songs are best) and *tertius gaudens* (i.e. keeping people apart when necessary to avoid unnecessary uncertainty and confrontation) techniques.

In order to be able to *"sell" an idea* to an individual adopter (e.g. a client) or to an internal distant community, knowledge brokers need to mobilize support, as good ideas rarely simply sell themselves (Leonardi and Bailey, 2013). For

[8] In this sense, Cillo (2005) proposes a taxonomy of internal brokers depending on the type of knowledge mobilized (i.e. codified versus un-codified, and simple versus complex), the cognitive distance between groups, the core competence in brokering (i.e. access, recombination, knowledge codification, and transfer), and the type of interaction (sporadic or continuous).

example, in Chapter 3 we saw a good example of the need to mobilize support from company partners, or as we call them "downstream partners", in order to find a market for the new services coming from the R&D and innovation units. Such mobilization of support often comes from the individual's vantage position in the network and from his/her reputation, as recipients of knowledge often perceive this unique position as an indicator of idea quality (Nerkar and Paruchuri, 2005).

Additionally, brokers often need to have persuasion and negotiation skills to be able to convince recipients of the worth of an idea (Zott and Huy, 2007). For example, in the context of innovation, Howell and Higgins (1990) state that good ideas require champions for their implementation and found that effective champions use many techniques to sell their ideas to decision-makers, such as informal chats in the way to meetings or real time tailoring of arguments to adjust to decision-makers' reactions. However, these persuasion and negotiation skills are often linked also to the individual's position in the company's network, to reputation and to formal and informal recognition. In fact, Alvesson (2001) defends that, in the real day-to-day work of at least some KIBS, theoretical knowledge plays a marginal role if compared to the "dependence on significant others for validation". Although applied to the relationships between knowledge intensive companies and their clients, he states that the ambiguity related to knowledge quality makes the relational character of knowledge more significant and, in this context, image (i.e. being perceived as having links with "important" people), rhetoric and the orchestration of social relations becomes crucial.

Besides, a specific type of knowledge brokerage has been analyzed in the literature: knowledge brokers that act as diffusors of innovation within organizations and as determinants of organizational innovativeness, namely "innovation champions". In this sense, Coakes and Smith (2007) state that the primary role of innovation champions in promoting innovation is embodied in Rogers' (1995) diffusion theory (see Chapter 3), as they play key roles mainly in terms of learning about the existence of an innovation and in terms of persuading colleagues about the innovation. For example, in the context of the adoption of technological innovations within a company, Purvis et al. (2001: 123) defines "management championship" as the "*extent to which an organization's senior management advocates the use of a technological innovation*", be it through expressed mandates, rewards systems and other incentives, or through symbols that signal their commitment to the technology. In fact, these authors recognize that senior management support within an organization is a key determinant of innovativeness.

With the objective of identifying knowledge brokers or individuals with a central position in the organizational informal network, social network analysis has provided important insights in this topic, for example referring to the type of ties that these individuals develop and that provide them with a position that is especially ideal for accessing a variety of good ideas and for "selling" them to the adopters. In this sense, some research has questioned the centrality of senior managers in informal networks (Allen et al., 2007). However, looking at the

characteristics that a knowledge broker must have in order to be able of articulating problems and conceiving appropriate solution (i.e. profound anchorage in the company, developed social network, social and communicative skills, acquaintance and recognition, experience and expertise, ability to mobilize support, persuasion and negotiation skills, image etc.) we could expect these characteristics to be highly correlated with seniority and a relatively high position in the company.

Before describing the methodology we have applied for answering to the objectives of this chapter, we consider it necessary to draw a bit of attention to some gaps found in the literature review regarding a lack of linkages between the different threads of research. In this regard we have detected very few linkages between: 1) the literature analysing the mobilization of different knowledge sources, that is, literature devoted to KM systems, personal ties and communities of practices (Hansen et al. 2005); and 2) the literature devoted to knowledge brokers and the literature devoted to the mobilization of different types of knowledge sources[9].

3. Methodology

In order to answer to our objectives we have analyzed the individual participation on knowledge mobilization of consultants at Alpha, distinguishing between the two dimensions analyzed in the literature of knowledge brokerage: the access of knowledge, related to the detection of "good" ideas, and the contribution of knowledge to the base of the company, related to translation of knowledge from a community to another and to the "selling" of ideas to potential adopters. Trying to cover some of the gaps detected in the literature, we have analyzed the mobilization of the different types of internal knowledge sources available in the company and we have adopted as integrative framework the theory on knowledge brokers, hence linking the different threads of research.

The following paragraphs are devoted to the description of the methodology we have applied to answer to our research questions. First we display the specific hypothesis, then we describe the data gathering process and the design of the survey instrument, and finally we describe the data analysis and the used quantitative methods.

3.1. Development of hypotheses

In the preliminary analysis described in Chapter 1, interviewees provided extensive descriptions of Alpha's knowledge sources, clarifying the distinct types

[9] Most literature on knowledge brokerage analyzes the role of knowledge brokers in the diffusion of knowledge through personal ties or in diffusion between communities (e.g. Obstfeld, 2005; Coakes and Smith, 2007).

of knowledge embedded in each of them and acknowledging that, sometimes, information is duplicated making access difficult and confusing. Hence, before getting into the core objectives of this Chapter we considered important to clear this point testing the following preliminary hypothesis.

Preliminary hypothesis: Different types of knowledge are stored in different knowledge sources.

As we have seen in the literature, many scholars have acknowledged the importance of "knowledge brokers" for knowledge circulation in organizations and have analyzed the characteristics that identify such individuals. However, in relation to the "unique" position that an individual holds in a network, linking distant knowledge spheres or "bridging structural holes", Burt (2004) makes an interesting remark when saying that "*structural holes and brokerage can be found in almost any task, depending on point of view*" (p.354). For example, in our case study company almost every employee could be considered a knowledge broker linking different projects, areas, industries, clients, communities, countries etc. In fact, if we look at the different professional categories, we can see that managers act as brokers between employees working with clients in their day-to-day work (i.e. the lower categories of the company: analysts and consultants) and the higher hierarchical levels, transferring information and knowledge related to the specific projects that they manage to senior managers in charge of many different projects within an industry. Senior managers, on the other hand, work as brokers between different areas of the company and as intermediaries with the higher levels at client companies. Finally, company partners are brokers between the different countries of the company, between the company and big client accounts etc. The lower levels of the company, on the contrary, have fewer opportunities to be knowledge brokers, as they have generally had less chances of building an image and reputation, and the necessary social network to mobilize support for selling their good ideas.

As a consequence, rather than focusing on individual characteristics of the respondents that can identify them as knowledge brokers (e.g. image or charisma), we believe that, in Alpha, the professional category (i.e. seniority) is the main variable linked to knowledge brokerage and hence to knowledge mobilization patterns. We hypothesize that: (In KIBS) a key person (or "knowledge broker") is not just someone with a specialized knowledge (as every employee in the company has a superior degree), but rather someone with this specialized knowledge, with experience in the company, and with internal authority and autonomy. In other words, we hypothesize that "knowledge brokers" are mainly seniors. Hence, we define a wide and impersonal profile of "knowledge broker", without conducting a social network analysis in which specific people are named as sources or recipients of knowledge.

Both for access and contribution of knowledge, we have followed a criteria similar to the one applied by Hansen and Lovas (2004), as our primary concern is not whether consultants decide to acquire/contribute new knowledge or competences but, to the extent that they do, where (through which sources) they are likely to do it within the company.

Regarding the ***access to knowledge***, however, the influence of seniority may vary from a source to source. For example, as the use of personal ties is pervasive and generalized to all categories of employees, we could expect seniority to have less influence on access to these sources. Something similar may happen with access to sources that include knowledge of the day-to-day work, be it general or specialized knowledge, which is normally not disruptive but rather incremental. On the contrary, we can expect seniority to have greater influence on the probability of accessing sources containing more disruptive or radical knowledge, as this type of knowledge may be more strategic and confidential and, hence, not all employees will have the possibility of exchanging it (Bouty, 2000). Similarly, seniority can be expected to have greater influence on access to communities, as we have seen that becoming a knowledgeable partner is important for this purpose (Duguid, 2008). Hence hypothesis 1 reads as follows:

Hypothesis$_1$: Seniority directly influences knowledge access.

Moreover, we believe tenure (i.e. the number of years that an individual has been working in the company) to have influence knowledge access patterns. Maurer et al. (2011) defend that building a social network (i.e. social capital) implies that actors have to invest time and effort for generating, growing, and sustaining social relationships. However, while stating that most skills of consultants are learned on the job, Haas and Hansen (2005) argue that less skilled teams may seek more knowledge and be affected by greater search costs than more skilled teams with greater absorptive capacity. Consequently, we pose the following hypotheses:

Hypothesis$_2$: Length of tenure inversely influences knowledge access.

We have seen in the literature that the perception of the existence of barriers in the company may hinder innovative behaviors. For example, Maurer et al. (2011) defends that knowledge holders will be reluctant to share their knowledge if they perceive that, by holding it, they benefit from internal competition and further individual career prospects. Similarly, perceptions about the existence of silos, conflicting messages (e.g. giving more importance to the bureaucratic charging of times than to time for knowledge sharing) or strong hierarchic barriers may restrain the circulation of knowledge and the social production of knowledge[10]. We pose the third hypothesis as follows:

Hypothesis$_3$: Perceptions about the existence of barriers that hinder knowledge access inversely influence knowledge access.

> H_{3a}: Perceptions about the existence of a *competitive evaluation* model that hinders access to particular information inversely influence knowledge access.

[10] The effects of these issues on knowledge circulation could have been analyzed from the contribution perspective instead of from the access. However, we believed that respondents to our survey would be more willing to answer about the difficulties they found to access knowledge rather than about the barriers they created for providing knowledge. Either way, we believe that results about the influence of the perceptions about barriers in the circulation of knowledge would have been similar but, with this choice, we believe they are less biased.

H_{3b}: Perceptions about the existence of difficulties for accessing the knowledge of a colleague if he/she cannot *charge* his/her time inversely influence knowledge access.

H_{3c}: Perceptions about the existence of *silos* or company divisions that hinder personal relationships inversely influence knowledge access.

H_{3d}: Perceptions about the existence of difficulties for accessing the knowledge of colleagues from higher categories or *hierarchy* inversely influence knowledge access.

Finally, we have seen that corporate culture is an important facilitator of social production of knowledge, mainly if the culture promotes collaboration and Gertler (2008). Hence hypothesis 4 reads as follows:

Hypotheis$_4$: Perceptions about the existence of a collaboration culture that makes access of knowledge easier directly influences knowledge access.

Looking now to ***contributions of knowledge***, and as it happens for access, the literature has highlighted that seniority is a factor influencing experience and know-how and, as a consequence, it is also probably related to the patterns of contribution. In fact, Burt's (2004) results show that people holding more senior ranks were more likely to act on their ideas. Hence, hypothesis 5 is the following:

Hypothesis$_5$: Seniority directly influences knowledge contribution.

Besides, we have seen in the literature review that, in homogeneous context such as a firm, the main challenge for innovation is to access diverse information and knowledge (Mors, 2010) and that the more variety of knowledge you access the more chances you have of contributing with new ideas (as these are new combinations of knowledge). Consequently, we pose hypothesis 6 as follows:

Hypothesis$_6$: Accessed knowledge sources directly influence contribution.

We have also seen how important reputation and recognition are for being internally considered knowledgeable individuals and to be internally validated, so that an individual's ideas are properly "sold". We could expect formal evaluations to be an indicator of such recognition and, as a consequence, individuals with a superior evaluation will have a better image and may be able to sell their knowledge better. In this sense, we hypothesize that:

Hypothesis$_7$: Obtaining a superior evaluation positively influences contribution.

In addition, literature has emphasized how important reinforcing behaviors (Hargadon and Bechky, 2006), such as perceived organizational support (Ramus, 2001), are for creativity and innovation. Hence, hypothesis 8 reads as follows:

Hypothesis$_8$: Perception of support from superiors positively influences contribution.

Finally, and similarly to what we have discussed for access, the creation of a reputed image is important for selling one's ideas, and this is linked to the building of trust and recognition. The building of trust and reputation needs of time, as time influences on two important issues related to reputation: 1) the gaining of sufficient experience and know-how, that is, the technical knowledge

necessary to be able to contribute with relevant knowledge to the company (Abrams et al., 2003), obtained mainly on the job (Haas and Hansen, 2005), and 2) the creation of recurrent exchanges (Bouty, 2000) and the social network necessary to gain credibility (Fleck, 1997), to be internally validated and to gain the image necessary to be influential (Alvesson, 2001). As a consequence, we expect tenure to be positively related to knowledge contribution.

Hypothesis$_9$: Length of tenure positively influences contribution.

3.2. Data gathering

Following the example of research in knowledge sharing (e.g. Hansen et al., 2005; Tsai, 2001; Haas and Hansen, 2005), we have designed an original survey instrument for finding the answers to our questions and hypotheses.

3.2.1 Design of the survey

The survey instrument (Appendix 3) has been divided into 4 sections: a section for the collection of demographic information and 3 main sections for questions regarding our research topic.

After presenting the objectives of the study, respondents have been asked to provide some demographic information regarding the area of the company for which they work, their professional category, their age, the number of years they have been working in the company, their sex, whether they telework or not, and their last performance evaluation. Information about age, sex and evaluation were voluntarily provided.

Besides the part devoted to demographic information, the survey has been divided into 3 different sections. The first part analyzes the patterns of access to different categories of knowledge through the various available sources, the reasons not to use a specific knowledge source, and the time devoted to accessing knowledge weekly. The second part of the questionnaire focuses on personal relationships as sources of knowledge, analyzing what factors are important for trusting a colleague's knowledge, the channels used for communicating, and the perceptions about the existence of barriers and incentives for accessing knowledge. Finally, the third part is devoted to the patterns of knowledge contribution, analyzing how frequently consultants use a source or the other for contribution, time invested in contribution, and the perception of barriers and incentives for contributing with knowledge.

Most questions in our survey were designed to have a closed answer: a 4 level Likert scale was used in most questions (i.e. those asking about frequencies of use of knowledge sources, about the level of agreement with the existence of barriers and incentives, or about the importance of some motivational issues) in

order to prevent respondents choosing the option in the middle avoiding positioning themselves.

Before launching the questionnaire, the survey instrument was tested with 5 employees of the company, which had participated in the interviews in the preliminary analysis, for clarity of the questions and to estimate the time needed to answer it. The declared average time needed to answer was 20 minutes.

The questionnaire has been sent to a total of 5.998 employees, which represent around the 60% of the employees of Alpha's Spanish subsidiary. We received a total of 637 complete questionnaires, following a distribution of categories and areas that is representative both of the sample and of the total population, obtaining a response rate of 10,6%, which represents the 6,3% of the total employees of the Spanish subsidiary. Table 4 shows the distribution of our valid responses.

Table 4: Sample (% of respondents in each categories and areas)

	Consulting	**Solutions**	**Services**	**Enterprise**	**Total**
Analyst	7,1	23,5	20,6	1,7	52,9
Consultant	8,2	14,2	5,9	1,9	30,2
Manager	5,2	1,2	1,6	0,8	8,8
Senior Manager	3,3	0,5	1,3	0,6	5,6
Senior Executive	1,7	0,2	0,4	0,1	2,4
Total	25,5	39,6	29,7	5,1	100,0

3.2.2 Operationalization of the theoretical framework

In order to avoid confusion among respondents when answering the survey we have decided to focus on the type of knowledge they mobilize to answer to the problems they face in their work, rather than on the type of innovation that might be generated as a consequence of knowledge mobilization as, in addition, in services it is often difficult to separate product and process innovation and radical and incremental innovation (Hipp and Grupp, 2005). Moreover, in this Chapter we have argued that different types of problems require different categories of knowledge and described some of the many classifications of knowledge found in the literature. But distinguishing between all these different categories of knowledge is not always easy either, as these are often intertwined and mixed in a complex continuum (Hall and Andriani, 2003). As a consequence, the survey has asked about the main categories of knowledge that a consultant can look for when facing a problem in the own terminology of the company. The selection of the different categories has been based on the literature, contrasted with the interviews, and discussed with the company before launching the survey. The 4 final categories have been: knowledge about the client, knowledge about the industry, specialized knowledge (e.g. about finance, law, a technology), and knowledge about the internal methodologies and

credentials of the company [11]. Additionally, the analysis of knowledge contribution has included a fifth category of knowledge, which refers to knowledge about innovation or the contribution of innovative ideas. Table 5 shows the selected knowledge categories and their correspondence with the classifications found in the literature.

Table 5: Knowledge categories

Knowledge categories (survey)	Examples	Tacit elements	Classifications from the literature	
			Gertler (2008)	Fleck (1997)
Client knowledge	Past experiences and projects with a client, peculiarities, contacts, …		Synthetic knowledge	Contingent
Industry knowledge	Consumption habits, relevant technologies, market and competence, regulatory issues…		Synthetic knowledge	Contingent
Specialized knowledge	About legal, engineering, financial, marketing…		Analytical knowledge (not only scientific)	Formal and instrumental
Methodology and credentials	Specific processes, such as project development, change management…		Synthetic knowledge	Informal and instrumental
Innovation	Innovative ideas, experiences related to innovation…		Symbolic knowledge	Tacit

Own elaboration.

To select the specific KM systems to be included in the analysis, we have detected the most important tools and methodologies from the interviews, excluding those that are used on a compulsory basis as part of the obligatory procedures of the company. The reason for the exclusion of these bureaucratic forms of codification (e.g. registering of times spent in different activities within projects) is that their use does not provide distinctive information about individual patterns of knowledge mobilization, as every consultant from a same category will be obligated to comply with the same rules and procedures. As a consequence, we believe that the voluntary patterns of use of the sources of knowledge will provide better information about individual decisions of access and contribution[12].

[11] Similar to this distinction, but only applied to the search of codified knowledge for developing project-sales proposals, Haas and Hansen (2005) distinguish between: a) industry and company background analysis, b) qualifications and value statements, c) solution descriptions, and d) proposals overall. Because our analysis did not distinguish between the uses of knowledge for developing sales proposals to bid for client contracts and the carrying out of existing contracts, we divided knowledge about the industry from knowledge about the client background, and grouped qualifications, solutions and proposals within methodology.

[12] For an interesting review on the different influence of voluntary and involuntary work on employees' wellbeing see Cañibano et al. 2012.

For the personal ties, and in order to take into consideration some insights gained from the literature on social network analysis regarding the importance of relational proximity (e.g. Allen et al. 2007), we have included a distinction between: a) supervisors and other colleagues, in order to reflect the importance of formal structures and hierarchy in terms of relational proximity, and b) colleagues from the same area or project and from different areas or projects, in order to reflect the effect of organizational silos in relational proximity. This type of distinction between functional groups has been used in network analysis (e.g. Cross et al. 2006).

Besides, we have detected that some internal departments are important in terms of providing specialized research services and knowledge in different areas, for example regarding marketing, finance, legal etc. Interviews have allowed us to assume that, sometimes, consultants will access directly an internal department to ask for specific help in a topic (e.g. legal help) rather than asking a colleague that is knowledgeable about the topic. In other words, sometimes, it is the formal organization that determines knowledge mobilization rather than the informal relational network. Because of this reason, we have analyzed these departments separately from the rest of knowledge sources. Similarly, and with the objective of exploring the link between the formal R&D and Innovation Infrastructure described in Chapter 3 and the mobilization of knowledge by individuals, we have also analyzed the use of this infrastructure (hereon indistinctively referred as Innovation Network) separately.

Due to the character of our research questions and hypotheses, that query whether seniority significantly influences the possibilities of accessing and contributing to the knowledge base of the company, we have so far focused on the available internal knowledge sources. However, in order to provide some insights in the use of external sources, we have analyzed external sources that include codified knowledge (i.e. the internet: e.g. Google, webpages…) and collective networks (i.e. Social networks). We have excluded the analysis of clients as external knowledge sources for the reasons mentioned in the literature review: 1) customer involvement is relatively less important for project-based firms, 2) it is unlikely that a consultant will be able to rely on the clients to facilitate integration of information, as clients will expect to receive the advice from the consultant rather than assisting him; and 3) much of the information received from clients, and particularly novel information, is confidential and, therefore, consultants will not be able to share it.

As a result, the different knowledge sources included in the survey, through which employees can access and contribute knowledge are 14, encompassing codified knowledge sources, personal ties, communities, specific units of the company, and external sources. Table 6 provides a short description of the 14 different knowledge sources analyzed in our survey and their classification according to section 2 in this Chapter.

Table 6: Analyzed knowledge sources

	Knowledge Source	Description of the source	Type of knowledge source
1	Knowledge Exchange	Global database. Stores all kind of knowledge.	KM tools (codified)
2	SharePoints and internal portals	Created by individuals to share knowledge with a closed group, e.g. for a specific project.	KM tools (codified)
3	Area-specific tools	ICT tools that are specific for an area, e.g. marketing	KM tools (codified)
4	Manuals	Physical or digital manuals about different topics (e.g. use of a tool)	KM tools (codified)
5	Supervisors	Superiors in charge of the project, of the area…	Personal ties
6	Colleagues from same area/project	Knowledge embedded in people working in the same functional division or project	Personal ties
7	Colleagues from other area/project	Knowledge embedded in people in the company that crosses functional divisions	Personal ties
8	Groups and internal communities	Global groups that share interest in specific topics and share knowledge through different means.	Communities
9	Research Department	Department providing internal market research services	Special Units (Internal Departments)
10	Other internal departments	Functional departments of the company, e.g. Legal, Finance, …	Special Units (Internal Departments)
11	Spanish Innovation Program	Specific portal for the Program, tool for bottom-up ideas, creativity school…	Special Units (Innovation Network)
12	Global R&D and Innovation Infrastructure	Technology R&D Units, Strategic Centers, Collaboration R&D centers Network for R&D diffusion…	Special Units (Innovation Network)
13	Internet	Google, webpages…	External
14	Social Networks	Facebook, LinkedIn, Twitter…	External

3.3 Data analysis

This subsection is devoted to the description of the analyzed variables and to the methods applied for the analysis of the survey.

3.3.1 Analyzed variables

Dependent variables

In the literature on knowledge brokers, we have discussed that the selection of what constitutes a "good" idea or valuable knowledge is a process full of ambiguity (Lingo and O'Mahony, 2010) that involves issues of image and rhetoric (Alvesson, 2001). Hence, for the purpose of this research, and similarly to Burt (2004), we have left the features of the quality and novelty of the ideas

aside. Instead, we have adopted the first possibility highlighted by Leonardi and Bailey (2013), in which knowledge brokers presume that all ideas are potentially good if used in the right situation. In other words, as Hargadon and Sutton (1997), we have assumed that all knowledge accessed and contributed by respondents of our survey is potentially valuable.

Knowledge Access, measured as the frequency of access (4-level Likert scale: never, occasionally, frequently, almost always) of the different categories of knowledge through the different knowledge sources, and as the number of hours per week devoted to accessing all types of knowledge through the different sources.

Knowledge Contribution (or individual innovative performance): Following Tsai (2002), whose dependent variable was reported behaviors of intra-firm knowledge sharing, we take reported intra-firm new knowledge contribution instead of performance outcomes as dependent variable. Hence, we have measured *knowledge contribution* as the reported intra-firm contribution of new knowledge and ideas, in terms of the frequency of contribution (4 level likert scale: never, occasionally, frequently, almost always) and the number of hours per week devoted to contribution (from less than 1 to more than 20), through the available different knowledge sources.

Mors (2010) calculates innovative performance of partners in a consultancy company, by combining the two ways in which they are expected to contribute to the firm: a) internally, in terms of new knowledge and ideas that may be helpful to other colleagues, and b) externally, in terms of the ability to create new knowledge and expertise that get them recognized in the market place. In this case, the two dimensions, the internal and the external, are difficult to disentangle. However, the objective of this research is to analyze the patterns of knowledge mobilization of all consultants, and not only of company partners. In this sense, most professional categories are not expected to get personal recognition in the market, and only pursue the internal objective regarding new knowledge contribution. Hence, we are going to focus only in the internal contribution of ideas. Moreover, Mors (2010) found that partners in the firm relied primarily on internal ties to create new knowledge, but on external local ties for revenue generation. Since the objective here is to analyze the creation of new knowledge, it seams reasonable to focus exclusively in the internal contribution of ideas.

Independent variables

Seniority. Respondents have provided demographic information about their hierarchic category in the company (i.e. senior executive, senior manager, manager, consultant, and analyst). The three categories above managers have been considered "seniors" as when employees become managers they gain important autonomy for managing their work and teams. Consultants and analysts have been grouped as "juniors".

Length of tenure. Following Reagans and McEvily (2003), we have measured tenure as the length of time (in years) that the firm has employed an individual.

Perceived barriers, culture and support have been measured in a four-level Likert scale (i.e. completely disagree, partially disagree, partially agree, and completely agree).

Previous evaluation. Respondents have provided information about their last evaluation (i.e. at the very top, significantly above, above, consistent with peer group, and below group), on a voluntary basis. We have converted this variable in a dichotomous variable where 1 includes employees evaluated at the very top and significantly above.

In an initial exploration, we also considered including the company area[13] in which respondents work as independent variables (i.e. consulting, solutions, services and enterprise). However, there is perfect multicolinearity between these variables (respondents have to be from one of the 4 areas) and to our interest in analyzing the general patterns of knowledge access by consultants in all areas (we could not make a satisfactory selection of which area to exclude), we have decided to not consider the company area in this analysis. Supporting this decision, it is interesting to say that Mors (2010) considered the industry of expertise as control variable for analyzing innovation performance, and found that consultants (partners) gained little in terms of innovation performance merely from the industry in which they worked.

3.3.2 Analytic Models

Before getting into our research questions, we conducted an exploratory *descriptive analysis* taking into consideration all the information of our survey, with the following objectives: 1) to confirm that seniority is a relevant variable that significantly influences individual knowledge access and contribution patterns in the company, and 2) to explore the additional factors that affect these patterns among the different issues tackled in the literature and included in the survey. To adjust to the first objective of this exploratory analysis we have initially grouped the different professional categories of the company into 3, distinguishing between: analysts, consultants, and seniors. We have also confirmed the stability of the dataset (robustness) that enables a disaggregate analysis for these categories.

After confirming the relevance of seniority and identifying the additional independent variables for our analysis, we have shaped the models to test out hypotheses. We use Eviews for all estimations in this study.

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[13] Many authors have signaled the area of expertise inside the organization to affect the patterns of mobilization of knowledge for different reasons. For example, Haas and Hansen (2005) emphasize the variation in time pressure among teams, which can affect both patterns of access (e.g. less time for accessing various sources) and of contribution (e.g. less time for codification of lessons learned from projects). Another reason why this is an important variable regarding the patterns of knowledge mobilization is that the degree of common knowledge is based on the areas of expertise (Reagans and McEvily, 2003). Hence, considering the area of expertise allows including issues related with cognitive distance.

After the general descriptive analysis, we have used *contingency tables* (Pearson, 1904) to analyze the frequency distribution of the different variables and the statistical significance of the differences found between seniors and juniors. It is important to emphasize that in the survey we distinguished patterns of access and contribution to the knowledge sources when looking for different categories of knowledge, i.e. knowledge about the client, about the industry, specialized knowledge and knowledge about methodologies (for contributions also contribution of innovative ideas). For this initial exploratory analyses we have not considered differences regarding categories of knowledge, grouping all categories for a given knowledge source. The applied aggrupation procedure has been the following: if a respondent frequently accesses a knowledge source when looking for at least one of the categories of knowledge, we have considered it to access the knowledge source frequently and not frequently in the opposite case.

These results have been also confirmed using the *one-way ANOVA* discriminant analysis (F-test). This method contrasts whether the means obtained in each of the respondent groups, that is, seniors and juniors, differ significantly between groups for each variable, i.e. for the use (access and contribution) of each knowledge source. F-tests have been used in the literature with similar purposes, such as to identify variables that significantly differentiate innovation champions and non-champions (Howell and Higgins, 1990).

However, before elaborating the models for testing how seniority influences access and contribution behaviors, we consider it important to analyze whether we can identify some latent variables behind all the variables (i.e. questions) included in our survey related to access and contribution of the available knowledge sources[14]. In this sense, it is important to consider that we have asked employees of the company to provide information about the use of 14 knowledge sources for accessing and contributing to different categories of knowledge. If we do not cluster all these possibilities, we would need to analyze 126 ungrouped explained variables separately, obtaining not only tedious but probably uninteresting results.

Hence, two *cluster analyses*[15] have been applied to identify latent variables in the patterns of access and contribution respectively and to test whether the appropriate focus for dependent variables was in the category of knowledge mobilized in each case (i.e. client, industry, methodologies, specialized) or in the

[14] Given the varied nature of the questions of the survey and the character of our research questions, we have decided to focus on the patterns of access and contribution exclusively.

[15] Besides the cluster analysis, we have applied a factorial analysis to unveil latent variables in our study. However, and because of the diverse nature of the questions in our survey (e.g. some directed to the analysis of patterns of access and contribution to knowledge sources by analyzing real individual behaviors, but others aiming at understanding more subjective issues, such as personal motivations for contribution or personal perceptions about existing barriers and incentives) we have seen that the factorial analysis provided results that were not easily interpretable. For example, selecting factors with eigenvalues higher than 1 we could only explain the 60% of the variance and that provided at least 19 factors for interpretation. Moreover, results showed that most variables related to perceptions about barriers, incentives etc explained a small proportion of the variance.

type of knowledge source used for mobilization. The objective of the cluster analysis is to unveil fewer latent dependent variables without losing information. This technique has been applied in the literature with many different purposes. For example, Vence and Trigo (2009) show that it has been applied to create taxonomies of innovation patterns in services and, in this line, Corrocher et al. (2009) use it for identifying modes of innovation in KIBS.

Moreover, taking into consideration that our research tries to unveil whether seniority is a variable that determines exclusivity of access and contribution to some knowledge resources, we have decided to exclude from upcoming analysis the differences found in the use of external knowledge sources, as the use of the Internet and Social Networks is equally open to anyone. This decision is supported by the results that show that seniority is inversely correlated with the use of external sources only in one case (contribution to social networks). As a result of all this, we have done the cluster analysis only for the variables regarding access of and contribution to the different *internal* knowledge sources. We have constructed the clusters taking into consideration the correlation between variables (and not between observations), as this type of grouping solves problems of multicolinearity.

The descriptive analysis and the cluster analysis have provided sufficient information to build the analytical models to test our hypotheses. The cluster analysis has provided us with 5 clusters of knowledge sources, depending on the type of knowledge they include: radical knowledge sources, communities, incremental general knowledge sources, incremental specialized knowledge sources, and personal knowledge sources[16]. The latent variables detected in the cluster analysis adjust to the classification of the knowledge sources used in the questionnaire, that was based on the literature review (Table 6) and, hence, support the application of such classification. However, there is one exception: based on the literature we had considered all KM tools within the same type of sources while the cluster analysis has revealed two different groups of tools, i.e. those including specialized knowledge and those including general knowledge (we have named them "incremental sources"). Due to the design of the survey[17] we have not been able to distinguish between the two types of incremental sources and, hence, we have designed the different regression models taking into consideration the following four types of knowledge sources: incremental (i.e. KM tools), personal, communities and radical (i.e. special units).

We have built 2 different models: one for access and a second one for contribution. In Model 1 we have analyzed what variables influence on the access patterns of respondents and tested whether seniority significantly influences knowledge access (i.e. *hypothesis 1 to 4*). ***Model 1*** is expressed as follows:

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[16] Further detail of the cluster analysis and the interpretation of the 5 clusters are found in the section devoted to results.

[17] When asking about the time (number of hours per week) devoted to contribution to each type knowledge sources, and in order to simplify this calculation to respondents, the questionnaire did not distinguish between incremental general and incremental specialized sources.

$$A_X = \beta_0 + \beta_1 \text{Seniority} + \beta_2 \text{Sex} + \beta_3 \text{Tenure} + \beta_4 \text{CompetitiveEvaluation} + \beta_5 \text{Chargeability} + \beta_6 \text{Silos} + \beta_7 \text{Hierarchy} + \beta_8 \text{Culture} + e$$

where A_X is the number of hours per week that the respondent devotes to access knowledge in each cluster of sources; *Seniority* is a dichotomous variable that equals 1 if the respondent is a senior and 0 otherwise; *Sex* is a dichotomous variable that equals 1 if the respondent is a woman and 0 if he is a man; *Tenure* is the neperian logarithm of the number of years that the respondent has been working in the company; *CompetitiveEvaluation*, *Chargeability*, *Silos and Hierarchy* are 4 level scale ordered variables that equal 1 if the respondent does not agree with the existence of the specific barrier that hinders knowledge access and 4 if he/she completely agrees with the existence of the barrier; *Culture* is a 4 level scale ordered variable that equals 1 if the respondent does not agree with the existence of a collaborative culture that promotes knowledge sharing and 4 if he/she completely agrees with its existence; and *e* is the error term. The same expression is replicated for the different dependent variables, for access to the different clusters of knowledge sources (i.e. radical, communities, incremental and personal). Because the dependent variable in Model 1 (A_X) is a nonnegative count variable (i.e. number of hours per week of access that range from less than 1 to more than 20), we have estimated Model 1 using the *Poisson regression model*, as this is a commonly applied model for nonnegative integers that describes events that occur both "randomly and independently" in time (Hausman et al., 1984).

Model 2 analyzes the variables affecting contribution (*hypotheses 5 to 9*) and is expressed as follows:

$$C_X = \beta_0 + \beta_1 \text{Seniority} + \beta_2 A_I + \beta_3 A_P + \beta_4 A_C + \beta_5 A_R + \beta_6 \text{Eval} + \beta_7 \text{Support} + \beta_8 \text{Tenure} + e$$

where C_X is the number of hours per week that the respondent contributes to each type of knowledge sources; *Seniority* is a dichotomous variable that equals 1 if the respondent is a senior and 0 otherwise; A_I, A_P, A_C, and A_R, are the number of hours per week that the respondent devotes to access each cluster of knowledge source; *Eval* is a dichotomous variable that equals 1 if the respondent declares that he/she has been evaluated at the very top or significantly above his/her peer group; *Support* is an ordinal variable of the support that respondents perceive they have from their superiors for contributing with knowledge and ideas to the company; and *Tenure* is the neperian logarithm of the number of years that the respondent has been working in the company (length of tenure); and *e* is the error term. The same expression is replicated for the different dependent variables, for contribution to the different clusters of knowledge sources.

In addition, we have considered the possibility of our contribution variables being biased, as it is reasonable to think that respondents to our survey are those employees that have greater propensity to contribute to knowledge of the company, as they in fact have shown to be more participative and keener to spend part of their time answering to a rather long questionnaire related to knowledge issues. In order to correct for this possible selection bias, we have

applied the two-stage estimation procedure proposed by Heckman (1976). This procedure enabled us specifying an assumed underlying relationship and correcting for it in the estimation, hence allowing to predict the value of the dependent variable that would be observed in absence of the selection bias. As a result of the Heckman two-step procedure we have obtained a ***corrected Model 2*** that includes a correction term ($Lambda_X$) that adjusts the estimates for selection bias:

$$C_X = \beta_0 + \beta_1 Seniority + \beta_2 A_I + \beta_3 A_P + \beta_4 A_C + \beta_5 A_R + \beta_6 Eval + \beta_7 Support + \beta_8 Tenure + Lambda_X + e$$

The same expression is replicated for the different dependent variables, for contribution to the different types of knowledge sources, changing the inverse Mills ratio (Lambda) also accordingly.

Heckman two-step procedure

The Heckman model follows a two-step approach. In the first step, the discrete choice to contribute is estimated using Probit. In other words, we have estimated the probability of observing a positive outcome in our dependent variable (time devoted to contribution), that is, we have estimated the probability of a respondent devoting at least one hour per week to contribution to each type of knowledge sources.

The first equation of the Heckman procedure is expressed as follows:

$$Pr(C^*_I=1) = \beta_0 + \beta_1 Seniority + \beta_2 Age + \beta_3 Sex + e$$

where C^*_I is a dummy variable that equals 1 if the respondent devotes to contribution to incremental knowledge sources at least 1 hour per week and 0 otherwise; *Seniority* is a dichotomous variable that equals 1 if the respondent is a senior and 0 otherwise; *Age* is the neperian logarithm of the respondent age[18]; *Sex* is a dichotomous variable that equals 1 if the respondent is a woman and 0 if he is a man; and *e* is the error term. The same expression is used for the other three dependent variables, each related to the probability of contributing to a different type of source at least one hour per week: C^*_P for personal knowledge sources, C^*_C for communities, and C^*_R for radical knowledge sources.

In the second step, the ultimate equation (i.e. the corrected Model 2 above), we explain knowledge contribution performance and we test our hypotheses. This ultimate equation includes a correction term computed in the first step of the model, which adjusts the estimates for selection bias. The correction term (i.e. the inverse Mills ratio or Lambda) is computed using the estimated parameters (β) from the Probit regressions in the first step. As a consequence, the Heckman model simultaneously estimates the main model (Model 2) while accounting for the likelihood of respondents to contribute with knowledge.

[18] 11 respondents provided no information about their age so, in order to construct valid neperian logarithms, we took into consideration the category of the respondents and considered the average age of seniors (38) for senior respondents and the average age of juniors (32) for junior respondents.

The Heckman model has been recently applied to econometric studies into innovation performance, for example in the analysis of how firm knowledge, industry dynamism and innovation interact in the way they influence firm performance (Thornhill, 2006) or of the impact of different sources of knowledge on innovation performance (Frenz and Ietto-Gillies, 2009). For example, Frenz and Ietto-Gillies (2009) believe that their dependent variable (log of innovative sales per employee) is only observed in innovative enterprises (selection bias) and that, besides, the decision to engage in innovation and the degree of innovation performance are likely to have different explanations. To take account of these issues, they estimate a Heckman selection model.

The dependent variables in Model 2 (C_X) are count variables (i.e. number of hours per week of contribution) and, consequently, they have been estimated using a Poisson's regression model[19].

4. Results

4.1. Descriptive analysis

The preliminary analysis of the data has allowed us to see that not all type of data sources are used with the same frequency by company employees regardless their category. For example, while codified and personal knowledge sources are very frequently used by almost all categories, Communities are much less accessed. In order to provide more valuable insights, we have decided to group the answers related to frequency of access[20] differently for each case. For codified, personal and external knowledge sources we have analyzed the groups of people that make a systematic use of these sources ("almost always"). For the use of communities, internal departments and the innovation network we have analyzed the group of employees that use the sources at least occasionally (excluding those that answered "never"). Additionally, we have also analyzed the frequent use ("almost always" plus "frequently") of Communities and external sources.

4.1.1 General patterns of access and contribution

Based on the insights gained in the literature review and in the results for the interviews, we have studied the patterns of knowledge mobilization in the company focusing on different issues detected in the literature as being relevant. In this sense, we have analyzed the perceptions about the existence of barriers that hinder knowledge mobilization and about motivations and incentives that improve such circulation.

[19] Includes a strong assumption; that the conditional variance of the dependent variable equals its conditional mean.

[20] Likert scale with 4 options: "almost always", "frequently", "ocasionally", "never"

A) Access of knowledge

Where (types of knowledge sources) do employees look for different categories of knowledge?

Results have shown that knowledge embedded in personal ties is by far the more frequently accessed source (it is almost always or frequently used by around 65% of the employees irrespective of their category). Table 7 shows that seniors make a more systematic use of codified and personal knowledge sources than analysts and consultants for looking for any of the categories of knowledge with two exceptions (knowledge about the client and about a specialty). In fact, in most cases the proportion of seniors that systematically use these sources nearly doubles the proportion of analysts that do it. Similarly, while around 60% of analysts and consultants access internal communities at least occasionally to look for knowledge, this proportion increases to more than 80% among seniors. The same important difference is evidenced if we look at employees that frequently use these sources: for all categories of knowledge (with the exception of knowledge about the client, with about 7% less usage) analysts and consultants that frequently use communities are around 20%, while seniors are around 37%.

The internal departments of the company (e.g. legal, marketing, research) are also important sources of knowledge, although the frequency of use of these areas is lower. In this sense, however, differences between analysts, consultants and seniors are very important. Around 40% of analysts and 30% of consultants access internal departments at least occasionally (except looking for knowledge about the client, around 5% less), while more than 60% of seniors do (except looking for methodologies, around 9% less). Interestingly, around 37% of analysts (except client knowledge), 28% of consultants (except industry knowledge) and 40% of seniors (except knowledge on internal methodologies) access the innovation network of the company at least occasionally.

Finally, external sources are systematically used similarly by all categories, between 18-25% (except looking for knowledge about internal methodologies, around 10% less).

In general terms, we can say that, when looking for knowledge, employees of the company access a media of 1,8 sources. We can also say that the frequency of use of the different types of sources depends on what type of knowledge employees are looking for. In this sense, when looking for knowledge about the client, the industry and about a specialty, results are quite similar for the different sources. On the other hand, we can see slight differences when employees look for knowledge about the internal methodologies; as it is evident, in this case, they less frequently use external sources and more frequently internal (more frequent use of codified sources and internal departments).

Table 7: Use of knowledge sources for accessing different categories of knowledge (%)

TYPE OF KNOWLEDGE SOURCE	FREQUENCY OF ACCESS	KNOWLEDGE ABOUT CLIENT				KNOWLEDGE ABOUT INDUSTRY				SPECIALIZED KNOWLEDGE			
		Analyst	Consultant	Senior	Total	Analyst	Consultant	Senior	Total	Analyst	Consultant	Senior	Total
CODIFIED KNOWLEDGE	Systematic	11,97	9,95	9,48	10,83	6,43	6,19	13,10	7,65	12,38	11,89	11,29	12,01
PERSONAL TIES	Systematic	21,82	27,35	37,63	26,69	17,81	21,52	30,91	21,56	18,78	22,98	27,15	21,77
COMMUNITIES	YES	59,61	61,17	84,68	64,99	64,17	60,19	83,87	66,72	63,52	62,62	83,06	67,03
	Frequent	13,68	16,50	29,84	17,74	20,85	19,90	37,90	23,86	22,15	22,82	37,10	25,27
INTERNAL DEPARTMENTS	YES	35,02	26,46	62,50	37,60	40,88	29,85	61,29	41,29	41,86	33,25	64,11	43,41
INNOVATION NETWORK	YES	32,90	28,64	42,74	33,44	37,62	25,24	40,32	34,14	38,11	27,91	41,53	35,48
EXTERNAL SOURCES	Systematic	18,40	19,90	21,37	19,47	20,36	23,06	24,60	22,06	23,45	23,79	21,77	23,23
	Frequent	41,37	44,66	50,40	44,19	41,37	42,48	48,79	43,17	41,21	42,96	44,35	42,39

TYPE OF KNOWLEDGE SOURCE	FREQUENCY OF ACCESS	KNOWLEDGE ABOUT INTERNAL METHODOLOGIES				ALL KNOWLEDGE			
		Analyst	Consultant	Senior	Total	Analyst	Consultant	Senior	Total
CODIFIED KNOWLEDGE	Systematic	9,45	12,50	20,36	12,56	10,06	10,13	13,56	10,76
PERSONAL TIES	Systematic	17,70	20,71	26,61	20,41	19,03	23,14	30,58	22,61
COMMUNITIES	YES	61,24	59,22	80,65	64,36	62,13	60,80	83,06	65,78
	Frequent	19,54	20,39	37,10	23,23	19,06	19,90	35,48	22,53
INTERNAL DEPARTMENTS	YES	41,04	33,01	51,21	40,42	39,70	30,64	59,78	40,68
INNOVATION NETWORK	YES	38,93	29,13	35,08	35,01	36,89	27,73	39,92	34,52
EXTERNAL SOURCES	Systematic	13,52	13,83	8,47	12,64	18,93	20,15	19,05	19,35
	Frequent	28,66	30,34	20,97	27,71	38,15	40,11	41,13	39,36

How much time do employees devote to the access of knowledge through the different sources?

Regarding time devoted to the access of knowledge (of the different categories) through the different sources, we can see important differences between analysts and consultants on the one hand and seniors on the other. Table 8 shows that, seniors that spend more than 20 hours per week to the access of knowledge through codified sources, through communities and through internal departments are more numerous (in the last two cases their proportion almost doubles the proportion of analysts and consultants). Similarly, there are fewer seniors that spend less than 1 hour a week in this activity. On the contrary, analysts spend more time on accessing knowledge embedded in personal ties and the two lower categories dedicate more time to the access through external sources.

These results confirm the analysis of Table 7, mainly regarding the higher use of communities and internal departments (in Table 8 including the innovation network of the company) by seniors, which provides a preliminary answer to our first research question.

Table 8: Time devoted to the access of knowledge (%)

Hours per week devoted to access	Analyst		Consultant		Seniors		Total	
	>20	<1	>20	<1	>20	<1	>20	<1
CODIFIED KNOWLEDGE	8,14	29,32	7,28	35,44	11,29	19,35	8,48	29,36
PERSONAL TIES	22,80	20,85	16,99	22,82	18,55	16,13	20,09	20,57
COMMUNITIES	1,63	53,42	0,97	56,80	3,23	46,77	1,73	53,22
INTERNAL DEPARTMENTS (including innovation network)	2,61	48,21	2,43	62,14	4,03	45,16	2,83	52,12
EXTERNAL SOURCES	16,94	13,68	16,99	18,93	11,29	15,32	15,86	15,70

Which are the principal barriers for using the different knowledge sources?

We have analyzed the main reason why the respondents do not use a specific type of knowledge source for accessing knowledge of the different categories. Table 9 shows that, in general, unawareness of the existence and/or utility of the knowledge sources is the main disincentive (except for the use of external sources that is mistrust, and for the use of personal ties that has not been captured properly by the survey). In this sense, as it is expected because of their longer tenure, seniors are always more aware than the rest of categories of the existence and utility of the sources, which may be an important explanation for their higher use of communities, internal departments and innovation network.

Table 9: Disincentives for accessing knowledge sources (%)

GENERAL	Analyst	Consultant	Seniors	Total
Complexity	8,50	10,20	11,82	9,69
Mistrust	13,24	11,22	13,26	12,59
Unawareness	46,13	43,98	39,94	44,22
Another reason	32,15	34,60	34,96	33,49

When accessing knowledge through personal ties, what characteristics of a colleague are important for trusting his/her knowledge?

Table 10 shows the percentage of employees in each category that consider the different characteristics of a colleague to be very or quite important for trusting his/her knowledge. Results evidence that all the analyzed characteristics are important for a higher proportion of seniors. For example, 41% of consultants consider the professional category of a colleague to be an important indicator for trusting his/her knowledge versus the 56% of seniors.

Table 10: Variables influencing on trust in knowledge of personal ties (%)

Importance given to:	Analyst		Consultant		Seniors		Total	
	Important	*	Important	*	Important	*	Important	*
Professional category	45,28	9,45	41,75	8,74	56,45	10,48	46,31	9,42
Years of experience	86,97	34,20	83,50	32,52	89,52	42,74	86,34	35,32
Official recognition as an expert	71,01	26,06	75,73	29,13	87,10	39,52	75,67	29,67
Non official recognition as an expert	76,87	27,04	84,47	29,61	92,74	44,35	82,42	31,24
Previous professional experience	90,23	41,37	89,81	48,54	92,74	49,19	90,58	45,21

Note: "Important" includes ratings as "very important" (*) and as "quite important".

What perception do employees have about the existence of incentives and barriers for accessing knowledge through personal ties?

We have analyzed whether employees perceive that there exist barriers in the company that have been emphasized in the literature and interviews as hindering collaboration. Specifically we have asked whether: a) company divisions hinder personal relationships (*silos*), b) the evaluation model, based on a competitive banding, hinders access to particular information (*competitive evaluation model*), c) it is difficult to access knowledge of a colleague if he/she cannot charge his/her time (*chargeability*), and d) there are problems to access the knowledge of people from higher categories (*hierarchy*). Table 11 shows the percentage of respondents that totally and quite agree with the existence of these barriers. Regarding incentives, interviews revealed some disagreements regarding the influence of company's collaboration culture on the access of knowledge, although most of them believed this culture made personal relations and access to knowledge easier (*culture*). The survey has confirmed this general belief.

Differences in perceptions between the different professional categories are important. Particularly relevant are the differences in perceptions about the influence of the competitive evaluation model (almost 50% of analyst perceive that it hinders access to particular information versus 27% of seniors) and about the effect of hierarchy on the access of knowledge (40% of analysts agree with saying that there are problems for accessing the knowledge of people from higher categories versus 25% of seniors).

Table 11: Perceived barriers and incentives for accessing knowledge (%)

BARRIERS	Analyst	Consultant	Seniors	Total
Silos	51,47	45,15	50,83	49,14
Competitive evaluation model	48,86	40,78	27,38	42,39
Chargeability	34,53	35,44	34,64	34,69
Hierarchy	40,07	33,01	25,41	35,64
INCENTIVES				
Culture	71,66	72,82	78,37	73,47

When accessing personal ties, are all types of knowledge as easy to access?

Regarding difficulty of access to the analyzed different types of knowledge, it is relevant that between 38 and 48% of respondents believe that it is difficult or very difficult to access knowledge of the different categories. Table 12 shows the percentage of respondents that consider it easy or very easy to access the different categories of knowledge. In this sense, it is interesting to see that methodology and credentials have been signaled as being the most difficult category of knowledge to access, very closely followed by specialized knowledge. It is also relevant to see that seniors systematically believe that knowledge is easier to access than the rest of categories.

Table 12: Easiness of access of knowledge

Categories of Knowledge	Analyst	Consultant	Seniors	Total general
Client	61,24	60,19	69,67	62,32
Industry	59,28	52,91	69,59	58,87
Specific	49,19	52,91	61,12	53,06
Methodology	48,21	53,40	63,24	52,12

B) Contribution of knowledge

Where** (types of knowledge sources) **do employees go when they want to contribute with different categories of knowledge?

A general analysis of results shows that, again, personal ties is by far the most used type of source for contributing with knowledge of any category. Looking deeper into results, Table 13 shows that seniors make more frequent knowledge contributions through personal sources, through communities, and through internal departments.

Table 13: Use of knowledge sources for contributing with different categories of knowledge (%)

TYPE OF KNOWLEDGE SOURCE	FREQUENCY OF ACCESS	KNOWLEDGE ABOUT CLIENT				KNOWLEDGE ABOUT INDUSTRY				SPECIALIZED KNOWLEDGE			
		Analyst	Consultant	Seniors	Total	Analyst	Consultant	Seniors	Total	Analyst	Consultant	Seniors	Total
CODIFIED KNOWLEDGE	Systematic	7,41	4,85	5,44	6,20	5,78	2,67	6,05	4,83	6,84	4,49	4,44	5,61
PERSONAL TIES	Systematic	16,29	23,30	28,49	20,93	11,29	17,48	26,88	16,33	14,98	19,26	26,61	18,63
	YES	51,47	53,88	72,58	56,36	47,56	42,72	67,74	49,92	45,93	46,12	68,55	50,39
COMMUNITIES	Frequent	11,73	17,96	24,19	16,17	13,68	14,08	25,00	16,01	12,70	15,05	24,19	15,70
INTERNAL DEPARTMENTS	YES	26,06	20,63	35,48	26,14	26,22	17,96	32,66	24,80	26,38	19,90	33,06	25,59
INNOVATION NETWORK	YES	22,48	16,50	23,39	20,72	24,27	13,83	25,00	21,04	25,24	16,26	24,19	22,14
	Systematic	3,26	1,94	2,82	2,75	2,44	2,43	1,61	2,28	3,42	1,94	2,02	2,67
EXTERNAL SOURCES	Frequent	12,87	8,25	6,45	10,13	10,75	7,04	5,24	8,48	11,89	8,01	5,65	9,42

TYPE OF KNOWLEDGE SOURCE	FREQUENCY OF ACCESS	KNOWLEDGE ABOUT INTERNAL METHODOLOGIES				ALL KNOWLEDGE			
		Analyst	Consultant	Seniors	Total	Analyst	Consultant	Seniors	Total
CODIFIED KNOWLEDGE	Systematic	4,89	3,03	5,44	4,40	6,23	3,76	5,34	5,26
PERSONAL TIES	Systematic	10,97	15,86	22,85	14,86	13,38	18,97	26,21	17,69
	YES	43,65	42,23	65,32	47,41	47,15	46,24	68,55	51,02
COMMUNITIES	Frequent	11,40	15,05	18,55	13,97	12,38	15,53	22,98	15,46
INTERNAL DEPARTMENTS	YES	25,73	18,69	33,06	24,88	26,10	19,30	33,57	25,35
INNOVATION NETWORK	YES	25,41	15,78	20,16	21,27	24,35	15,59	23,19	21,29
	Systematic	3,09	1,21	1,61	2,20	3,05	1,88	2,02	2,47
EXTERNAL SOURCES	Frequent	9,93	5,34	4,03	7,30	11,36	7,16	5,34	8,83

Interestingly, analysts and seniors appear to contribute similarly through the innovation network of the company (close to 10% more than consultants) and analysts seam to contribute more knowledge about internal methodologies through this channel. Regarding the use of the external sources, seniors that make their contribution to knowledge through this channel frequently are less than analysts and consultants for all categories of knowledge.

In general terms, we can say that, when contributing with their knowledge about the different issues (i.e. client, industry, specialized, methodology), employees of the company use a media of 1,4 sources. We can also say that the frequency of use of the different types of sources depends on what type of knowledge employees are contributing to. All knowledge sources are used slightly more frequently for contributing with knowledge about the client than with knowledge of another category, with one exception: the innovation network is used a bit more frequently for contributing with specialized knowledge.

How much time do employees devote to contribute knowledge through the different sources?

Going deeper into patterns of contribution, Table 14 shows some important differences between categories. First of all, we can see that seniors that spend more than 20 hours per week to contribution of knowledge through codified sources are less than analysts and consultants. Second, regarding personal ties we find little differences. Third, seniors spend considerably more time than analysts and consultants in contribution through communities and internal departments (while less than 1 analyst and consultant among 100 devote more than 20 hours a week to contribute to communities, 5,6 seniors among 100 do it). It is also very relevant to see that, comparing to contribution through codified sources, where contributions are less intensive in time (0,8% devote more than 20 hours a week) but more spread among seniors (45% of seniors devote less than 1 hour a week), contributions through communities and internal departments are more intensive in time (around 5% of seniors devote more than 20 hours a week) but less spread (between 50 and 60% of seniors devote less than 1 hour a week).

Table 14: Time devoted to contribution of knowledge (%)

Hours per week devoted to contribution	Analyst		Consultant		Seniors		Total	
	>20	<1	>20	<1	>20	<1	>20	<1
CODIFIED KNOWLEDGE	5,86	43,97	4,37	52,43	0,81	45,97	4,40	47,10
PERSONAL TIES	22,15	9,45	24,76	9,71	24,19	10,48	23,39	9,73
COMMUNITIES	0,65	59,28	0,97	64,08	5,65	51,61	1,73	59,34
INTERNAL DEPARTMENTS (including innovation network)	1,30	59,28	1,46	73,79	4,84	62,10	2,04	64,52

When providing knowledge, how important are required time, chargeability, reciprocity and personal relationships?

Similar to access of knowledge, when contributing with knowledge of the different categories to the company, personal relationships appear to be the most important means. That is, helping a colleague when he/she asks for knowledge is the main channel through which employees make their contributions. Following

insights gained form the literature, we have analyzed what factors influence on the predisposition of people to provide help: the required time, the possibility of charging the time used, reciprocity, and the previous relationship with the colleague play an important role. We have analyzed whether perceptions about the importance of these issues vary between professional categories, as this could influence the contribution patterns.

As an initial important insight, Table 15 shows that while 82% and 75% of analysts and consultants have answered that they always contribute with their knowledge to help a colleague, 65% of the seniors have given this answer. The reason for this difference is that seniors give more importance to the time required to help the colleague, and 34% of them contribute with their help only if this doesn't require too much time (versus 17% of analysts).

Table 15: Predisposition to offer help to colleagues (%)

If a colleague asks me for help, I contribute with my knowledge…	**Analyst**	**Consultant**	**Seniors**	**Total**
Always	81,76	74,76	64,52	76,14
Only if it doesn't require to much time	16,94	23,79	33,87	22,45
Only if I know the colleague personally	0,65	1,46	1,61	1,10
Only if I have received help from the colleague previously	0,33	0,00	0,00	0,16
Only if I can charge the time I use helping	0,33	0,00	0,00	0,16

When contributing knowledge through personal relations, how important are the different incentives?

The literature has also acknowledged the existence of different incentives that promote contribution of knowledge through personal relationships and our interviews have provided evidence about some perceptions about these issues. In this sense, we have analyzed whether employees value the opportunity of rethinking a problem and seeing it from a different perspective (*new insights*), recognition in the form of retributions or formal status (*official recognition*), recognition in the form of credibility, visibility or gratitude from colleagues (*informal recognition*), the possibility of obtaining help in the future (*potential reciprocity*), the strengthening of personal relations (*relations*), and the implementation of the contributed ideas (*implementation*) as incentives for contributing with their knowledge and helping a colleague.

Table 16 shows that analysts give systematically more importance to all the different incentives than consultants and seniors, which is explained by their higher need of being recognized (both officially and informally), to gain experience and new insights, and to build a status. On the contrary, while considering all issues quite important, seniors give considerably more importance to the strengthening of personal relationships. This could mean that, as they have already an internal recognition in the company and a good experience, their main interest is in building and improving their social network.

Table 16: Incentives for contributing through personal relationship

	Analyst		Consultant		Seniors		Total	
Importance given to:	**Important**	*****	**Important**	*****	**Important**	*****	**Important**	*****
New insights	86,31	24,10	84,95	26,70	80,65	25,00	84,77	25,12
Official recognition	81,43	33,55	75,73	32,04	71,77	29,03	77,71	32,18
Informal recognition	84,69	29,32	79,12	30,58	78,23	25,81	81,63	29,04
Potential reciprocity	82,74	32,25	76,21	24,27	79,84	29,84	80,06	29,20
Relations	91,21	36,16	87,38	39,32	93,55	41,94	90,42	38,30
Implementation	87,30	27,04	81,07	25,73	84,68	30,65	84,78	27,32

Note: "Important" includes ratings as "very important" (*) and as "quite important".

What perception do employees have about the existence of incentives and barriers for contributing with knowledge?

Going deeper into incentives and barriers for contribution of knowledge through personal sources, both the literature and the interviews have also emphasized the importance of other issues such as the availability of information about the use that is going to be given to the contributed idea (*information*), the support of supervisors (*support*), the negative effect of time-shortages (*time-shortages*) and the importance of being aware of the available channels for contributing with knowledge to the company (*awareness*).

In this sense we can see two important results. Table 17 shows on the one hand that seniors have a more positive view of the company, as the percentage of them that agrees with the existence of incentives (available information and support of supervisors) is higher than in the rest of categories, and the percentage that agrees with the existence of barriers (time-shortages) is lower. Additionally, they are more aware of the most adequate channels for contributing (40% of analysts versus 62% of seniors). A second important insight is that consultants are systematically more pessimistic than analysts about the existence of incentives and barriers.

Table 17: Perceived incentives and barriers for contribution (%)

INCENTIVES	**Analyst**	**Consultant**	**Seniors**	**Total**
Information (information about the use that is going to be given to the contributed idea is an incentive)	73,94	70,87	74,96	73,16
Support (I have the support of my supervisors to contribute with my experiences to the company)	55,70	52,43	61,43	55,42
BARRIERS				
Time-shortages (time-shortages are a barrier to contribution)	82,08	84,47	75,26	82,10
PRE-REQUISITE				
Awareness (I know which is the most adequate channel for contributing with my experience and ideas)	39,74	42,72	62,02	43,64

C) Contribution of innovative ideas

When individuals want to contribute with their innovative ideas and experiences related to innovation, through what sources do they do it?

We also analyzed how consultants contribute specifically with innovative ideas to the company through the different available sources. Table 18 distinguishes between systematic contribution, frequent contribution and at least occasional contribution to the different sources by the different categories.

Results show that seniors contribute with their innovative ideas more frequently (considering all systematic, frequent and at least occasional contributions) than juniors through personal sources, through communities and through internal departments. On the other hand, analysts contribute with their innovative ideas through codified knowledge and external sources more frequently than any other category. Interestingly, the innovation network is used systematically for contributing with innovative ideas similarly by all categories, but seniors that use this channel at least occasionally are more numerous. Consultants that use this channel frequently are considerably less (10%).

Table 18: Contribution of innovative ideas (%)

	Analyst	Consultant	Seniors	Total
CODIFIED KNOWLEDGE				
Systematic contribution	4,15	2,79	3,02	3,49
Frequent contribution	21,91	14,81	12,70	17,82
YES	49,59	38,59	43,35	44,82
PERSONAL TIES				
Systematic contribution	12,27	14,89	23,39	15,28
Frequent contribution	46,04	44,82	58,33	48,04
YES	79,04	74,43	83,06	78,34
COMMUNITIES				
Systematic contribution	1,63	3,40	7,26	3,30
Frequent contribution	11,73	12,14	20,97	13,66
YES	43,32	38,35	58,87	44,74
INTERNAL DEPARTMENTS				
Systematic contribution	1,30	0,00	2,02	1,02
Frequent contribution	7,17	2,43	7,26	5,65
YES	26,38	18,69	31,85	24,96
INNOVATION NETWORK				
Systematic contribution	1,3	1,2	1,2	1,3
Frequent contribution	7,17	3,88	6,85	6,04
YES	27,69	20,15	31,05	25,90
EXTERNAL SOURCES				
Systematic contribution	2,9	1,0	0,8	1,9
Frequent contribution	11,24	6,31	5,65	8,56
YES	30,94	18,93	17,34	24,41
ANY SOURCE				
Systematic contribution	3,93	3,88	6,28	4,37
Frequent contribution	17,54	14,06	18,63	16,63
YES	42,83	34,86	44,25	40,53

Hence, results about the specific contributions of innovative ideas by company employees show that seniors provide a more systematic contribution to the company.

4.1.2 Seniority. Statistical significance.

The initial descriptive analysis has shown relevant differences between the knowledge mobilization patterns (access and contribution) of analysts and consultants (juniors) and seniors of the company. In order to provide a deeper understanding of these issues we are going to apply several additional methods.

First of all, it is important to see whether the differences found between juniors and seniors in regard to the use of the available knowledge sources to access and contribute to the knowledge base of the company are significant. In order to do this we have first used contingency tables (Pearson, 1904) to analyze the frequency distribution of the different variables and the significance of the differences between proportions. We have crossed the variable "category" with the variables related to the access and contribution to the different knowledge sources, hence obtaining 28 contingency tables of the following kind:

Table 19: Example of contingency table

		Category		
		Junior	Senior	Total
AccKX	Non frequent	299	40	339
	Frequent	215	83	298
Total		514	123	637

Chi-square Test		**Value**
Pearson Chi-Square		26.230**
Likelihood Ratio		26.503**
Symmetric Measures		
Ordinal by Ordinal	Kendall's tau-b	.203**
	Gamma	.485**

**. 95% significance level

Table 19 shows an example in which we can read among the total respondents how many of the juniors and seniors access frequently the Knowledge Exchange (AccKX) database and how many do not access it frequently. In order to see whether the analysis in terms of "seniority" makes sense, that is, to see whether seniority is a variable that significantly influences the patterns of mobilization of knowledge, it is important to see whether the two variables are associated. In other words, we need to see whether the variables are independent. If the proportions of individuals in the different columns vary significantly between rows (or vice versa), we say that there is a contingency between the two

variables, meaning that the two variables are not independent. If there is no contingency, we say that the two variables are independent.

The degree of association between two variables can be assessed by a number of coefficients. We have tested independence through the Pearson's chi-square test and, additionally, given that our variables are ordinal measures, through the Gamma test and Kendall taub test. All the different coefficients give an approximate sigma that is smaller than 0.05, meaning that the two variables are associated.

The same procedure has been applied to all knowledge sources for access and contribution, providing us with the following information regarding the (in)dependence of their use with the category of the respondent. In Table 20, the column called "independence" shows the variables of access and contribution to knowledge sources for which the null hypothesis could not be rejected, that is, there is no significant difference in the use of such sources by seniors and juniors. On the contrary, the column called "dependence" shows the variables for which the null hypothesis has been rejected and the alternative hypothesis accepted, as there is significant difference in the use of the knowledge sources for seniors and juniors.

Table 20: Dependence between use of the knowledge sources and category

Independence	Kendall tau_b value	Dependence (95% level of confidence)	Kendall tau_b value
Acc_HerramientasArea	.006	Acc_KX	.203
Acc_Supervisor	.002	Acc_Portales	.099
Acc_CompañerosArea	-.008	Acc_Manuales	-.207
Acc_RedGlobalInnov	.004	Acc_CompañerosOtrasAreas	.149
Acc_Internet	.033	Acc_Comunidades	.189
Acc_RedesSociales	.029	Acc_Research	.156
Contrib_KX	.036	Acc_DepInternos	.221
Contrib_Portales	.031	Acc_Innovación	-.098
Contrib_HerramientasArea	.002	Contrib_Manuales	-.168
Contrib_Research	.035	Contrib_Supervisor	.126
Contrib_DepInternos	.065	Contrib_CompañerosArea	.079
Contrib_Innovacion	-.030	Contrib_CompañerosOtrasAreas	.094
Contrib_RedGlobalInnov	.039	Contrib_Comunidades	.113
Contrib_Internet	-.067	Contrib_RedesSociales	-.088

When the Kendall tau_b test provides a negative value, that means that the association between the specific variable and seniority is negative, for example, we can see that there is a relationship between the access of knowledge through manuals and category, but the relation is negative. That means that we can accept with a 95% of security that, if a respondent is senior, he/she will not access knowledge through manuals.

To confirm these results we have also run a discriminant analysis using the one-way ANOVA method. Table 21 shows an example of the test for the case of access to knowledge through the KX database by juniors and seniors. We can see that the mean for juniors is .42 while the one for seniors is .67. None of these means falls in the 95% confidence interval of the opposite category, meaning that

they are significantly different. The same is evidenced by the fact that the F coefficient has a sigma smaller than 0.05.

We have checked the sigma values of the obtained F coefficients and have verified that results of the one-way ANOVA perfectly correspond with the results from the contingency tables. That is, the same variables that have shown significant differences regarding means for juniors and seniors are the variables that have appeared to be associated with seniority in the contingency tables.

Table 21: Example of Oneway ANOVA

						95% Confidence Interval for Mean			
		N	Mean	Std. Deviation	Std. Error	Lower Bound	Upper Bound	Mini	Max
AccKX	Junior	514	.42	.494	.022	.38	.46	0	1
	Senior	123	.67	.470	.042	.59	.76	0	1
	Total	637	.47	.499	.020	.43	.51	0	1

		Sum of Squares	df	Mean Square	F	Sig.
AccKX	Between Groups	6.530	1	6.530	27.270	.000
	Within Groups	152.060	635	.239		
	Total	158.590	636			

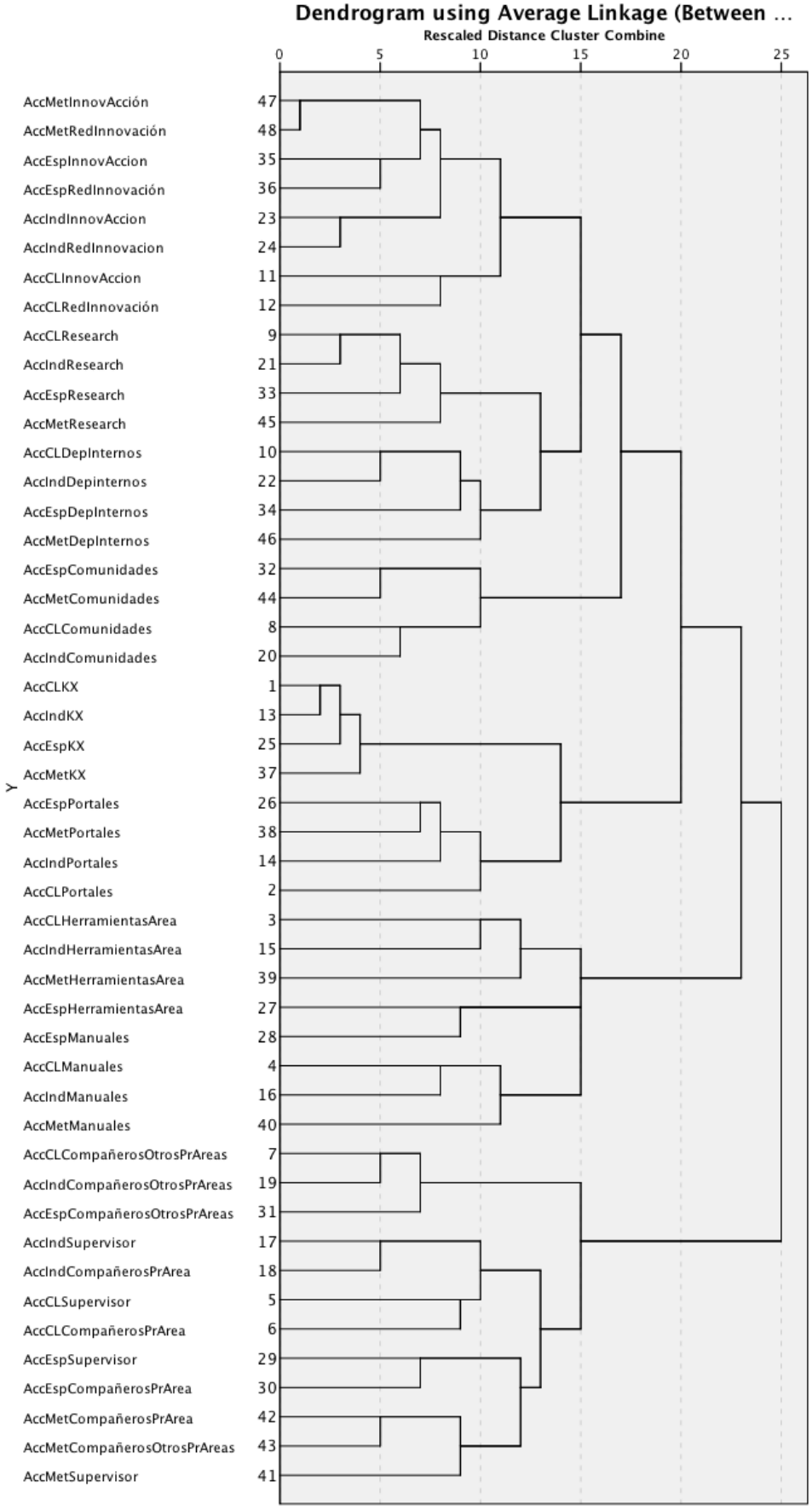
These analyses have helped confirming that seniority is a variable that significantly influences knowledge mobilization behaviors regarding access and contribution to the different knowledge sources at least in half of the cases.

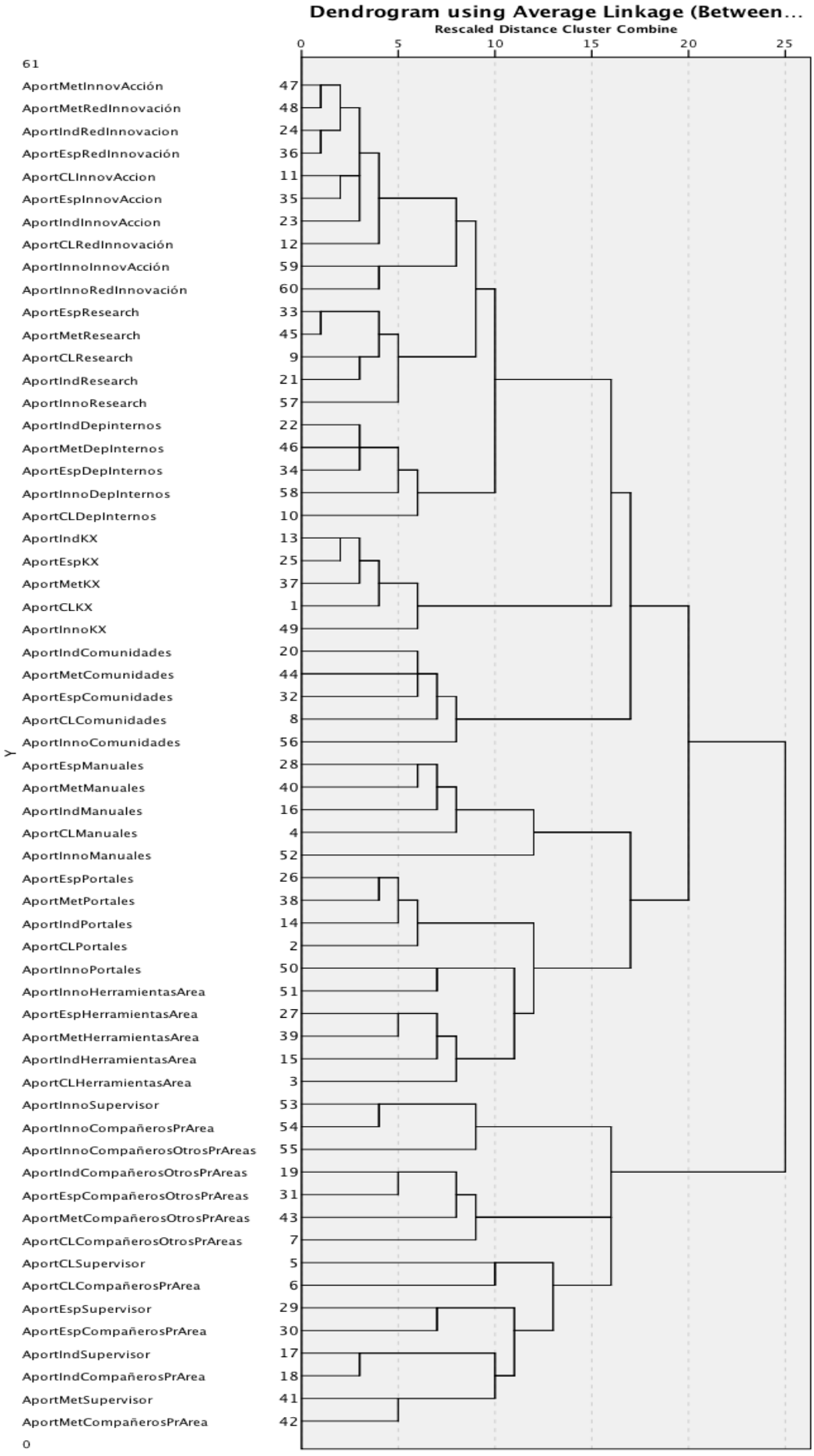
4.1.3 Identification of latent variables

Results for the cluster analysis for access and contribution are shown in Figure 1. We can see that the obtained clusters are very similar in both cases. It is interesting to notice that the analyzed different categories of knowledge (i.e. client, industry, methodology, specialized) cluster together in terms of the mobilized knowledge source. That is, the patterns of access and contribution do not correlate depending on the category of knowledge that is being mobilized, but rather depending on the knowledge source that is being used. This result allows us to defend that issues different from the type of knowledge that is being looked for or provided motivate knowledge mobilization patterns.

If we cut the obtained dendrograms at the rescale distance 17, the found clusters for access variables are the following: 1) Innovation Program, Global Innovation Network, Research department, other internal departments; 2) communities; 3) KX and Portals; 4) area specific tools and manuals; and 5) supervisors and colleagues from the same and different area/project. Sources have been grouped from less frequent to more systematic use. For contribution the clusters are very similar, with an isolate and subtle exception found for the use of the KX database. Considering this subtle difference, in upcoming analyses we are going to apply the clusters found for knowledge access to both activities.

Figure 1: Cluster analysis




Dendrogram using Average Linkage (Between...
Rescaled Distance Cluster Combine
0
5
10
15
20
25
61
AportMetInnovAcción 47
AportMetRedInnovación 48
AportIndRedInnovacion 24
AportEspRedInnovación 36
AportCLInnovAccion 11
AportEspInnovAccion 35
AportIndInnovAccion 23
AportCLRedInnovación 12
AportInnoInnovAcción 59
AportInnoRedInnovación 60
AportEspResearch 33
AportMetResearch 45
AportCLResearch 9
AportIndResearch 21
AportInnoResearch 57
AportIndDepinternos 22
AportMetDepInternos 46
AportEspDepInternos 34
AportInnoDepInternos 58
AportCLDepInternos 10
AportIndKX 13
AportEspKX 25
AportMetKX 37
AportCLKX 1
AportInnoKX 49
AportIndComunidades 20
AportMetComunidades 44
AportEspComunidades 32
AportCLComunidades 8
AportInnoComunidades 56
AportEspManuales 28
AportMetManuales 40
AportIndManuales 16
AportCLManuales 4
AportInnoManuales 52
AportEspPortales 26
AportMetPortales 38
AportIndPortales 14
AportCLPortales 2
AportInnoPortales 50
AportInnoHerramientasArea 51
AportEspHerramientasArea 27
AportMetHerramientasArea 39
AportIndHerramientasArea 15
AportCLHerramientasArea 3
AportInnoSupervisor 53
AportInnoCompañerosPrArea 54
AportInnoCompañerosOtrosPrAreas 55
AportIndCompañerosOtrosPrAreas 19
AportEspCompañerosOtrosPrAreas 31
AportMetCompañerosOtrosPrAreas 43
AportCLCompañerosOtrosPrAreas 7
AportCLSupervisor 5
AportCLCompañerosPrArea 6
AportEspSupervisor 29
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AportIndSupervisor 17
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AportMetSupervisor 41
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Y

We have interpreted the unveiled latent variables in the light of results from our interviews, that helped us understand the content of each analyzed knowledge sources, and the literature review. In this sense, we have interpreted the 5 different clusters as follows:

1) Innovation Program, Global Innovation Network, Research department, other internal departments: These are knowledge sources that are used sporadically and that contain very specific knowledge that is generally not applied in the day-to-day work of consultants. As it has been analyzed in Chapter 2, the R&D and innovation infrastructure of the company is devoted to the development (and detection in the case of the Spanish Innovation Program) of new emergent technologies. Besides, the Research department at Alpha analyzes market trends in many industries providing knowledge about projections of market evolution. Hence, the knowledge embedded in these sources is more distant from the knowledge mobilized by consultants in a day-to-day basis to answer to client needs, and contains knowledge of a more radical character. As a consequence we have interpreted this group as ***sources of radical knowledge*** and, for simplification, we will refer to this cluster of knowledge sources as radical sources. However, it is important to clarify that with "radical" we refer to the knowledge embedded in this sources and not to the innovations that may emerge from the mobilization of this source. In fact, we have already emphasized that in services the distinction between radical and incremental innovations is questionable because continuous innovation is necessary (Hipp and Grupp, 2005). Hence, two issues need to be considered when interpreting the term "radical" as used in this thesis: a) we are defining the knowledge embedded in the sources and not innovation, b) we are defining radical in relative terms, in comparison to the knowledge embedded in the rest of clusters, because the knowledge in this sources is more distant from the knowledge used in the day-to-day work and of a more radical nature, as it deals with, for example, research in new emergent technologies and services.

2) ***Communities***: Within these communities people share a common interest and practice, sharing knowledge of different kinds that are related to each specific community. Literature about Communities of Practices is extensive and, hence, we find it easy to interpret this cluster.

3) KX database and Portals/SharePoints: These two sources contain very diverse types of knowledge. For example, the KX database stores all kind of knowledge, such as information and documentation about previous successful projects at the global level (in English). SharePoints are created by individuals to share knowledge within a closed group, e.g. for a specific project. The knowledge embedded in these sources is of very diverse kind, but it is used and generated in the routine work, for example to look for similar problems found in other projects. As a consequence, knowledge in these sources is (generally) closer to the already existing knowledge than the one embedded in the R&D and innovation infrastructure of the first cluster. Additionally, these sources are useful for any type of industry, area, and even country (the KX is a global database) of the company. Hence, we have interpreted this group as

sources of incremental general knowledge. As for the first cluster, the term "incremental" refers to the knowledge contained in this cluster of sources and not to the type of innovation that might be generated with its mobilization and is defined in relative terms, in comparison to the knowledge embedded in the rest of sources.

4) Area specific tools and manuals: These two sources contain knowledge that is specific for a particular area or subject, and that is used more frequently in the day-to-day work of consultants. As a consequence, most of the knowledge mobilized through these sources is also less radical. We have interpreted this cluster as ***sources if incremental specialized knowledge***. The term "incremental" is interpreted as for the third cluster.

5) Supervisors and colleagues from the same and different area/project: Finally, the most frequently mobilized knowledge sources are personal ties, that is, knowledge embedded in personal relationships. Literature on these sources is also extensive and, hence, the interpretation of this cluster has been direct. We have interpreted this cluster as containing ***personal knowledge sources***.

The results of the cluster analysis have validated the classification of types of knowledge sources emergent from the literature and applied in the questionnaire, with one exception: incremental sources have not been subdivided in the questionnaire. As a consequence, we have analyzed the two clusters (i.e. specialized and general incremental sources) together. For simplification, we will refer to these two clusters of knowledge sources as incremental sources.

Additionally to the grouping of the knowledge sources into these 5 clusters, this analysis has allowed use to test the preliminary hypothesis, i.e. *different types of knowledge are stored in different knowledge sources*. In this sense, however, obtained results are not the ones we expected, as we assumed that consultants would access a different source when looking for a different category of knowledge (i.e. client, industry, etc.) for solving their problems. Instead, we have found that the patterns of access and contribution cluster around the types of knowledge sources used, and not around the categories of knowledge looked for or provided. Nevertheless, the interpretation of the clusters of knowledge sources has provided some interesting insights, as it seams that they in fact store different types of knowledge, but this typology is more related to the day-to-day use that is given to the sources containing incremental and personal knowledge (routine sources), or to the more sporadic use that is given to communities and to the sources containing more radical knowledge (non-routine sources).

4.2. Tests of the hypotheses

Results of the Poisson analysis for Model 1 (Table 22) evidence that seniority directly influences knowledge access through all analyzed types of sources but, looking at the estimated parameters, we can see that the influence on access of

personal sources is much softer than the influence on access of the knowledge embedded in communities. Hence, *hypothesis 1* is accepted.

Length of tenure inversely and significantly influences knowledge access through all sources but radical sources. As a result, *hypothesis 2* is accepted.

As expected, results show that the effect of the perceptions about the existence of barriers that hinder knowledge access on time devoted to accessing knowledge is negative but, in most cases, this effect is not significant. Hence, *hypothesis 3* cannot be generally accepted. However, there are some exceptions that are significant. For example, results show that people that perceive that the competitive evaluation hinders access to some types of information are expected to devote less time to access incremental sources and more time to access radical sources. Moreover, perceptions about the negative influence of chargeability (i.e. the need to charge time used to help a colleague to a specific account) on access has a direct effect on time devoted to access incremental sources and an inverse effect on time devoted to access of radical sources. This means that people that believe that chargeability hinders access of knowledge through personal ties are more prone to access incremental sources and less prone to access radical sources. It is interesting to see that the perception about the existence of silos in the company only (significantly) hinders access to radical knowledge sources.

On the other hand, results show that the perception about the existence of a collaborative culture that supports knowledge access directly influences time devoted to gaining knowledge from all sources. Hence, *hypothesis 4* is accepted.

Table 22: Results of model 1

	Model 1			
Parameters	**A_I**	**A_P**	**A_C**	**A_R**
C	1.63*	2.13*	1.19*	1.09*
Seniority	.375*	.077*	.490*	.212*
Sex	.193*	.025	-.040	.144*
Tenure	-.171*	-.058*	-.205*	-.040
Competitive evaluation[1]	-.043*	-.003	-.040	.085*
Chargeability[1]	.059*	-.029	-.044	-.117*
Silos[1]	-.012	.013	-.004	-.119*
Hierarchy[1]	-.000	-.036	-.062	-.010
Culture[2]	.056*	.049*	.083*	.098*

[1] As it increases so does the belief of the existence of a barrier that hinders knowledge access.
[2] As it increases so does the belief of the existence of a collaborative culture that benefits knowledge access.
Note: The symbol (*) stands for 95% confidence in rejecting the null hypothesis

Regarding the variables affecting contribution, Table 23 shows the results for model 2 and for the corrected model 2. The R-squared statistics show an explanatory power that oscillates between 22% and 28,7%, which can be

considered an acceptable result for micro data[21]. The LR statistics shows a significant explanatory power of the variables of the model all together.

First of all, we can see that the calculated Lambda are significant, meaning that our data are affected by a selection bias as we can expect that respondents that have answered to our questionnaire are those that devote more hours per week to contribution of knowledge in the company. Hence, we are going to focus on the results of the corrected model 2.

Results show that seniority is a significant variable for all types of contributions but the effect of seniority is inverse for contribution to incremental and personal sources and direct for contribution to communities and radical sources. This means that being a senior directly influences in the probability of contributing to non-routine knowledge sources, while seniors are expected to contribute less to the sources used in the day-to-day work. Moreover, looking at the absolute values of the calculated parameters, seniority appears as the most important explanatory variable in the model. As a result, *hypothesis 5* is accepted, although results for contribution to incremental and personal sources are inverse.

The effects of the accessed knowledge sources on contribution appear to be significant and direct in most cases, that is, employees that devote more time per week to the access of knowledge through any source have higher probability of devoting more time to contribution through any source, with one exception: time devoted to the access of knowledge embedded in communities is only significant for explaining the time devoted to contribution of knowledge to communities. However, if we look at the calculated parameters, there is an interesting result: when devoting time to contribution to a given knowledge source, the most influential knowledge source accessed is the same type of source. For example, respondents that have reported to devote more hours per week to accessing knowledge through radical sources are expected to devote more hours per week to contribution of knowledge through any type of sources but more importantly through radical sources. Hence, results show that accessed knowledge sources have a direct influence on contribution, so *hypothesis 6* is accepted. However, it is important to realize that, comparing the values of the calculated parameters, the explanatory power of the access variables is lower than the explanatory power of seniority, previous evaluation, perceived support, and length tenure in most cases.

Obtained prior evaluation appears as a significant variable influencing on time devoted to contribution to communities and radical sources, that is, people that has been evaluated over peers have higher probabilities of devoting more time to contribution through these channels. As a consequence, *hypothesis 7* is accepted for contribution to non-routine knowledge sources (i.e. radical and communities) but not accepted for contribution to knowledge sources used in the day-to-day work (i.e. incremental and personal).

[21] For example, Miotti and Sachwald (2003) obtain a R-squared of 27,7% in their article published in Research Policy.

Table 23: Results of model 2

	Model 2				**Corrected Model 2** (Heckman)			
	C_I	**C_P**	**C_C**	**C_R**	**C_I**	**C_P**	**C_C**	**C_R**
C	0,371*	1,665*	-0,960*	-0,441*	2,379*	2,144*	-3,297*	-4,175*
Seniority	-0,397*	-0,137*	0,140	0,286*	-0,409*	-0,086*	0,581*	0,596*
A_I	0,071*	0,012*	0,020*	0,013*	0,069*	0,011*	0,020*	0,011*
A_P	0,010*	0,046*	0,009*	0,005*	0,010*	0,046*	0,009*	0,005
A_C	-0,012*	-0,002	0,070*	0,004*	-0,008	-0,002	0,070*	0,009
A_R	0,028*	0,006*	0,037*	0,100*	0,027*	0,006*	0,038*	0,098*
Evaluation	0,049	0,033	0,297*	0,207*	0,086	0,038	0,317*	0,273*
Support	0,076*	-0,020	0,218*	0,209*	0,076*	-0,024	0,226*	0,231*
Tenure	0,003	0,078*	0,152*	-0,126*	-0,075*	0,068*	0,114*	-0,222*
Lambda	-	-	-	-	-2,520*	-2,433*	2,380*	3,550*
R-squared	0,2286	0,2869	0,2649	0,2234	0,2249	0,2877	0,2714	0,2329
LR statistic	1015,5	1154,1	906,5	996,9	1034,8	1167,3	914,7	1027,7
Prob (LR)	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000
Akaike info	7,1164	8,9236	4,9585	5,3161	7,0892	8,9059	4,9489	5,2709

Note: The symbol (*) stands for 95% confidence in rejecting the null hypothesis.

The perception of having the support of superiors is significant and directly related to contribution to all sources, with the exception of personal sources. Hence, *hypothesis 8* is accepted except for contribution through personal ties.

Finally, length of tenure appears to have a significant impact on contributions to all types of sources. However, its effect is direct on contributions through personal sources and to communities and inverse on contributions to incremental and radical sources. *Hypothesis 9* is, hence, accepted for contributions to personal sources and communities. For incremental and radical contributions the hypothesis null is rejected and the alternative hypothesis accepted, but for an inverse relation.

Results have shown that: a) individuals that devote longer to accessing knowledge in all the available sources are seniors and b) time devoted to access directly influences time devoted to contribution. Hence, we have considered the possibility of finding two different effects of seniority in contribution: a direct effect and an indirect through its effect on access. To test this possibility, we have estimated an alternative model substituting the direct effect of seniority and access on contribution with the marginal effects of seniority on access. The marginal effects appeared as being significant in all cases, but the obtained model fits (R-squares) were considerably lower (around 2%). Hence, we have focused on the model providing a better explanation, that is, Model 2 above[22].

Summarizing all results, we have seen that the frequency of use of the analyzed knowledge sources is slightly influenced by the category of knowledge that is being mobilized (i.e. client, industry, specific or methodology), but we have also demonstrated that these decisions are more dependent on whether the knowledge that is being mobilized is used in the day-to-day work or sporadically. Hence,

[22] Because of high multicolinearity we could not include all explanatory variables together.

through the defined quantitative models, we have analyzed what variables affect the mobilization of sources containing day-to-day knowledge (incremental and personal) and non-routine knowledge (communities and radical).

In this sense, results (Table 25) show that: 1) personal characteristics like seniority and length of tenure influence time devoted both to access and to contribution of knowledge, seniority mainly directly and tenure mainly inversely; 2) perceptions about the existence of barriers that hinder knowledge access do not affect knowledge access patterns significantly, with some exceptions; 3) perceptions about the existence of an incentivizing context (i.e. a collaboration culture and support from superiors) and real incentives (i.e. superior evaluation) directly affect time devoted to access and contribution; 4) time devoted to accessing knowledge directly affects time devoted to contribution. Results also show that the effects of the analyzed variables on access and contribution considerably change between the sources used in the day-to-day work by most consultants and the sources used more sporadically by fewer consultants.

Table 25: Summary of results

HYPOTHESIS		**RESULTS**				
ACCESS (Model 1)		**A_I**	**A_P**	**A_C**	**A_R**	**TEST**
H_1: **Seniority** directly influences knowledge access.		+	+	+	+	✓
H_2: Length of **tenure** inversely influences knowledge access.		-	-	-		✓
H_{3a}: Perceptions about the existence of a **competitive evaluation** model that hinders access to particular information inversely influence knowledge access.		-			+	☒
H_{3b}: Perceptions about the existence of difficulties for accessing the knowledge of a colleague if he/she cannot **charge** his/her **time** inversely influence knowledge access.		+			-	☒
H_{3c}: Perceptions about the existence of **silos** or company divisions that hinder personal relationships inversely influence knowledge access.					-	☒
H_{3d}: Perceptions about the existence of difficulties for accessing the knowledge of colleagues from higher categories or **hierarchy** inversely influence knowledge access.						☒
H_4: Perceptions about the existence of a **collaboration culture** that makes access of knowledge easier directly influences knowledge access.		+	+	+	+	✓
[Additional variable. Sex (1= w; 0= m)]		+			+	
CONTRIBUTION (**Corrected Model 2**)		**C_I**	**C_P**	**C_C**	**C_R**	**TEST**
H_5: **Seniority** directly influences knowledge contribution.		-	-	+	+	±
H_6: **Accessed knowledge sources** directly influence contribution.						✓
	$A_{INCREMENTAL}$	+	+	+	+	✓
	$A_{PERSONAL}$	+	+	+		✓
	$A_{COMMUNITIES}$			+		☒
	$A_{RADICAL}$	+	+	+	+	✓
H_7: Obtaining a **superior evaluation** positively influences contribution.				+	+	½
H_8: Perception of **support** from superiors positively influences contribution.		+		+	+	✓
H_9: Length of **tenure** positively influences contribution.		-	+	+	-	±
[Selection bias]		-	-	+	+	±

NOTE: Symbol ✓ for alternative hypothesis accepted in more than 75% of cases; ½ hypothesis accepted in more than 50% of cases; ± when the null hypothesis is rejected but effects are mixed (direct and indirect); ☒ when the null hypothesis could not be rejected.

5. Discussion

The literature review on knowledge mobilization has evidenced that research on this topic has been quite disparate, as the knowledge sharing and mobilization process is an overarching, multifaceted, complex process (Hansen et al. 2005). In fact, scholars have examined diversity of topics related to knowledge mobilization, such as the difficulty of transferring tacit knowledge, the nature of informal relationships, the problems of searching for knowledge etc. (Ibid). However, we have seen that each research thread has tended to evolve in a non-converging path, mainly focusing on the mobilization of a specific type of knowledge or knowledge source and giving less attention to the interrelation and commonalities among them. For example, research on interpersonal communication has focused on network analyses and on understanding what factors make of an individual a central part of a network, while research on KM has mainly focused on the benefits of implementing KM tools and codifying knowledge, often adopting a technology centered perspective.

In particular, Hansen et al. (2005) highlight that research has not empirically disentangled the two phases of search and transfer of knowledge and that, as a consequence, there is little knowledge about the extent to which different factors explain these phases. Similarly, they highlight that scholars adopting a relational approach to knowledge sharing have also focused on different subsets of relations, such as informal relations within teams, external relations, relations among subunits of organizations, and that, furthermore, some scholars analyze group relations while others dyadic relations. These authors address some of these gaps by analyzing what properties of social networks explain the three phases of knowledge sharing (i.e. deciding to seek knowledge, searching for knowledge and transferring knowledge).

Also with the objective of addressing these gaps in the literature, we have turned to the literature on knowledge brokerage as the integrative framework to look at the mobilization of knowledge from the individual perspective. Although network analysis has often evidenced the peripheral nature of senior managers within informal networks (Allen et al, 2007), we believe that in a company such as the one we have analyzed, the characteristics that the literature has emphasizes as identifying knowledge brokers pretty much adjust with the characteristics of seniors. In fact, the "up or out" career of employees in Alpha and the growth strategy focused on internal career means that, in general, individuals gain their experience on the job within the company. Hence, as they stay longer in the company (length of tenure) and gain seniority (the career path is quite ensured to consultants and is in fact one of the main incentives of these types of KIBS) they obtain a profound anchorage in the company, which is a necessary precondition to be a knowledge broker (Muller et al., 2013).

Moreover, in order to become a senior, length of tenure is not the only thing to be considered: the social and communicative skills of consultants are also taken into consideration, which are also preconditions for knowledge brokers (Ibid).

Additionally, when becoming seniors, individuals also gain formal recognition and a vantage position in the hierarchal pyramid, requisites necessary to mobilize support (Leonardi and Bailey, 2013) and the autonomy needed to take decisions about the investment of individual time.

Because of all these reasons attributing the characteristics necessary to become a knowledge broker to seniors in our company, instead of conducting a network analysis to identify specific individuals that work as knowledge brokers, we have analyzed the influence of observable characteristics such as seniority on knowledge mobilization. Is this the main individual attribute that influences the mobilization patterns of the available internal knowledge sources? Are seniors knowledge brokers with access to exclusive sources?

Having these two things in mind, that is, the lack of an overarching or integrative approach to knowledge mobilization that considers the main internal knowledge sources and the analysis of seniors of the company as the main knowledge brokers, we have obtained two very different types of results:

a. General insights about the mobilization of knowledge through the different available internal sources. In this first part we have aimed at confirming that the different issues detected in the literature as being important for the mobilization of knowledge, that is, the problems, barriers, incentives and motivations studied in the literature, are applicable to KIBS.
b. A more specific analysis in which we have aimed at filling the gap detected in the literature, adopting an integrative perspective that is rooted in the literature on knowledge brokerage. We have also analyzed whether behaviors and perceptions significantly differ between seniors and juniors.

Finally, and considering that one of the objectives of this chapter is to analyze whether the resources described in Chapter 3, the R&D and Innovation Infrastructure, are "exclusive" resources that are mainly mobilized by seniors, we will specifically discuss results on this topic.

5.1. General insights about knowledge mobilization: Routine versus non-routine sources

From a general perspective, results have shown that, in average, respondents use 1,8 sources when looking for knowledge and 1,4 when contributing with knowledge. The mobilized knowledge sources slightly vary depending on the problem that is being faced by consultants, that is, a problem regarding knowledge about the client with whom they are working on a project, about the industry in which the client works, about the internal methodologies used in the company for specific purposes, and about specific formal knowledge (e.g. about a technology, about legal issues, about financial formulae etc.

However, although these slight differences exist, results have evidenced that, in fact, the use of knowledge sources is more dependent on whether the knowledge that is being mobilized is needed in the day-to-day work or sporadically.

The knowledge sources that are used very frequently in the day-to-day work are KM tools and personal ties, which are complementary (Faulconbridge, 2006) and necessary for innovation, as the conversion of knowledge into explicit allows for the creation of a common knowledge base, diffusing not only lessons learned but also standard operating procedures that make the integration of knowledge and information across the organization easier (Mors, 2010). The knowledge stored in the KM tools is of very diverse kinds, as the tools themselves are diverse (e.g. some are more specific for an area or specific technology and some of more general knowledge for global use). However, in line with the literature (Scarbourgh and Swan, 2008), interviews have evidenced that, because of many reasons, consultants in KIBS tend to report and codify only those results issues that are obligatory and "more urgent" and have less propensity to invest time in codifying knowledge in a voluntary manner. As a consequence, most of the knowledge included in the KM tools is of an incremental nature and less radical[23].

More radical or distant knowledge is mobilized mainly through other sources, such as the R&D and Innovation Infrastructure analyzed in Chapter 3. These knowledge sources are not only more sporadically mobilized, but also by fewer people. As explained in the literature review, the mobilization of knowledge through sources such as communities is very important because it helps explaining the development of organizational knowledge over time (Amin and Cohendet, 2000), as it enables "*learning from projects to the wider organization*" (Scarbrough and Swan, 2008).

We have seen in the literature review that the mobilization of knowledge through each of the analyzed sources increases the potential for innovation, as each of them has specific benefits that complement each other. In this sense, our analysis has evidenced that individuals at Alpha mobilize all the available sources to some level, although not all types of internal knowledge sources are mobilized in a similar way. The main insight in this sense, gained for example from the cluster analysis, is that patterns of mobilization of routine or day-to-day sources, including rather incremental and non-radical knowledge, differ from patterns of mobilization of non-routine or sporadically used sources, containing more radical knowledge. These results have a parallelism with March's (1991) organizational learning theory, which distinguishes exploitation, as learning activities involving the use of resources the firm already has, and exploration, as learning activities that lead to the addition of new resources. In this sense, Tushman and O'Reilly (1996) highlight that for firms to prosper, they must excel in both types of activities, succeeding at managing the tensions emanating between them. In other

[23] It is important to keep in mind the special meaning of the terms radical and incremental applied in this thesis and that they refer to the type of knowledge embedded in the sources, in relative terms, and not to the typologies of innovation that may emerge from their mobilization (see the interpretation of the clusters of knowledge sources).

words, organizations need to be ambidextrous and be capable of simultaneously managing contradictory KM processes (Andriopoulos and Lewis, 2009).

This distinction between routine and non-routine knowledge sources seams an obvious result but on what variables, among the issues detected in the literature as important, does the mobilization of each type of knowledge source depend? For the discussion of these results, however, we will turn to the literature on knowledge brokers and distinguish between the two main activities that they conduct (Leonardi and Bailey, 2013): the access or identification of ideas and the contribution or selling of ideas.

5.2. Knowledge brokerage and the role of seniors

5.2.1. Knowledge access: Identifying good ideas

The general analysis has evidenced the important influence of seniority in the patterns of access of knowledge. Seniors access more intensively both routine and non routine sources, but specially interesting is their more intensive use of internal communities and internal company departments, both regarding the proportion of seniors that access them and regarding the time devoted to this activity. Moreover, results in Model 1 have confirmed these initial insights and shown that seniority directly influences knowledge access through all analyzed types of sources.

On the contrary, length of tenure inversely and significantly influences knowledge access through all sources but radical sources. This could seam contradictory, as we know that seniority and length of tenure are quite correlated in a company such as ours, where the career pattern is “up or out”. However, it is important to have in mind that our dependent variable is the number of hours devoted to accessing knowledge through the different sources. This could mean that seniors devote longer time to accessing knowledge than juniors and, specifically non-routine sources but at the same time, as employees stay in the company, they become more effective in their knowledge searches and need to invest less time in accessing knowledge. In fact, our descriptive analysis has evidence that unawareness of the existence and/or utility of the knowledge sources is the main disincentive for their use (except personal and external). And, as expected, seniors have higher awareness about available sources than the rest of categories, as a result of the gained anchorage in the company (Muller et al., 2013). As a consequence, they may also know better where to go for gaining specific knowledge and, hence, save time in this activity. Haas and Hansen (2005) made a similar observation saying that search and transfer costs incurred in obtaining personal and codified knowledge may be somewhat lower for experienced teams. They believe that these differences might be due to the higher capacity of experienced teams to locate relevant knowledge sources more

rapidly, to their greater absorptive capacity and to their more proper interpretation of the accessed knowledge.

Hence, results show that individuals that devote longer to accessing knowledge in all the available sources are seniors that have been shorter time in the company.

Many authors have analyzed what variables influence *who* people ask when they need help or additional knowledge on an issue, emphasizing the importance of confidence on the sufficient competence or expertise of the help-giver (Abrams et al., 2003) and of the recognition of these capabilities (Fleck, 1997). In this sense, the descriptive analysis has evidenced that professional category, experience, and (official or informal) recognition of the colleague are important for all respondents, but more specially for seniors. Maybe with the exception of informal recognition, we may say that all the analyzed characteristics are importantly correlated with seniority. Hence, this means that "seniority" of the help-giver is in fact a key variable that influences *who* people access for help and, consequently, it passively affects the patterns of knowledge access.

In addition, the literature has analyzed some barriers that importantly hinder knowledge circulation and both our preliminary interviews and the survey have confirmed that some employees perceive that these problems exist in Alpha. Some authors have evidenced that inter-organizational and interpersonal competition is negatively associated to knowledge exchange (Reagans and McEvily, 2003). We have analyzed the existence of these barriers, considering whether company divisions hinder personal relationships (*silos*) and whether the evaluation model, based on a competitive banding, hinders access to particular information (*competitive evaluation model*). Additionally, we have tested whether it is difficult to access knowledge of a colleague if he/she cannot charge his/her time (*chargeability*) and whether there are problems to access the knowledge of people from higher categories (*hierarchy*).

In this sense, we have analyzed whether perceptions about the existence of these barriers significantly differ between seniors and juniors, as Soo et al. (2002) evidenced that there are important discrepancies between these categories on perceptions about the efficacy of firm's KM systems. These authors show that seniors have a higher perception about the effectiveness of organizational policies and knowledge systems. The descriptive analysis has confirmed these differences in perceptions among categories as, for example, juniors that perceive that hierarchy and the competitive evaluation model hinder knowledge circulation double the number of seniors that believe so. Similarly, seniors are more positive about the perception of a collaborative culture that promotes knowledge circulation.

However, interestingly, results of Model 1 show that the effects of perceptions about the existence of barriers on time devoted to accessing knowledge are negative but that, in most cases, these effects are not significant. There are some exceptions:

- Access of sources containing radical knowledge is significantly affected by perceptions about the existence of barriers, as people that perceive that organizational silos and bureaucratic requirements for chargeability of time hinder knowledge sharing are expected to devote less time to the access of knowledge through radical sources.
- People that perceive that the competitive evaluation hinders access to some types of information are expected to devote less time to access of routine sources and more time to access of non-routine or radical sources.

The first exception means that willingness of acquisition of radical knowledge is more sensitive to perceptions about barriers. This result is quite rational, as the access of sources containing non-routine knowledge that is not frequently applied in the day-to-day work is more affected by voluntary patterns of knowledge mobilization and, consequently, individual perceptions have greater impact on behavior. On the other hand, when accessing knowledge that is needed in the day-to-day work, mobilization patterns are more influenced by specific work needs and individual perceptions are less influential, that is, if a consultant obligatory needs to gain some information for the day-to-day work, it will not matter whether he/she perceives that there exist some barriers for accessing that knowledge.

The second exception means that, as employees perceive that they need to differentiate themselves from peers in their evaluations, that is, as they perceive higher inter-organizational and interpersonal competition (Reagans and McEvily, 2003), they will believe that accessing non-routine knowledge will provide them with relative advantages that day-to-day incremental knowledge will not provide.

In concordance with the literature (Gertler, 2008), the perception about the existence of a collaboration culture is directly related to time devoted to gaining new knowledge through all sources, and seniors are also more positive about this perception.

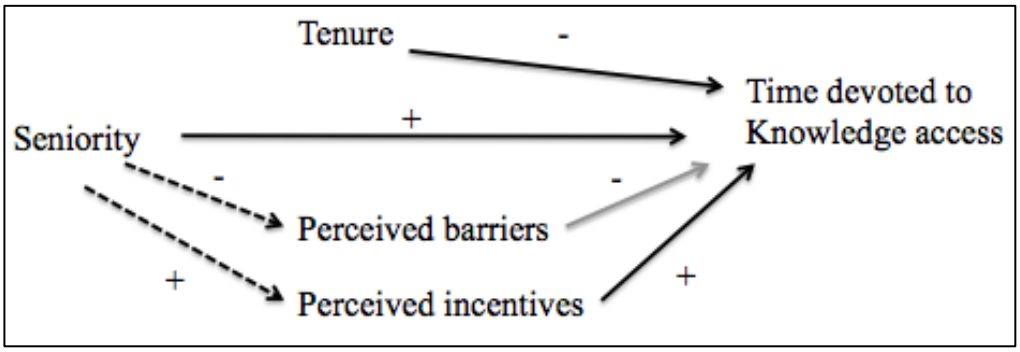
In addition, related to barriers for knowledge circulation we have also analyzed whether it is equally difficulty to access all types of knowledge (through personal relationships), and we have found that between 38 and 48% of respondents believe that it is difficult or very difficult to access knowledge of the different categories. These results provide an idea of the weight that the analyzed barriers (and other non-analyzed barriers) have for accessing the knowledge needed for giving answer to the main problems that can arise in the day-to-day work of a consultant. It is very relevant to see that seniors systematically believe that knowledge is easier to access than the rest of categories, confirming their more positive vision of Alpha's knowledge system (Soo et al., 2002).

As a conclusion regarding the influence of perceptions about barriers and incentives on patterns of knowledge access we can say that: a) perceptions about the existence of barriers hinder knowledge access, although not always significantly, b) perceptions about the existence of incentives, such as a collaboration culture, fosters knowledge access, and c) seniors have more

positive about the effectiveness of the firm's knowledge systems, hence perceiving less barriers and better incentives.

Although very simplistically, the Figure 2 summarizes these issues:

Figure 2: Influence of seniority on knowledge access



NOTE: The dashed arrow means that the relation has not been tested through the models but evidenced in the descriptive analysis by means of contingency tables. The grey arrow means that we have found a negative but non-significant relationship in the model.

5.2.2. Knowledge contribution: selling of ideas

As in the case of access, the important influence of seniority in the patterns of contribution of knowledge has been evidenced in two main ways in the results. First, we have seen that the effective usage of the knowledge sources changes from juniors to seniors importantly. In this sense, the main difference has been found in the more intensive use of internal communities and internal departments of the company by seniors, both regarding the proportion of seniors that contribute to them and regarding the time devoted to this activity. Second, we have seen that the perceptions about the different variables that influence on knowledge contribution behaviors or patterns (i.e. incentives and barriers) vary considerably from juniors to seniors, which will affect the use of all analyzed sources.

When looking at contribution patterns we can see bigger differences in results for the mobilization of routine sources (i.e. personal and incremental) and non-routine sources (i.e. communities and radical). First of all, results of Model 2 show that seniority has a direct influence on the mobilization of non-routine sources, but indirect for routine sources. We believe that this has to do with the fact that as consultants become seniors they can chose to contribute with their knowledge through other sources that are more "exclusive". In line with the literature, seniors will have the opportunity to share their knowledge in the Communities of Practice, as they have gained the status necessary to be considered a knowledgeable partner and have become insiders (Duguid, 2008). Similarly, for their knowledge to be taken into consideration in the sources containing more radical knowledge, individuals need to have gained recognition and a status of having the necessary technical experience. Moreover, these sources often contain confidential knowledge, as they deal with the exploration

of new strategic venues for the company. It seams rational that, in a company with thousands of employees, confidential knowledge will be only mobilized by the higher spheres, that is, by "insiders" of a specific community with access to strategic and confidential knowledge. In other words, and using the terminology introduced by Coakes and Smith (2007), these individuals need to become insiders of company's Communities of Innovation.

However, if we look at the effect of length of tenure on contribution, we can see that the effect is indirect for sources that are more "impersonal", that is, incremental and radical sources, and direct for contribution through sources with a more relational component (i.e. personal and communities). The reason for these effects may be found in the time necessary to cultivate social networks and in the preferences of employees for solving their problems through informal interactions by means of these networks (Hargadon and Bechky, 2006). As a consequence, as employees stay longer in the company and invest more time in cultivating their internal social networks, they will have greater opportunities of mobilizing these resources and, as this is their preferred way of sharing knowledge, they will invest relatively more time in contributions through personal networks than through incremental sources.

Additionally, results of Model 2 have shown that time devoted to accessing knowledge directly affects time devoted to contribution to all sources. This is in line with the literature that says that, as innovations are new combinations of knowledge, accessing diverse information is the main challenge for innovation (Mors, 2010)[24]. It is important to remember that, when analyzing access patterns, we have seen that individuals that devote longer to accessing knowledge in all the available sources are seniors and that the marginal effect of seniority on access significantly affects contribution. In fact, Burt's (2004) results show that people holding more senior ranks were more likely to act on their ideas but that this action was less a result of the rank itself but rather a result of the connections of seniors to other groups. In other words, it seams that Burt found that the influence of seniority came more from the fact that seniors can access more sources of knowledge than from the hierarchical category itself. We have found similar results, although we have not been able to contrast the effect of all these variables together for multicolinearity reasons.

Following the insights gained in the literature, we have analyzed the influence of perceptions about transparency of communication, critical for reducing ambiguity and apprehension about the risks of innovation (Lyons et al. 2007), the negative effect of time pressures (Amabile et al. 2002), and the importance of awareness about available channels for knowledge contribution. Similar to what we found regarding perceptions about barriers for access and in line with the literature (Soo et al., 2002), the descriptive analysis has evidenced that seniors are more positive about the existence of information and transparent communication, and think that time-shortages are less damaging. Additionally,

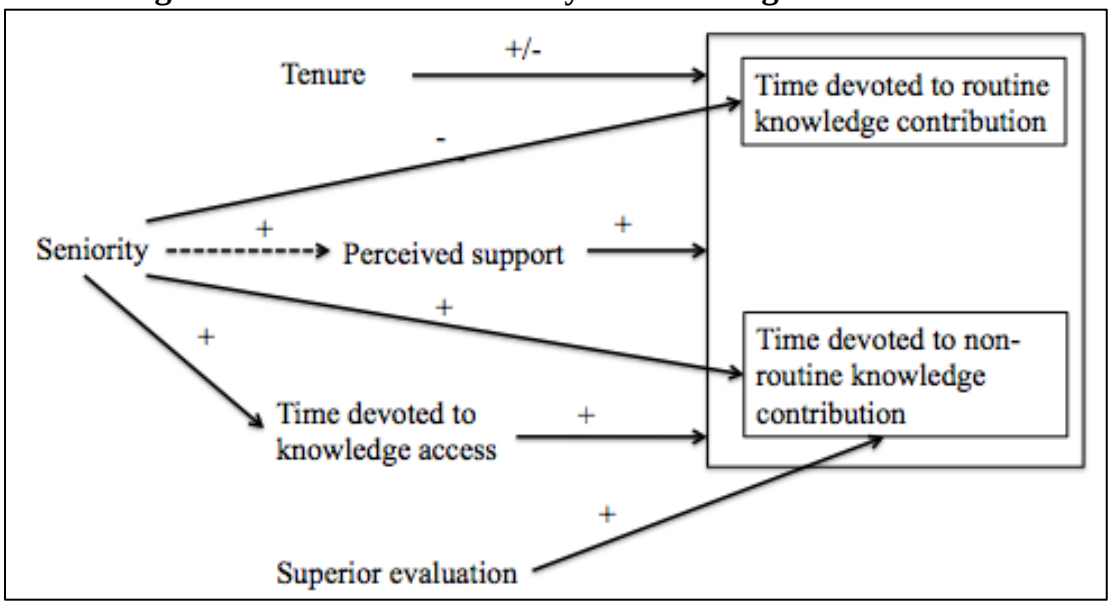
[24] As an exception, only contribution to communities is exclusively affected by time devoted to accessing communities, which may be attributed to the exclusive nature of CoPs and to need to become an insider or a recognized member.

they are more aware of the most adequate channels for contributing (40% of analysts versus 62% of seniors).

As analyzed knowledge contribution is rather voluntary and, hence, falls beyond employees' functional responsibilities, the literature has highlighted the importance of incentives for increasing engagement (Henard and McFadyen, 2008). As a consequence, we have tested the effect of reinforcing behaviors, such as recognition in the form of retributions or formal status, credibility, visibility or gratitude from colleagues (Hargadon and Bechky, 2006), and or organizational support (Ramus, 2001) on contribution patterns. In this sense, results of Model 2 have shown that obtaining a superior evaluation in comparison to peers has a direct effect exclusively on contribution to non-routine sources. The explanation for this is precisely the one emphasized in the literature: employees with a superior evaluation acquire higher internal status and credibility, which is necessary to mobilize support and "sell" ideas (Leonardi and Bailey, 2013). In addition, the perceived support from superiors directly influences time devoted to contribution except for personal sources, as in this case the communication is pervasive. In this case, seniors have also better perceptions about obtained support from their superiors than juniors.

Figure 3 summarizes the found relations for knowledge contribution, although very simplistically:

Figure 3: Influence of seniority on knowledge contribution



NOTE: The dashed arrow means that the relation has not been tested through the models but evidenced in the descriptive analysis by means of contingency tables.

Summarizing, we have evidenced that seniority is the most significant determinant of the probability of individuals engaging into the two main activities of knowledge brokerage, namely the access of diverse resources and the diffusion and translation of the gained ideas into distant communities. In fact, seniors are specifically involved into contributing to non-routine sources that contain more radical knowledge and are more engaged in the mobilization of

knowledge through communities. This more participative behavior is also specially influenced and enhanced by their higher perceptions about the firm's knowledge systems (Soo et al., 2002), which increase their motivation to engage into activities that fall beyond their functional responsibilities (Henard and McFadyen, 2008). Consequently, we may say that at least some of the motivational skills that have been attributed to knowledge brokers (Dobbins, 2009) are highly correlated with seniority.

5.3. Mobilization of non-routine knowledge sources

We have so far left a research question with little words: Are the knowledge resources analyzed in Chapter 3 (the different R&D and innovation units) channels that are only mobilized by seniors? Can they be seen as "exclusive" channels? Results have shown that, with some exceptions, around 37% of analysts, 28% of consultants, and 40% of seniors access these sources at least occasionally. This would mean that the knowledge resources analyzed in Chapter 3 are channels that are not mobilized exclusively by seniors. However, we have seen that the percentage of seniors that spend more than 20 hours per week accessing this channel almost doubles the percentage of analysts and consultants. Regarding contribution, it is interesting that analysts and seniors appear to contribute similarly through the innovation network of the company (close to 10% more than consultants), but seniors spend considerably more time than analysts and consultants in this activity. Moreover, our models have shown that there is a direct relation between time devoted to access of radical sources and time devoted to contribution to them. Hence, our results are in line with the literature that suggests that seniors are more likely to act on their ideas due to their better accessibility to more knowledge sources (Burt, 2004).

This means that, even though analysts and consultants have acknowledged using these channels at least occasionally both for accessing knowledge and contributing with it, they make a "superficial" use of the sources rather than going deeper into the possibilities that they offer while seniors contribute to a deeper level. In fact, our models have demonstrated that seniority directly influences on the mobilization of sources containing radical knowledge, including the Innovation Network. We have argued that this might be explained by the fact that seniors have had the chance to develop their social networks, their image and status (Duguid, 2008), becoming "insiders" of Alpha's Communities of Innovation (Coakes and Smith, 2007), often containing rather strategic and confidential knowledge. The gaining of this "insider" status would explain the more intensive mobilization of these resources by seniors.

In addition, we have seen that the acquisition of knowledge through radical sources is more sensitive to individual perceptions about barriers (silos and chargeability) as it is rather voluntary activity, in contrast to the acquisition of routine knowledge applied in the day-to-day work. However, we have also seen that employees that perceive the existence of interpersonal competition regarding

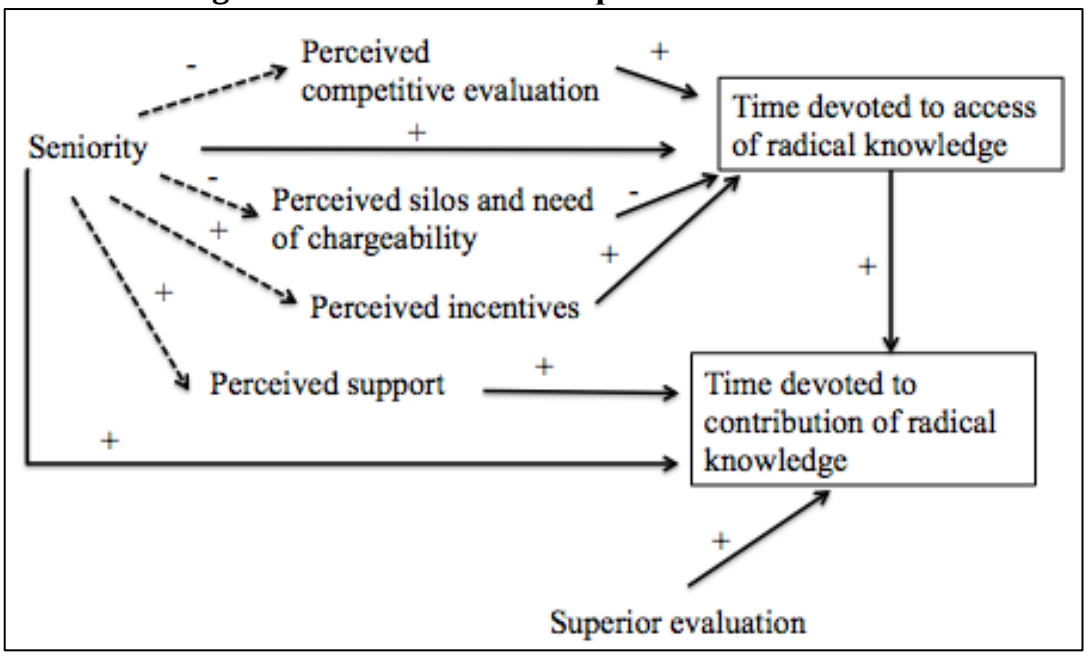
the evaluations devote more time to the access of radical sources, as this type of non-routine knowledge allows them to differentiate themselves from peers (Reagans and McEvily, 2003).

Similarly, perceptions of having the support of superiors directly influences time devoted to contribution to radical sources. In this sense, Lyons et al. (2007) have defended that leaders play a critical role in reducing apprehension for individuals to provide their ideas, as this activity attracts more intense scrutiny from the organization. Hence, informing about the guiding missions of the organization regarding innovation is key to reduce the inherent risk of innovation.

In line with Soo et al. (2002), we have seen that seniors of our company have a more positive perception about the situation of the company regarding the existence of barriers and incentives.

Finally, we have demonstrated that employees that obtain a superior evaluation in comparison to peers are expected to contribute more to the radical sources and the Innovation Network, as their higher internal status allows them to mobilize the needed support to "sell" their ideas (Leonardi and Bailey, 2013). Figure 4 summarizes all results regarding the mobilization of radical knowledge sources:

Figure 4: Mobilization of Alpha's radical sources



NOTE: The dashed arrow means that the relation has not been tested through the models but evidenced in the descriptive analysis by means of contingency tables.

Because more than 65% of employees have signaled unawareness as the main reasons for not using the innovation network as a knowledge source, we believe that it is an important challenge for the company to increase the company wide transparent communication of the available resources and the guiding missions of Alpha (Lyons et al., 2007).

Conclusions

Acknowledging the importance that mobilization of professional knowledge has in services, in which consultants need to tap into all available knowledge to provide adequate ad-hoc solutions to the different clients, we have tried to provide new insights about how knowledge is mobilized at the individual level in KIBS. Our analysis has attempted to cover some gaps detected in the literature, regarding the lack of linkages between the analysis of the mobilization of different knowledge sources and between these and the literature devoted to knowledge brokers. In addition, and because we have detected that many employees are not aware of the existence of specific units devoted to R&D and innovation in Alpha, we have analyzed whether the patterns of knowledge mobilization substantially differ between different categories of individuals within the company. In other words, we have analyzed whether we can find "two types of corporate citizens" (Kanter, 2006) that can access and contribute to different types of sources, some being able to mobilize more "exclusive" sources of knowledge. Hence, we have tested whether "seniority" is the main variable that determines differences in the patterns of access and contribution to the knowledge base of the company. With these objectives in mind, we have adopted literature on knowledge brokerage as integrative framework, analyzing whether seniors of the company can be considered to be the main "knowledge brokers" that mobilize "exclusive" knowledge resources. Some authors have in fact acknowledged the need to further analyze the internal driving forces of innovation in KIBS (Muller et al. 2013).

Regarding the general insights gained about knowledge mobilization patterns in KIBS, results have evidenced that the mobilized knowledge sources slightly vary depending on the problem that is being faced by consultants. However, although these slight differences exist, we have seen that, in fact, the use of knowledge sources is more dependent on whether the knowledge that is being mobilized is needed in the day-to-day work or sporadically. In this sense, the mobilization patterns of the different internal knowledge sources have been grouped into four differentiated clusters (from a more intense to a less intense use): personal sources, incremental sources (i.e. tools with codified knowledge), communities, and radical knowledge sources (i.e. the R&D and Innovation infrastructure and other internal departments). On the one hand, personal and incremental sources, which are mobilized in a routine basis or systematically by all consultants in the company, contain very diverse knowledge but generally less radical (e.g. best practices, globally adopted methodologies), often due to the characteristics of the documentation process. On the other hand, non-routine sources contain more radical knowledge, mobilized mainly through communities and special internal departments (e.g. devoted to the generation of new technologies).

The main insight gained in this sense is that patterns of mobilization of routine or day-to-day sources, including rather incremental knowledge, differ from patterns of mobilization of non-routine or sporadically used sources, containing more radical knowledge, in line with March's (1991) organizational learning theory

that distinguishes exploitation and exploration activities. Besides differences regarding the frequency and intensity of mobilization, results have also evidenced that the effects of perceptions about the existence of barriers on time devoted to accessing knowledge are different for these two types of sources. We have seen that access of radical knowledge is more sensitive to perceptions about barriers, probably because it is more affected by voluntary patterns of knowledge mobilization and, consequently, individual perceptions have greater impact on behavior. Moreover, employees that perceive higher inter-organizational and interpersonal competition (Reagans and McEvily, 2003) access non-routine knowledge more intensively, as this is more "unique" and provides them with relative advantages that day-to-day incremental knowledge will not provide.

Regarding the role of seniors as the main knowledge brokers, results have shown that seniority is the most significant determinant of the probability of individuals engaging into the two main activities of knowledge brokerage: access of diverse resources and contribution or selling of ideas. This more participative behavior is also specially influenced and enhanced by seniors' higher perceptions about the firm's knowledge systems (Soo et al., 2002), which increase their motivation to engage into activities that fall beyond their functional responsibilities (Henard and McFadyen, 2008). Consequently, we may say that at least some of the motivational skills that have been attributed to knowledge brokers (Dobbins, 2009) are highly correlated with seniority.

Regarding the mobilization of non-routine knowledge sources we have obtained interesting insights. First of all, we have proved that the R&D and Innovation Infrastructure of the company and the rest of non-routine sources are channels that are not mobilized exclusively by seniors. However, juniors make a "superficial" use of the sources rather than going deeper into the possibilities that they offer while seniors contribute to a deeper level. This means that seniority directly influences mobilization of radical sources and of the Innovation Network, probably as a consequence of their more developed social networks, image and status (Duguid, 2008), and to their acceptance as "insiders" of Alpha's Communities of Innovation (Coakes and Smith, 2007). Finally, our analysis has shown that there is a direct relation between time devoted to access of radical sources and time devoted to contributing to them, hence, suggesting that seniors are more likely to act on their ideas also due to their better accessibility to more knowledge sources (Burt, 2004).

Summarizing, in this Chapter we have evidenced that "seniority" is a good explanatory variable that allows gaining important insights about individual knowledge mobilization patterns. In fact, seniors appear as important "knowledge brokers", more intensively engaging into the main activities of these key individuals, access and contribution of knowledge, and especially through the non-routine sources available in the company. Consequently, these individuals importantly contribute to the diffusion of more radical knowledge, translating knowledge between distant communities of practices.

CHAPTER 5: GENERAL DISCUSSION: MANAGING THE TENSIONS BETWEEN EXPLORATION AND EXPLOITATION

Introduction

In the preliminary analysis in Chapter 2 we evidenced important distinctions between the day-to-day work, in which consultants exploit existing Alpha's knowledge by adding incremental and ad-hoc innovations to answer client needs, and the more sporadic activities in which new knowledge is explored (e.g. participation bottom-up initiatives of the local innovation programs) as perceived by consultants. We have also found distinctions between the more incremental or continuous innovations and more radical innovations at the company level, and between the more exploratory and exploitative activities conducted by employees at Alpha.

Moreover, the literature review evidenced the importance for companies of balancing the two activities and managing the tensions emerging between these activities if they want to succeed in innovation (Andriopoulos and Lewis, 2009) and, as a consequence, we pointed at these tensions as the fourth "hot topic" to be further analyzed in the thesis. Moreover, some authors have pointed out the need to examine this topic at the micro level and at multiple levels of analysis (Gupta et al. 2006).

Trying to address these issues and the needs detected in the literature, the objectives of this chapter are to shed new light into the management of these tensions in KIBS, at the micro level, analyzing the interplay between exploration and exploitation both at the organizational and individual level, and to offer a general discussion that integrates the results of the thesis.

1. Some insights from the literature

The use of the concepts of "exploration" and "exploitation" has pervaded organizational analysis since the coining of the terms by March's (1991) article, but the definitions and connotations of the twin concepts are still lacking consensus (Gupta et al. 2006). In a very clarifying article on the interplay between these two concepts, Gupta et al. (2006) highlight that the central ambiguity regarding the definition of these concepts lies in whether the two are distinguished by differences in the type of learning or by the presence versus the absence of learning. Drawing from the reflections done by these authors, we are going to adhere to the authors that support that the two activities are associated with learning and innovation, albeit of different types or amounts. The authors base their reflection on the building on March's logic, as he distinguished the essence of the two activities noting that exploitation's is "*the refinement and*

extension of existing competencies, technologies, and paradigms" while exploration's is "*experimentation with new alternatives*" (1991: 85). From the same perspective, Baum et al. (2000: 768) define exploitation as "*learning gained via local search, experiential refinement, and selection and reuse of existing routines"* and exploration as "*learning gained through processes of concerted variation, planned experimentation, and play*" (2000: 768).

However, as Gupta et al. (2006: 695) highlight, when defining exploration and exploitation it is essential to carefully specify the unit of analysis, as "*what one individual or organization may view exploratory and experimental learning, another team or individual may view as exploitative or incremental learning*".

In addition, the article by Gupta et al. (2006) evidences the debate on the literature on whether exploration and exploitation are: a) incompatible or two ends of a continuum, as a consequence of the competence for scarce resources, the self-reinforcing of the activities and the radically different mindsets and organizational routines they require, or b) orthogonal or simultaneously achievable, as for example learning and knowledge can be considered unlimited. Gupta et al. (2006) defend that here too the answer may depend on the level of analysis, as it may be easier to larger groups or organizations to succeed at both activities than for individuals. For example, a company may delegate exploration to an R&D unit and exploitation to the rest of complementary units (e.g. service, sales), but individuals within each group will be more devoted to one or the other due to the difficulty to develop routines to excel simultaneously at both, as the needed routines and focus on learning are substantially different. As a consequence, Gupta et al. (2006) conclude that: 1) within a single domain (i.e. an individual or subsystem), the two activities will generally be mutually exclusive but 2) across different and loosely coupled domains, the two activities may coexist.

Many authors have signaled how important it is for firms to balance exploration and exploitation, but there is lack of consensus as how to achieve and manage this balance and the tensions that emerge between them, as the two activities that are the same time complementary and contradictory (Andriopoulos and Lewis, 2009). On the one hand, exploitation and exploration are complementary activities: exploitation allows for the creation of a common knowledge base and for the replication of ad-hoc innovations and diffusion, while exploration opens new paths of activity and extends the knowledge base of the company and its future capabilities for innovation. On the other hand, the two activities are contradictory: exploitation demands efficiency to harness current capabilities and, hence, applies stricter procedures, while exploration involves experimentation efforts and, hence, needs of higher freedom of "movement". Moreover, Andriopoulos and Lewis (2009) explain that it is natural for firms to get a bias towards one of the two activities, as they tend towards homogeneity, increasingly adopting a one-sided focus on either exploitation or exploration. But they also highlight that this is a counterproductive trap, as a one-sided focus on exploitation, although allowing immediate profits, can drive companies to eventual stagnation, and a one-sided focus on exploration, can drive the company

to sought future opportunities at the expense of current operations. In other words, organizations such as Alpha face important managerial challenges to manage exploration-exploitation tensions and to avoid falling into the vicious cycles that a one-sided focus can trigger.

The main mechanisms proposed for helping organization achieving the balance between exploration and exploitation are ambidexterity and punctuated equilibrium (Gupta et al., 2006), the first option aiming at achieving the two activities simultaneously in time and the second one option for temporal cycling between periods of exploration and exploitation. Regarding the most appropriate mechanism for balancing the need for both exploration and exploration, Gupta et al. (2006: 698) conclude that: 1) when the analysis is confined to a single domain and, hence, the two activities are considered as two ends of a continuum, punctuated equilibrium is more appropriate; 2) when the analysis involves action in multiple and loosely connected domains and, hence, the two activities are orthogonal, ambidexterity is more appropriate.

In addition, we may also find two different paths of tactics for achieving ambidexterity (Andriopoulos and Lewis, 2009): architectural ambidexterity, which proposes dual structures and strategies that differentiate the efforts directed to these activities, and contextual ambidexterity, which is focused on behavioral and social means of integration, such as team-building. In other words, the main approaches advocate either for differentiation or integration, but the two tactics have their downsides: while differentiation tactics may engender isolation and impede coordination, integration tactics may increase complexity and confusion among actors as a result of the contradictory approaches of innovation.

Taking all the above in mind, the following paragraphs are devoted to analyzing the evidences found at Alpha on the interplay between exploration and exploitation and the management of the tensions emerging between them.

2. Evidence of existing exploration-exploitation tensions at Alpha

We have kept the tension between exploration and exploitation in mind all over the previous chapters of the thesis, and we have found evidence of these tensions in each of them.

First, in terms of perceptions of interviewees in the preliminary analysis, as the following quote evidences:

> *"I am not sure if we have been exactly informed about how (…) the innovation process is going to impact on our every-day work"* (Senior Manager, Consulting)
>
> *"Most employees are motivated to provide their ideas but there is no time for it because the day-to-day work takes it all. Work time is always dedicated to projects and thinking about innovation is*

something you do from your own personal time" (Manager, Consulting).

In fact, interviews have evidenced that employees make a distinction between: a) *incremental innovations* emerging from the *day-to-day work* with clients, in which services are improved continuously to adjust to the different needs in an ad-hoc basis; and b) the more *radical innovations* that emerge as a result of *specific initiatives and sporadic activities*, such as new technology emerging from the work done in the R&D units or from local innovation programs. In relation to this perception, although Hipp and Grupp (2005) questioned the distinction between radical and incremental innovations in services, employees at Alpha have distinguished between: a) the more radical the prototypes created in the Technology R&D Units or even some of the marketing and organizational innovations mentioned in Chapter 2; and b) the ad-hoc, incremental, and continuous innovations emerging from the day-to-day work in close relation to clients.

Second, the analysis of knowledge creation and mobilization from the organizational perspective (Chapter 3) has also evidenced the tension between exploration and exploitation in two ways:

1) Indirectly, as we have implicitly distinguished the R&D and Innovation infrastructure and the units specifically devoted to the more exploratory activities from the rest of the consultants of the company, working with clients in a day-to-day basis and exploiting all available knowledge; and
2) Directly, as we have found two types of R&D and innovation units:
    i. *Home base augmenting units* (i.e. Technology R&D Units, Strategic Centers, Collaboration R&D Centers and Country-specific Programs), devoted to the exploration of emergent technologies and the creation of new knowledge that increases the company's technological capabilities and absorptive capacity; and
    ii. *Home base exploiting units* (i.e. Network for small-scale R&D diffusion, and Network for large-scale delivery and implementation), which exploit and apply the existing knowledge and technologies developed in the previous units, by adapting it to the specific needs of the clients.

Third, in the analysis of knowledge mobilization by consultants, from the individual perspective (Chapter 4), we have also found evidence of these tensions, also in two ways:

1) As we have found quantitative evidence of the distinction between sources mobilized in the day-to-day work or routine sources, containing knowledge of a more incremental nature, and sources mobilized sporadically or non-routine sources, containing knowledge of a more radical nature; and
2) As we have proved that seniors more intensively mobilize non-routine sources, of a more exploratory nature, while juniors contribute more to routine sources, with more exploitative purposes.

Besides, we have also found evidence of the managerial tensions that emerge when trying to combine these "contradictory" activities. For example, our results have evidenced that perceptions about pressures for chargeability, that is, the existence of bureaucratic procedures that force employees to charge the time they invest in helping others to a specific account, directly influences the time that employees devote to the access to KM systems (i.e. incremental sources). In other words, people that perceive the existence of these pressures devote longer time to access to codified sources. On the contrary, the same perceptions inversely influence time devoted to accessing sources containing more radical knowledge. Hence, the mobilization of non-routine sources is more sensitive to the perception about barriers, as this activity needs more freedom of movement.

3. Discussion

Following the recommendation done by Gupta et al. (2006) regarding the importance of specifying the unit of analysis when defining exploration and exploitation, we have analyzed the interplay between the two activities from two different perspectives: the organization and the individuals. On the one hand, we have analyzed the R&D and Innovation units of the company, in contrast to the rest of divisions of the company, highlighting that there are two types of units depending on their functions: home base augmenting or exploring and home base exploiting (Kuemmerle, 1996). On the other hand, we have analyzed the tensions that individual consultants feel in their work, when dividing their time between day-to-day more routine practices, where they mobilize the knowledge available in the company more systematically, and the more sporadic practices, where they mobilize more exclusive sources that provide them with differential knowledge.

From the *organizational perspective*, we have seen in Chapter 3 that Alpha has created a robust infrastructure, i.e. the R&D and Innovation units, for exploration and for the creation of more radical innovations, such as the prototypes using new emergent technologies implemented at clients used (see the examples in the boxes in Chapter 3). Additionally, we have also seen that the outcomes that emerge from these units are included in the portfolio of the company and diffused through the home base exploiting units, which exploit Alpha's knowledge base. Moreover, in the exploitation and mobilization of existing knowledge, the rest of divisions of the company (not included in the R&D and innovation infrastructure) and all consultants of the company play a fundamental role, that has been analyzed in Chapter 4.

As a consequence, if we take as unit of analysis the organization, we can see that the two activities are simultaneously achievable or orthogonal (Gupta et al., 2006): while the home base augmenting units of the company are mainly devoted to exploration, the rest of the company is mainly devoted to the refinement and reuse of existing routines. In addition, the mechanism applied for finding a balance between the two activities is ambidexterity, that is, simultaneity in time, mainly by applying the differentiation tactic (Andriopoulos and Lewis, 2009).

From the *individual perspective*, we have analyzed the individual patterns of knowledge access and contribution by consultants, distinguishing among the types of sources that they mobilize. In this sense, results have shown that, although the mobilized knowledge sources slightly vary depending on the problem that is being faced, the choice of the sources is more dependent on whether the knowledge that is being mobilized is needed in the day-to-day work (routine knowledge) or sporadically (non-routine knowledge).

The knowledge sources that are used very frequently in the day-to-day work (i.e. KM tools and personal communication) are complementary (Faulconbridge, 2006) and necessary for innovation, as the conversion of knowledge into explicit allows for the creation of a common knowledge base (Mors, 2010), allowing the replication of ad-hoc innovations and diffusion. However, both interviews and the literature (Scarbourgh and Swan, 2008) have evidenced that consultants in KIBS tend to report and codify information that is obligatory and urgent, and have less propensity to invest time in codifying knowledge voluntarily. As a consequence, most of the information included in the KM tools is of an incremental nature, which is used with mainly exploitation objectives (e.g. accessing lessons learned, or methodologies that have been already accepted, or reusing templates applied in previous projects). On the contrary, more exploratory or radical knowledge is mobilized mainly through other sources, such as communities and special internal departments (e.g. the R&D and Innovation units) in a more voluntary manner. Hence, these knowledge sources are not only more sporadically mobilized, but also by fewer people, willing to explore knowledge that is more distant from their day-to-day work.

As a consequence of the above, we may say that from the individual perspective exploration and exploitation are two ends of a continuum and that, as a consequence, consultants devote time to one or the other. As a consequence, and following the reflections of Gupta et al. (2006), the mechanism for balancing the two activities is punctuated equilibrium, that is, consultants devote long times to exploitation activities alternated with shorter times of exploration.

However, the analysis in Chapter 4 has evidenced that not all consultants mobilize knowledge sources equally. In fact, seniors have emerged as crucial knowledge brokers, as they are able to access and contribute more intensively to all kind of knowledge sources but especially to sources containing non-routine knowledge. We have proved that seniors mobilize more frequently and more intensively knowledge sources that are more related to exploratory activities, that is, sources containing more radical knowledge and communities. In fact, as we have defined "radical" knowledge as knowledge that is more distant from the knowledge mobilized in the day-to-day work practice, in relative terms, it can be clearly related to exploratory activities. This means that, as consultants grow in the hierarchy and become seniors, and also as they grow as seniors and become senior managers and company partners, their focus expands little by little, adopting a more integrative perspective to ambidexterity and increasingly combining exploitation and exploration, as seniors are more involved into knowledge mobilization of all the analyzed types. Consequently, as consultants

grow in the hierarchy, the differentiation tactic is softened and individuals perceive a more integrative management of the exploitation-exploration tension. In other words, although the mechanism for balance between exploration and exploitation at the individual level is still punctuated equilibrium, the time devoted to exploration increases with seniority. This change in the equilibrium may affect motivation and individual perceptions about the knowledge system of the company (Gupta et al. 2006).

4. Conclusions

Looking at all these insights, we may say that that, at the organizational level, Alpha is an ambidextrous organization as it manages both exploration and exploitation simultaneously. But what can we learn about the tactics applied by KIBS to manage the tension between the two activities from our case study?

We have seen that, from an organizational perspective, Alpha implements a differentiation tactic that maintains the more explorative activities of the R&D and innovation units separated from the day-to-day work of consultants, which is more focused on efficiency and on the exploitation of existent knowledge in new contexts (i.e. new clients). As a consequence, we could say that we can actually find two different categories of "corporate citizens" (Kanter, 2006): consultants mainly focused on exploration and consultants mainly focused on exploitation.

From the individual perspective, we have evidenced a separation between exploration and exploitation, in terms of the sources mobilized in each case, but mainly in terms of the distinct activities done by juniors and seniors: juniors more devoted to exploitation and seniors more intensively to exploration. This means that, if we include a dynamic perspective in terms of time (length of tenure) or in terms of the dynamic of the professional career at the company, we find a more integrative management of exploitation and exploration that comes with seniority. Hence, the differentiation tactic applied is softened if we include this new variable.

Taking into consideration that we have evidenced a more positive perception by seniors about the knowledge system of the company, we believe that this could be explained by the more integrative management of the tension between exploration and exploitation as perceived by seniors. If the more integrative balance of the two activities and perceptions about the knowledge system of the company are related, this would create a positive virtuous cycle, as we have proved that positive perceptions reinforce the mobilization of knowledge and specially the more sensitive voluntary mobilization of non-routine and radical sources.

CHAPTER 6. LIMITATIONS AND FUTURE RESEARCH

Before summarizing the main conclusions of this thesis, it is important to have in mind that this research has some important limitations.

First of all, in the preliminary analysis and along the rest of chapters, we have evidenced that there exists an important gap in the literature regarding the integration of the different frameworks or theoretical threads, for example between the authors focusing on stocks of knowledge (mainly ICM literature) and flows of knowledge (mainly KM literature). In this sense, we have agreed with Adams et al. (2006) when they say that "*there is a risk that different operationalizations of the same effect will produce conflicting findings, and that theoretical advances become lost in the different terminologies that resist the accumulation of knowledge*" (p.22).

In this thesis, we have tried to adopt an integrative perspective to make a little step in the sense of finding common places in the literature. However, we acknowledge that the achieving of such integration of the different operationalizations and theories is a very ambitious objective, and it is evident that this thesis has only achieved a tinny step. We believe that this is an important gap and that more research and theoretical reflection is needed.

Second of all, our analysis is based on a single case study and, hence, results cannot be generalized for the entire service industry. In addition, we have only considered the case of the Spanish subsidiary to analyze: a) the specificities of the local R&D and innovation infrastructure, and b) the patterns of individual knowledge mobilization. However, regarding the analysis of the R&D and Innovation Infrastructure in Chapter 3, even if we only present the results of one company these are enough to evidence that the general theory that states that innovation in service companies is produced ad-hoc and neglects the existence of specific R&D units should be revisited. Moreover, as it has been already explained in the section devoted to methodology in Chapter 3, the Spanish Innovation Program represents one of the most advanced local initiatives within the company, which has gained important recognition and attention, and its analysis perfectly allows envisaging the complexity of the R&D and Innovation infrastructure of the company. Regarding the analysis of the patterns of knowledge mobilization, as the object of analysis goes down to the individuals, we believe that the analysis of a single company can provide important insights that could be applied to similar large KIBS. In this sense, we have seen that many studies on knowledge circulation are based on single case studies.

Third, the analysis in Chapter 3 does not provide an exhaustive picture of all existing units and information about their creation and evolution. This is because many of the analyzed units have been created in the time span of this research

and additional information has been continuously added to the documentary analysis, evidencing the "on the making" character of Alpha's R&D and Innovation infrastructure. Further research with a longitudinal perspective could provide new interesting insights regarding the evolution of the R&D and innovation organization in KIBS.

Forth, in relation to Chapter 4, an important part of the literature has emphasized the benefits of knowledge mobilizations for companies in terms of increasing effectiveness, as it allows the exploitation of lessons learned and best practices, or in terms of increasing innovation, as it allows the exploration of new ideas to develop creative solutions. As a consequence, it could seam that the more knowledge is mobilized and the more time is invested in accessing and contributing to knowledge the best for companies. In this sense, some scholars have challenged this generally accepted idea and emphasized that, sometimes, the potential drawbacks of knowledge sharing (e.g. difficulties to search relevant knowledge, complexity of knowledge transfer and integration, difficulties to act on acquired knowledge etc.) may outweigh its potential benefits (Haas and Hansen, 2005). For example, Haas and Hansen (2005) analyze the strategies that consultant teams followed for utilizing knowledge when developing proposals for clients and found out that some of the strategies were detrimental, attributing this to the "motions of consulting" and the formal incentives that prompted consultants to utilize all available knowledge sources and to the informal but pervasive norm of knowledge sharing in the firm. We find similar insights in the literature devoted to knowledge brokers as, for example, Leonardi and Bailey (2013) state that "*like most work activities, recognizing and selling good ideas take time and energy, both of which may be in short supply for brokers*".

To address this question, Haas and Hansen (2005) propose that there is a need to evaluate the impact of knowledge use on the performance of critical tasks of the firm, that is, to adopt a "situated performance perspective" of knowledge sharing. Although we acknowledge that these authors have posed an important issue and that knowledge should be seen as good that has value in use (Ibid.) we have not adopted a situated performance perspective in our analysis of knowledge mobilization. In fact, we have not analyzed the direct effects on performance of Alpha's knowledge circulation, as we believe it is very difficult to attribute to a specific knowledge mobilization some specific innovation or performance outcomes. Instead, and following Hargadon and Sutton (1997), we have rather presumed that all ideas and knowledge are potentially good if used in the right situation. Hence, we have presumed that greater mobilization of knowledge would increase the potential or capability for innovation. In addition, the interviews and the results of the survey have evidenced that the "motions of consulting", regarding the bureaucratic needs of charging times, meeting deadlines and of being effective, actually restrain the investment of time in voluntary knowledge mobilization activities and, hence, the potential detrimental effects of investing "excessive" time in mobilizing knowledge are "naturally" controlled. However, we acknowledge the need of further research in this topic.

Fifth, also regarding Chapter 4, social network literature has found out that seniors often play a peripheral role in informal networks within organizations (Allen et al., 2007), showing that this type of analysis is useful to determine important individuals or knowledge brokers. We acknowledge that our analysis does not provide this type of results and that we have provided an image of seniors of the company as if they were a homogeneous category. If we had conducted a social network analysis we could have possibly found out that different seniors follow very different patterns of knowledge mobilization. Hence, we believe that there is yet much place for further research on knowledge brokering and on the identification of the issues that influence individual decisions and behaviors regarding knowledge mobilization.

Finally, both the literature review and the empirical analysis have evidenced the existence of many organizational tensions that have an important influence on the management of innovation in KIBS. We have mainly looked at tensions between exploitation and exploration, but there is much place for research in the topic of the management of contradiction in organizations.

CHAPTER 7. SUMMARY OF CONCLUSIONS AND CONTRIBUTIONS OF THE THESIS

This thesis aimed at shedding new light into some aspects of the knowledge creation and mobilization process in KIBS, as these processes have been highlighted as critical for building innovation capabilities in any company. We have addressed this general objective from two perspectives: a) from an organizational perspective, looking at the case study company as object of analysis and analyzing its organization of R&D and innovation; and, b) from an individual perspective, looking at individual knowledge mobilization patterns, with consultants of the Spanish subsidiary as object of analysis.

Regarding the organization of R&D and innovation, we have seen that large KIBS such as our case study company have important similitudes with large technology-intense manufacturing industries. In particular, we have found that some of the R&D and Innovation units found at Alpha mirror the units found in large technology-intensive manufacturing, in terms of their focus on long-range thinking or the immediate market needs, their functions (i.e. generic R&D, applied R&D, tailored R&D, small-scale diffusion and large-scale diffusion), their basic roles (i.e. home base augmenting units and home base exploiting units), the reason for their location (i.e. access to science and technology and access to markets and led users). In addition, we have also found that the innovation diffusion process at KIBS has many common features with the diffusion process described by Rogers (1995).

However, we have also found important differences between large KIBS and large technology-intensive industries. A remarkable difference is the existence of specific units devoted to the small-scale diffusion and large-scale adoption of the developed new solutions that follow an ad-hoc implementation perspective with high involvement or participation of the clients, which is typical for services and that is not generally found in manufacturing (Miles, 2008; Gadrey and Gallouj, 1998). Consequently, the diffusion process at KIBS more intensively relies on individuals and on the knowledge mobilized by consultants.

However, maybe as a consequence of the high dynamism of the R&D and innovation infrastructure, or of its complexity (as there coexist many global-reach units, local programs, business units and industry divisions, hierarchical levels, and client accounts), or of its "on the making" character, it seams that very few people in Alpha have a general perspective of its infrastructure. We have also analyzed an alternative explanation for this unawareness, trying to find out whether knowledge mobilization patterns and access to available resources changes between employees of the company. In other words, we have analyzed whether we can find two different groups of corporate citizens in the company with different opportunities for mobilizing knowledge.

Regarding individual patterns of knowledge mobilization in KIBS, we have tried to integrate some different threads of the literature, adopting as integrative framework the literature on knowledge brokers (Muller et al. 2013). In this sense, we have seen that, in fact, in KIBS seniors play a central role in knowledge mobilization, contrary to previous insights from the literature that positioned them as peripheral (Allen et al., 2007).

Seniors at KIBS more intensively mobilize all types of knowledge sources, but specifically those containing non-routine knowledge (i.e. more radical knowledge and knowledge embedded in communities of practice). In addition, we have also evidenced that many of the attributes or motivational skills that had been previously related mainly to intrinsic personality characteristics of knowledge brokers (Howell and Higgins, 1990; Dobbins, 2009), such as motivation, charisma, or engagement beyond functional responsibilities (Henard and McFadyen, 2008) are highly correlated with seniority and may be developed while working in the company. In other words, we have found evidence supporting that knowledge brokers are not necessarily born but grown.

Moreover, we have shown that KIBS are ambidextrous organizations (Andriopoulos and Lewis, 2009), as they pursue activities for the exploration of new knowledge and for the exploitation of the existent knowledge at the same time. However, the tensions emerging from the different and even contradictory management styles of each activity poses important managerial challenges to these organizations. Our results shows that, at the organizational level, in our case study company these tension are managed by adopting a differentiation tactic that maintains the more explorative activities of the R&D and innovation units separated from the day-to-day work of most consultants, which is more focused on efficiency and on the exploitation of existent knowledge in new contexts (i.e. new clients). As a consequence, we may say that we can actually find two different categories of corporate citizens (Kanter, 2006): consultants mainly focused on exploration and consultants mainly focused on exploitation. At the same time, at the individual level we have also seen that, as consultants grow in the hierarchy and become seniors, their focus expands little by little, mobilizing more intensively non-routine knowledge sources more related to exploration. In other words, adopting a dynamic perspective that includes time (length of tenure) or a dynamic vision of the professional career, the differentiation tactic is progressively reduced and seniors perceive a more integrative management of the exploitation-exploration tension, which may affect their general perceptions about the knowledge system of the company (Soo et al. 2002).

As a final conclusion, our results suggest that, if the better individual perception about the knowledge system of the company by seniors is a consequence of the more integrative management of the tension between exploitation and exploration for these individual, this tactic creates a positive virtuous cycle that reinforces the mobilization of knowledge and specially the more sensitive voluntary mobilization of non-routine and radical sources.

As a consequence of the above, we believe that this thesis makes the following contributions to this very complex and multidimensional topic:

1. It contributes to the literature on KM, ICM, and innovation management, as it adopts an integrative perspective needed for the accumulation of knowledge, with a static vision on "stocks" and a dynamic vision on "flows" of the knowledge creation and mobilization in services, and with a broad view of knowledge management and intellectual capital management that includes some socio-technical aspects of innovation (e.g. trust, culture clashes, organizational support, competing priorities…).
2. It provides further evidence that supports that large KIBS have important differences and similitudes with large technology-intensive manufacturing, corroborating previous research that calls for a synthesis approach (Gallouj and Windrum, 2009) to the analysis of KIBS.
3. It contributes to the literature on innovation in services with an organizational analysis of R&D and innovation infrastructures in KIBS, evidencing the need to rethink the traditional theory that overlooks the existence of R&D units in services.
4. It contributes to the literature on knowledge sources and knowledge mobilization with a joint analysis of the mobilization of the most important knowledge sources available in companies, adopting literature on knowledge brokers as integrative perspective.
5. It proves the central role of seniors as knowledge brokers in KIBS, contrasting with some research on informal knowledge networks that has considered them to be peripheral figures.
6. It contributes to the literature on knowledge brokers surpassing an analysis based on characteristics of individual personality, such as charisma, and adopting an organization focus and developing a methodology that can be useful to detect knowledge brokers by looking at observable characteristics of individuals, such as category, length of tenure, evaluation, and another set of variables based on individual perceptions. Moreover, it establishes a relationship between the characteristics of personality traditionally analyzed in the literature and category.
7. It contributes to the literature on the interplay between exploration and exploitation, as it analyzes their balance at different levels of analysis, including the micro level, evidencing the importance of considering a dynamic perspective, such as time (length of tenure) or a dynamic vision of the professional career, on the analysis of the tensions between exploration and exploitation.

RESUMEN Y CONCLUSIONES

EL CONOCIMIENTO PARA LA INNOVACIÓN EN LAS KIBS: UN ESTUDIO DE CASO SOBRE EL EQUILIBRIO ENTRE EXPLORACIÓN Y EXPLOTACIÓN. EL ROL DE LA ORGANIZACIÓN DE LA I+D Y DE LOS CONSULTORES

1. Introducción y objetivos

La creación de nuevo conocimiento y la movilización de todo el conocimiento existente para dar soluciones creativas e innovadoras a las necesidades de los clientes es clave para cualquier empresa, pero de manera más importante para las empresas de negocio intensivas en conocimiento (Knowledge Intensive Business Services, KIBS). En este sentido, el ***objetivo general*** del trabajo de tesis doctoral que se resume en este documento ha sido el de ***iluminar algunos aspectos del proceso de creación y movilización del conocimiento, que son clave en la capacidad innovadora de las KIBS***. Para ello, se ha analizado en profundidad el caso de una gran empresa multinacional referente en el sector de la consultoría y que constituye el arquetipo de este tipo de empresas. Para mantener la confidencialidad en la tesis se ha sustituido el nombre de la empresa por Alpha y se han modificado los nombres de otras unidades, estructuras, herramientas etc. que pudieran ser fácilmente identificables.

En una fase preliminar exploratoria de la tesis se identificaron los intangibles clave para la innovación en base a la literatura especializada en gestión del conocimiento, gestión del capital intelectual y gestión de la innovación y se realizaron un análisis documental y una serie de amplias entrevistas cuyos objetivos eran: a) obtener una imagen de la empresa en términos de su nivel y satisfacción con los intangibles clave para la innovación, y b) detectar aquellos aspectos de mayor interés, en relación a la gestión del conocimiento de la empresa, que serían analizados en mayor profundidad en las siguientes fases de la tesis.

Como consecuencia del análisis preliminar pudimos verificar que: 1) Alpha es una empresa muy innovadora, que genera innovaciones tanto de producto/servicio como organizativas y de marketing habitualmente; 2) de manera general, los empleados de Alpha tienen una opinión positiva sobre el sistema de conocimiento de la empresa; 3) Alpha tiene una red global de unidades especialmente dedicadas a la I+D y a la innovación, lo cuál ha sido señalado en la literatura como algo inusual en servicios; 4) existen algunas percepciones sobre la existencia de limitaciones o barreras para el flujo o la movilización interna de conocimiento, que se han identificado en la literatura como "trampas a la innovación" habituales, que deberían ser estudiadas en más profundidad; y 5) existe una importante distinción por parte de los empleados

entre su trabajo del día a día y las actividades más esporádicas relacionadas con la innovación.

Teniendo estos resultados preliminares en consideración, en una segunda fase se ha analizado más específicamente la creación y movilización del conocimiento dentro de la empresa desde dos perspectivas:

1) Desde un ***punto de vista organizativo***, hemos analizado en profundidad las distintas ***unidades*** existentes en la empresa ***dedicadas a la I+D y a la innovación*** y, por tanto, a la exploración o creación de nuevo conocimiento. En este sentido, hemos intentado dar respuesta a las siguientes preguntas: *¿Cómo se crea y se distribuye el conocimiento en las KIBS? ¿Cómo se organiza la innovación en las KIBS? ¿Son las grandes KIBS diferentes de las grandes empresas manufactureras intensivas en tecnología en este aspecto?*
2) Desde un ***punto de vista individual***, hemos analizado la ***participación de los consultores en la creación y movilización del conocimiento de la empresa***, mediante el acceso y la contribución a la base de conocimiento de la misma. Además, en el análisis de la participación individual en la creación y movilización del conocimiento, hemos intentado responder por qué existen percepciones contrapuestas entre los empleados sobre el sistema de conocimiento de Alpha, es decir, sobre la existencia de incentivos y barreras, y en qué medida influyen las limitaciones encontradas en las decisiones individuales de participar. En este sentido, las preguntas a las que hemos intentado dar respuesta son las siguientes: *¿Qué variables influyen sobre los patrones individuales de participación en la creación y movilización del conocimiento en las KIBS?* O en otras palabras, *¿Qué variables influyen en los patrones individuales de acceso y contribución a las distintas fuentes de conocimiento disponibles en las KIBS?* Además nos hemos preguntado lo siguiente: *¿Es la categoría de "senior" (incluyendo seniors, senior managers y senior executives) la principal variable que determina las diferencias en los patrones individuales de movilización del conocimiento?¿Son los seniors en las KIBS los principales "knowledge brokers"?¿Son los recursos de conocimiento generados en las unidades de I+D e innovación de la empresa recursos "exclusivos" que son movilizados principalmente por los seniors de la empresa?*

Además, dado que en el análisis preliminar se ha detectado una clara ***separación*** por parte de los empleados entre su ***trabajo del día a día y el trabajo más esporádico relacionado con la innovación***, un último objetivo del estudio ha sido el de entender de qué dependen estas percepciones y cómo influyen en la creación y movilización del conocimiento. En esta línea, se ha intentado arrojar nueva luz sobre el balance y gestión de las tensiones entre la actividades relacionadas con la explotación del conocimiento existente en la empresa y con la exploración de nuevo conocimiento.

2. Metodología

Como ya se ha mencionado, la tesis doctoral que aquí se resume se ha basado en un único estudio de caso en profundidad de una gran empresa consultora, que provee de distintos servicios de negocio (consultoría, soluciones tecnológicas y outsourcing de procesos de negocio) a multitud de clientes a nivel global.

El análisis preliminar y el análisis de las unidades de I+D e innovación detectadas en éste se han basado en métodos cualitativos, dado que requerían de una comprensión en profundidad y visión de la empresa que sólo este tipo de métodos pueden conseguir. Así, además de un análisis documental que incluyó material muy diverso (e.g. informes tecnológicos y de innovación, documentos internos con modelos de gestión de la innovación, documentos sobre la visión y misión de la empresa, información de la intranet sobre comunidades, grupos, y unidades, información sobre metodologías internas) se realizaron un total de 39 entrevistas con empleados de diversos perfiles (Tabla 1).

Tabla 1: Resumen de entrevistas

Periodo	Nº entrevista	Región	Nivel gestión	Área
10/05/2010 05/06/2012	39	España (38) Francia (1)	17 Alto 16 Medio 6 Bajo	20 Consultoría 1 Soluciones Tecnológicas 1 BPO 17 Funciones Corporativas

El análisis de la participación individual en la creación y movilización de conocimiento de la empresa, por su parte, se ha basado en una encuesta original enviada a parte de los empleados de la empresa en España. Partiendo de los conocimientos obtenidos del análisis preliminar, se diseñó un cuestionario en el que se estudian: a) los patrones de acceso (frecuencia de acceso y tiempo dedicado) por parte de los empleados a las distintas fuentes de conocimiento disponibles en la empresa, para obtener distintos tipos de conocimiento (sobre el cliente, la industria, temas específicos, y metodología interna); b) la movilización del conocimiento mediante las relaciones personales en la empresa; y c) los patrones de contribución por parte de los empleados a las distintas fuentes de conocimiento disponibles en la empresa. En total, se analizó el uso de 14 fuentes de conocimiento diferentes, que pueden dividirse en cinco grandes bloques: herramientas de gestión del conocimiento (conocimiento codificado), conocimiento basado en relaciones personales, comunidades o grupos internos, unidades especiales (departamentos internos y la red de unidades de I+D) y fuentes externas.

Además de los patrones de acceso y contribución al conocimiento, la encuesta analizaba las percepciones individuales sobre la existencia de algunas barreras e incentivos señalados en la literatura como importantes para la movilización del conocimiento y que se habían identificado en las entrevistas. Así, analizamos las percepciones sobre la influencia en el acceso al conocimiento de las divisiones de la empresa o silos, de la cultura de colaboración, del modelo de evaluación basado en un banding competitivo, de la cargabilidad de los tiempos, y de la

jerarquía, así como las percepciones sobre la influencia en la contribución al conocimiento del apoyo por parte de los supervisores y de la información sobre el uso que se iba a dar a las ideas.

La encuesta se envió a un total de 5.998 empleados en España, siguiendo un patrón de envíos que mantuviera la representatividad del total de la población y su distribución. Obtuvimos una tasa de respuesta del 10,6%, con un total de 637 cuestionarios completos recibidos. La Tabla 2 ofrece un resumen de la clasificación por áreas y categoría de los respondientes.

Tabla 2: Resumen de la encuesta (% respuestas)

	Consultoría	**Soluciones Tecnológicas**	**BPO**	**Funciones Corporativas**	**Total**
Analyst	7,1	23,5	20,6	1,7	52,9
Consultant	8,2	14,2	5,9	1,9	30,2
Manager	5,2	1,2	1,6	0,8	8,8
Senior Manager	3,3	0,5	1,3	0,6	5,6
Senior Executive	1,7	0,2	0,4	0,1	2,4
Total	25,5	39,6	29,7	5,1	100,0

Los resultados de la encuesta se analizaron utilizando distintos métodos:

- un análisis descriptivo básico mediante tablas de contingencia, para ver si la variable de la categoría de "senior" es una variable relevante en el análisis y para detectar otra serie de factores a incluir en los modelos econométricos,
- un análisis discriminante para estudiar la significatividad estadística de la variable de "seniority"
- un análisis cluster para estudiar la existencia de variables latentes que influyan en las decisiones de movilizar las distintas fuentes de conocimiento internas existentes en la empresa
- dos modelos econométricos diferentes: el primero para estudiar los patrones de acceso a las fuentes internas de conocimiento y el segundo para estudiar los patrones de contribución a las fuentes internas de conocimiento (ver Anexo).

3. Resultados y Discusión

3.1. Organización de la I+D y la innovación

De la revisión de la literatura en innovación en servicios y de la literatura en organización de la I+D en grandes empresas de manufacturas intensivas en tecnología hemos extraído una serie de ideas clave que se enumeran a continuación (Tabla 3) y que han servido de base para el análisis de las distintas unidades dedicadas a la I+D y a la innovación detectadas en Alpha.

Tabla 3: Ideas clave de la revisión de la literatura

Innovación en servicios
– Existencia de distintos patrones de innovación; – Aspectos organizativos de la innovación no adecuadamente abordados; – Investigación enfocada en la idea de que el conocimiento y la innovación en servicios sector se producen de manera ad-hoc, en co-creación con el cliente, subestimando la existencia de unidades específicas dedicadas a la I+D; – Los servicios hacen I+D, aunque no esté organizado en unidades funcionales especializadas, pero la definición de esta actividad es amplia incluyendo p.e. investigación en ciencias sociales y humanidades;
Organización de la I+D en grandes empresas manufactureras intensivas en tecnología
– La organización interna de la I+D en manufacturas no se ha estudiado suficiente; – Existe una tensión histórica entre la I+D básica y aplicada que se ha traducido en un dilema organizativo entre: a) énfasis en I+D básica que permite un pensamiento a largo plazo al servicio de las necesidades de la organización, y b) énfasis en I+D aplicada que persigue resultados a corto plazo y sirve las necesidades del mercado y de las líneas de negocio; – 3 modelos generales de diseño de la I+D, dependiendo de su enfoque en: a) investigación básica, b) necesidades del negocio, y c) mix entre orientación a la ciencia y al mercado. – En las áreas o industrias en las que la cercana comprensión de las necesidades de los clientes es clave, una estructura organizativa de la I+D descentralizada provee de conocimiento más customizado. – Razones principales para establecer unidades de I+D en el extranjero: a) acceso a la ciencia y la tecnología, y b) acceso a mercados y usuarios líderes. – 2 tipos de unidades de I+D descentralizadas, dependiendo de su rol como: a) adaptadoras del conocimiento existente a las necesidades locales, y b) creadoras de nuevas tecnologías y conocimiento.

Teniendo en cuenta los resultados de la revisión de la literatura se han analizado los distintos tipos de unidades dedicadas a la I+D y la innovación detectadas en Alpha, las cuales se han clasificado en seis categorías: 1) Unidades de I+D Tecnológica; 2) Centros Estratégicos; 3) Centros de I+D en Colaboración; 4) Red de Difusión de la I+D; 5) Red de Implementación; y 6) Programas de I+D e Innovación Específicos al País. La Tabla 4 ofrece un resumen del análisis de estas unidades.

Además del análisis de las distintas unidades resumido en la Tabla 4, se ha hecho un "mapeo" no exhaustivo de la localización de las distintas categorías de unidades en la empresa a nivel global, analizando el por qué de la selección de dichas localizaciones. En este sentido, se ha visto que dicha localización suele basarse en un mix de razones que incluyen el acceso a mercados, a alianzas tecnológicas, a conocimientos, a condiciones institucionales específicas etc.

Tabla 4: Análisis de las unidades de I+D e innovación

	Función / Objetivo	Link a servicios innovadores	Ejemplos introducidos
Unidades de I+D Tecnológica	I+D genérica. Producir nuevas tecnologías.	Las eventuales aplicaciones de los resultados de I+D se presentan a sponsors (senior executives) que estudian las necesidades de los clientes y hacen de intermediación con ellos.	Box1: Descripción del método de análisis seguido para fijar la estrategia tecnológica de I+D en base a las tendencias clave del mercado. Box2: Mención a I+D genérica realizada en herramientas analíticas y web mining, tecnologías de servicios de TV interactivos... Box3: Soluciones para: a) análisis predictivo para prever problemas en el transporte público y b) seguimiento del comportamiento de consumidores.
Centros Estratégicos	I+D aplicada. Producir nuevo conocimiento y tecnologías unidas a iniciativas estratégicas		Box4: Dos ejemplos de creación de nuevos centros para I+D en: a) técnicas analítica y business intelligence para la cadena de suministros, y b) soluciones innovadoras para los medios sociales.
Centros de I+D en Colaboración	I+D a medida. Desarrollo de soluciones a medida a las necesidades de cada alianza.	La alianza explota los resultados de la I+D en función de los acuerdos establecidos.	Box5: Ejemplos de cooperación para el desarrollo de soluciones analíticas relacionado con plataformas SAP y de cooperación para el desarrollo de merchandising digital.
Red de Difusión de la I+D	Difusión a pequeña escala de la I+D. Difusión de los resultados de I+D a clientes actuales y potenciales.	La red difunde los usos y aplicaciones de las nuevas tecnologías desarrolladas y de los servicios innovadores asociados.	Box6: Ejemplos de centros donde se ofrecen experiencias (e.g. demostraciones, workshops) al cliente en relación a nuevas tecnologías en servicios de gestión de la información, showcases tecnológicos relacionados con la industria de pagos global, o con soluciones tecnológicas aplicables al sector manufacturero.
Red de implementación	Implementación a gran escala de la I+D. Despliegue y desarrollo de las tecnologías aceptadas para ajustarse a las necesidades específicas del cliente.	La red implementa las tecnologías desarrolladas en los clientes creando innovaciones incrementales para ajustarse a sus necesidades específicas.	Box7: Ejemplo de implementación de metodologías y herramientas para la transformación de las operaciones de recursos humanos de un cliente en el área de los servicios financieros.
Programas de I+D e Innovación Específicos al País	Adaptación de innovación interna y externa a necesidades locales. 1) cultura interna de innovación y creatividad (bottom-up), 2) creación de negocio, 3) imagen y respuesta local.	Incrementan la capacidad de absorción local, integrando capacidades externas y articulando las ideas bottom-up, para dar respuesta a las necesidades locales de los clientes.	Box8: Ejemplo del Programa de Innovación Español en el que se describen de manera escueta los 3 objetivos perseguidos por el mismo y el medio de alcanzarlos.

Con los resultados descritos hasta ahora hemos podido dar respuesta a las dos primeras preguntas de investigación planteadas: *¿Cómo se crea y se distribuye el conocimiento en las KIBS? ¿Cómo se organiza la innovación en las KIBS?* Sin embargo, para dar una estructura más clara a los resultados y responder si *las grandes KIBS son diferentes de las grandes empresas manufactureras intensivas en tecnología*, es necesario poner en conjunto los resultados de la revisión de la literatura y los resultados del análisis. Así, teniendo en cuenta la literatura en organización de la I+D en empresas manufactureras intensivas en tecnología, hemos clasificado las diferentes unidades de I+D encontradas en Alpha en función de una tipología que considera dos variables: el rol que juega la unidad y la razón principal para elegir la localización de la unidad de I+D. Por lo que respecta al rol principal que juega la unidad hemos distinguido entre la creación de nuevo conocimiento (home base augmenting unit) o la explotación del conocimiento existente (home base exploiting unit). Por lo que respecta a las razones principales para elegir una localización hemos distinguido entre el acceso a la ciencia y la tecnología y el acceso al mercado o a usuarios líderes. La Tabla 5 muestra el resultado de dicha clasificación.

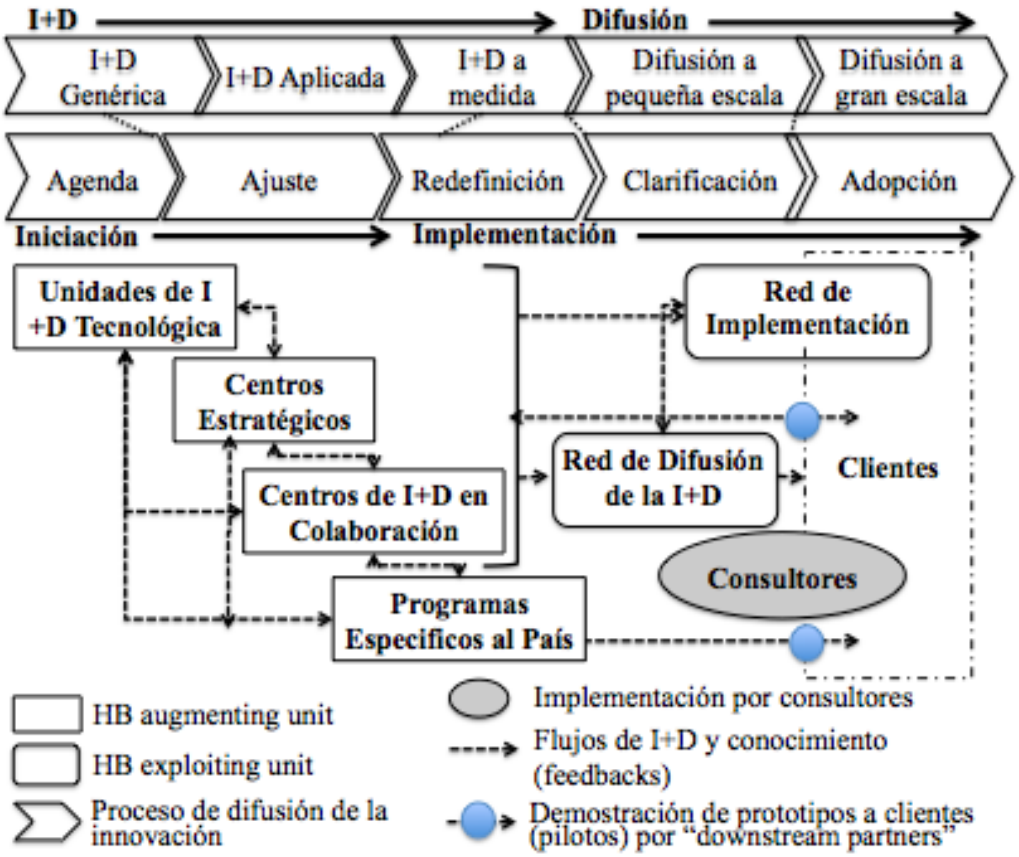
Tabla 5: Tipología de unidades de I+D e innovación

	Razón principal para localización de la I+D (Zedtwitz and Gassman, 2002).	
Rol principal (Kuemmerle, 1996)	Acceso a **CIENCIA y TECNOLOGÍA**	Acceso al **MERCADO** y **LED USERS**
Home base augmenting units	*Unidades de I+D Tecnológica* → Enfoque en investigación a largo plazo	*Centros Estratégicos* & *Centros de I+D en Colaboración* & *Programas de I+D e Innovación Específicos al País* → Enfoque en necesidades del mercado
Home base exploiting units	No hallado.	*Red de Difusión de la I+D* & *Red de Implementación* → Enfoque en adaptar e implementar las tecnologías desarrolladas en cada cliente

Además, nuestro análisis también ha puesto en evidencia que las distintas unidades intervienen en un momento diferente del proceso de innovación ya que, mientras las "home base augmenting units" se dedican a la I+D que va desde genérica a aplicada y a medida, las "home base exploiting units" están dedicadas a la difusión de los resultados a pequeña y gran escala, ajustando las soluciones de manera ad-hoc a los clientes. Teniendo esta evidencia en cuenta, hemos contrastado las funciones de las distintas unidades con las fases definidas por Rogers (1995) en su famosa teoría de la difusión de la innovación, y hemos encontrado un ajuste importante con éstas. Dicha teoría establece 5 fases en el proceso de innovación-desarrollo: 1) creación de una agenda de innovación en base a las necesidades o problemas identificados (hemos visto en el Box1 que las Unidades de I+D Tecnológica cumplen con esta función); 2) diseño de una solución que de respuesta a la necesidad detectada (todas las "home base

augmenting units" cumplen con esta función); 3) desarrollo y redefinición de la innovación para ajustarse a la organización (los Programas de I+D e Innovación Específicos al País adecúan las innovaciones a las necesidades locales); 4) clarificación de la relevancia de la innovación para la empresa (la Red de Difusión de la I+D a pequeña escala demuestra la utilidad de las soluciones en un limitado número de clientes); y 5) adopción de la innovación en las actividades regulares de la organización e inclusión en la cartera de productos (la Red de Implementación a gran escala implementa las soluciones cuando éstas ya son estandarizadas). La Figura 1 ilustra el ajuste entre las distintas fases descritas por Rogers y las funciones desempeñadas por las distintas unidades de I+D e innovación de Alpha.

Figura 1: Rol de las unidades de I+D e innovación en el proceso de difusión



Por tanto, ¿pueden considerarse las grandes KIBS o las grandes consultoras diferentes de las grandes empresas orientadas a la tecnología? Los resultados del análisis cualitativo de las unidades de I+D e innovación existentes en Alpha y su comparación con la literatura en grandes empresas manufactureras intensivas en tecnología han permitido encontrar una serie de similitudes importantes entre la organización de la I+D en ambos sectores. Resumiendo dichos puntos en común son los siguientes:

- Existe una tensión entre el énfasis en la investigación a largo plazo para dar respuesta a las necesidades futuras de negocio (Unidades de I+D Tecnológica) y el énfasis en los mercados y en las necesidades del

negocio a corto plazo (Centros Estratégicos), que se refleja en una organización mixta de la I+D;
- La razón principal para elegir una localización de los centros de I+D es el acceso a información superior relacionada con: a) la ciencia y la tecnología y b) las necesidades del mercado;
- Podemos distinguir dos categorías de unidades dependiendo de su rol principal como: a) creadoras de nuevo conocimiento (home base augmenting units); y b) implementadoras y adaptadoras del conocimiento existente (home base exploiting units);
- Existen unidades específicas locales (Programas de I+D e Innovación Específicos al País) que cumplen funciones ampliamente discutidas en la literatura de gestión de la innovación, es decir, incrementar la capacidad de absorción de conocimiento local, promover la creatividad y la participación bottom-up, y mejorar la respuesta a las necesidades locales.
- Las funciones desempeñadas por las distintas unidades de I+D e innovación encontradas en servicios se ajustan en gran medida a las fases de la difusión de la innovación descritas en la teoría generalmente aceptada de Rogers.

Sin embargo, nuestro análisis también ha puesto en evidencia unas diferencias importantes entre los servicios y las manufacturas o unas características que, aunque puedan encontrarse en grandes empresas manufactureras intensivas en tecnología, en las KIBS tienen una mayor importancia relativa. Estos rasgos diferenciales a tener en cuenta son los siguientes:

- Las redes de difusión de la I+D y la innovación a pequeña y gran escala encontradas (i.e. Red de Difusión de la I+D y Red de Implementación) son poco comunes en manufacturas. Aunque su rol principal es explotar el conocimiento existente, estas unidades desarrollan las distintas soluciones ad-hoc, para adecuarse en cada caso a las necesidades de los clientes, introduciendo así innovaciones incrementales. Por tanto, podemos ver que, como afirma la literatura en innovación en servicios, la interacción y co-creación con el cliente toma una mayor relevancia en los servicios, mientras que en el sector manufacturero suele haber un menor grado de individualización.
- Como consecuencia del punto anterior, en las KIBS el rol de los consultores en su trabajo del día a día con los clientes es clave, como ha quedado reflejado en la Figura 1. Así, los consultores tienen que movilizar todo el conocimiento existente en la empresa para dar soluciones creativas a los clientes.
- Finalmente, el mapeo de las distintas unidades existentes en la empresa ha puesto en evidencia el gran dinamismo de la infraestructura de I+D e innovación de Alpha, ya que muchas de las unidades se han creado en los últimos tres años y la mayoría de ellas han surgido desde 2006. Una posible explicación de este dinamismo, en contraste con las estructuras más estáticas en manufacturas, son los menores costes fijos que requiere crear una unidad de I+D en servicios. Otra posible explicación es que la

infraestructura que hemos analizado esté en "proceso de creación", lo cuál explicaría que la literatura tradicional haya pasado este fenómeno por alto.

Antes de pasar a los resultados del análisis sobre la movilización y creación de conocimiento a nivel individual, es importante establecer un link con el análisis a nivel organizativo. En este sentido, por una parte, hemos visto que el conocimiento creado en las unidades de I+D es finalmente aplicado y difundido por los consultores en su día a día con los clientes, lo cuál hace necesario pasar al análisis individual. Por otra parte, las entrevistas iniciales han mostrado que no todos los empleados de Alpha están al corriente de la existencia de la infraestructura de I+D y del conocimiento creado en estas unidades, lo cual pone de manifiesto la necesidad de analizar por qué existen esas diferencias entre empleados, ya que la literatura ha hecho énfasis en los peligros de que existan dos clases de "ciudadanos corporativos" y de la importancia de la transparencia.

3.2. Participación individual en la creación y movilización de conocimiento

La revisión de la literatura sobre los distintos tipos de conocimiento (e.g. formal, instrumental, tácito, informal…), tipos de fuentes de conocimiento (e.g. codificado, personal, comunidades), y la problemática de su movilización, ha permitido ver que la movilización o uso de cada uno de ellos conlleva una serie de beneficios para la organización. Asimismo, hemos podido ver que las limitaciones de cada una de ellas pueden ser contrarrestadas con los beneficios de otras y que, por tanto, es importante que todas esas fuentes se movilicen.

Sin embargo, la revisión ha puesto en evidencia que existe poca integración entre los estudios enfocados en unos y otros temas (p.e. investigación sobre la movilización de conocimiento mediante redes personales frente a investigación sobre el uso de las tecnologías de la información para la movilización de conocimiento codificado). Dado que en el punto anterior hemos visto que los consultores juegan un papel fundamental en la movilización de la base de conocimiento de la empresa al servicio de los clientes y que las decisiones sobre utilizar una fuente de conocimiento u otra se toman a nivel individual, hemos adoptado la perspectiva del individuo como punto integrador, tomando como referencia la literatura sobre "knowledge brokers" (KB).

En este apartado de la tesis hemos analizado de qué depende que unos consultores participen de manera más activa en la movilización y creación de nuevo conocimiento. Para ello, y en base a la teoría sobre KB hemos analizado las dos actividades principales que estos individuos desempeñan y que son: a) el acceso al conocimiento existente y la detección de "buenas ideas" y b) la contribución de conocimiento o la "venta" de ideas a potenciales usuarios de las mismas. Por tanto, hemos intentado identificar quiénes son los KB en las KIBS, ya que estos juegan un papel clave en la creación y difusión de conocimiento en la empresa y, finalmente, en la innovación. Sin embargo, en vez de fijarnos en características de la personalidad (p.e. carisma), como han hecho estudios

anteriores, hemos enfocado el análisis en rasgos "observables", como la categoría profesional.

Partiendo de la revisión de la literatura, y para dar respuesta a las primeras preguntas de investigación, se han establecido una serie de hipótesis concretas que han sido contrastadas con los modelos econométricos descritos en el Anexo metodológico. La Tabla 6 ofrece un resumen de los resultados de todos los test de hipótesis realizados.

Es importante mencionar que, como resultado del análisis cluster hemos comprobado que la movilización de las distintas fuentes de conocimiento disponibles en la empresa no se basa (principalmente) en el tipo de conocimiento que se busca o se quiere aportar (sobre el cliente, la industria, específico o sobre metodologías internas) sino en el tipo de fuente que se moviliza en sí mismo. Es decir, hemos visto que, independientemente del tipo de conocimiento que se busque (aunque haya variaciones sutiles) las fuentes codificadas, que contienen conocimiento más incremental, y las fuentes personales son movilizadas de manera sistemática y rutinaria por todos los consultores. Por el contrario, las comunidades y las fuentes con conocimiento más radical (las unidades específicas, como por ejemplo las unidades de I+D) son movilizadas de manera mucho más esporádica y por una proporción menor de consultores. En otras palabras, podemos hacer una distinción entre las fuentes de uso rutinario y las fuentes de uso no-rutinario. Los resultados en la Tabla 6 diferencian entre acceso/contribución a fuentes de conocimiento incremental (I), personal (P), comunidades (C) y radical (R).

Por tanto, *¿Es la categoría de "senior" (incluyendo seniors, senior managers y senior executives) la principal variable que determina las diferencias en los patrones individuales de movilización del conocimiento (acceso y contribución)?* La razón por la que hemos testado si los "seniors" de la empresa pueden considerarse, de manera general, los KB es porque esta categoría está correlacionada con bastantes de las características que se han señalado en la literatura como pre-requisitos para ser KB. Por ejemplo, se ha señalado que los KB tienen un gran anclaje en la empresa, buenas habilidades sociales y comunicativas, son conocidos y reconocidos internamente por los compañeros, pueden movilizar apoyo interno, tienen habilidades de persuasión y negociación etc. Aunque parte de estas características pueden tener un componente de personalidad, dado el modelo de carrera que tiene Alpha y los aspectos que se tienen en cuenta como parte de las habilidades requeridas para ser senior, hemos considerado que la categoría podía ser una variable suficiente que integrara estas características o pre-requisitos de los KB. Así, los resultados de los modelos han puesto en evidencia que, en efecto, "seniority" es la variable determinante más significativa para explicar los patrones individuales de movilización del conocimiento en la empresa. En otras palabras, los seniors son significativamente más activos en los dos principales roles que juegan los KB: acceder a nuevo conocimiento y contribuir a la base de conocimiento de la empresa.

Tabla 6: Resumen de los resultados del test de hipótesis

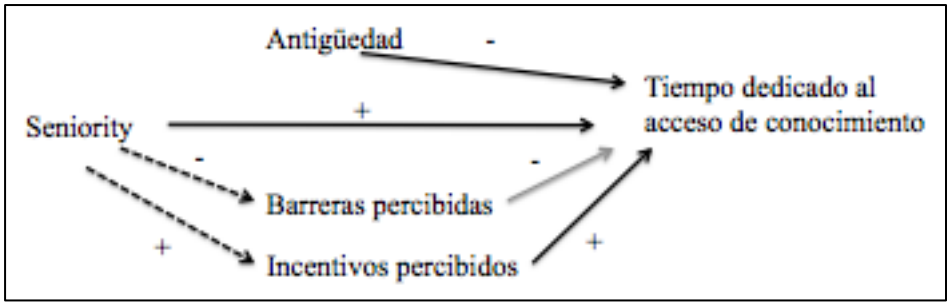
HYPOTHESIS		**RESULTADOS**				
ACCESO (Modelo 1)		**A_I**	**A_P**	**A_C**	**A_R**	**TEST**
H_1: Ser senior (**seniority)** influye directamente en el acceso al conocimiento.		+	+	+	+	✓
H_2: La antigüedad (length of **tenure)** influye inversamente al acceso al conocimiento.		-	-	-		✓
H_{3a}: La percepción sobre la existencia de un modelo de evaluación competitiva (**competitive evaluation),** que dificulta el acceso a algunos tipos de información, influye inversamente en el acceso al conocimiento.		-			+	☒
H_{3b}: La percepción sobre la existencia de dificultades para acceder el conocimiento de los compañeros cuando estos no pueden cargar su tiempo (**need of chargeability)** influye inversamente en el acceso.		+			-	☒
H_{3c}: La percepción sobre la existencia de divisiones en la empresa o **silos** que dificultan las relaciones personales influye inversamente en el acceso al conocimiento.					-	☒
H_{3d}: La percepción sobre la existencia de dificultades para acceder al conocimiento de los compañeros de mayor categoría o jerarquía (**hierarchy)** influye inversamente en el acceso al conocimiento.						☒
H_4: La percepción sobre la existencia de una cultura de colaboración que facilita el acceso al conocimiento (**collaboration culture)** influye directamente en el acceso al conocimiento.		+	+	+	+	✓
[Variable adicional. Sexo (1= mujer; 0= hombre)]		+			+	
CONTRIBUCIÓN (**Modelo 2 Corregido**)		**C_I**	**C_P**	**C_C**	**C_R**	**TEST**
H_5: Ser senior (**seniority)** influye directamente en la contribución de conocimiento.		-	-	+	+	±
H_6: El acceso al conocimiento (**Time devoted to knowledge access**) influye directamente en la contribución al conocimiento.						✓
	$A_{INCREMENTAL}$	+	+	+	+	✓
	$A_{PERSONAL}$	+	+	+		✓
	$A_{COMUNIDADES}$			+		☒
	$A_{RADICAL}$	+	+	+	+	✓
H_7: Obtener una evaluación superior (**superior evaluation)** influye directamente en la contribución.				+	+	½
H_8: La percepción de apoyo de los superiores (perception of **support)** influye directamente en la contribución.		+		+	+	✓
H_9: La antigüedad (length of **tenure)** influye directamente en la contribución.		-	+	+	-	±

NOTA: Símbolo ☐ cuando la hipótesis alternativa se ha aceptado en más del 75% de los casos; ½ hipótesis alternativa aceptada en más del 50% de los casos; ± cuando la hipótesis nula es rechazada pero los efectos son mixtos (directo and indirecto); ☐ cuando la hipótesis nula no ha podido ser rechazada.

¿Qué otras variables influyen en los patrones individuales de movilización del conocimiento? Por lo que se refiere al acceso al conocimiento, los resultados de los modelos han demostrado que la antigüedad en la empresa está negativamente relacionado con el tiempo dedicado al acceso al conocimiento mediante las distintas fuentes, que la percepción de barreras está negativamente relacionado con el tiempo dedicado al acceso (aunque no siempre de manera significativa) y que la percepción de una cultura de colaboración está positivamente relacionada con el tiempo de acceso. La Figura 2 resume los resultados para la variable dependiente de tiempo dedicado al acceso al conocimiento.

Además, es importante tener en cuenta que el análisis descriptivo de los resultados ha puesto en evidencia que los seniors de la empresa tienen una percepción más positiva del sistema de conocimiento de la empresa, es decir, perciben menos barreras y más incentivos que los juniors. Esta diferencia en percepciones entre juniors y seniors ha sido además identificada en la literatura en gestión de la innovación como algo habitual (Soo et al., 2002). La Figura 2 ilustra esta relación y, por tanto, el efecto indirecto de la variable seniority sobre el acceso.

Figura 2: Resumen del modelo que explica el acceso al conocimiento

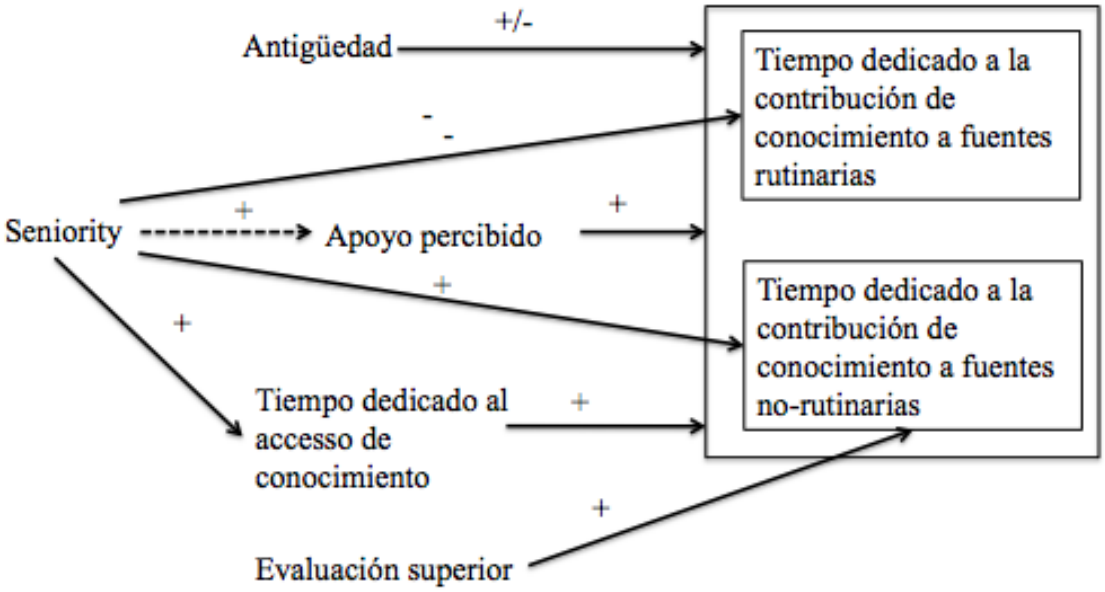


Por lo que respecta al tiempo dedicado a contribuir con el conocimiento individual a la base de conocimiento de la empresa, es interesante ver que las diferencias respecto a la movilización de fuentes rutinarias y no rutinarias son más importantes. En primer lugar, los resultados de nuestro modelo han probado que la variable "seniority" es la que mayor fuerza explicativa tiene. En este sentido los resultados son interesantes, ya que se demuestra que los seniors contribuyen más a las fuentes de conocimiento no-rutinarias (comunidades y fuentes con conocimiento radical) y menos que los juniors a las fuentes rutinarias (incremental y personal). Estos resultados están en línea con la literatura que explica que, para poder movilizar el conocimiento de las comunidades, es necesario que los individuos se conviertan en "miembros" de esa comunidad, para lo cuál es indispensable ser reconocidos como expertos y haber ganado cierto estatus (Duguid, 2008). Además, este tipo de fuentes no-rutinarias, como por ejemplo las fuentes donde reside un conocimiento más radical, suelen tener un componente más estratégico y confidencial, ya que por ejemplo incluyen conocimiento sobre tecnologías innovadoras que la empresa está desarrollando con vistas al futuro. Por ello, la movilización de dicho conocimiento queda en mayor medida en manos de los "miembros" de una comunidad más restringida con acceso a esa información estratégica.

En cuanto a la influencia de otras variables, hemos visto que, en primer lugar, la antigüedad en la empresa influye de manera directa en el tiempo dedicado a contribuir a través de las fuentes que tienen un componente relacional (i.e. personal y comunidades) y de manera inversa en la contribución a las fuentes con componente no relacional (i.e. fuentes incrementales o codificadas y unidades especiales con conocimiento más radical). Esto puede ser explicado porque la literatura ha identificado una preferencia por este tipo de comunicación interpersonal y porque los seniors han tenido la oportunidad de desarrollar y cultivar sus redes internas en mayor medida (Hargadon and Bechky, 2006). Por otra parte, la percepción de tener apoyo de los supervisores influye de manera positiva en el tiempo dedicado a contribuir a través de todas las fuentes analizadas. Asimismo, el tiempo dedicado a acceder al conocimiento mediante las distintas fuentes influye de manera directa en el tiempo dedicado a aportar tanto a las fuentes rutinarias como a las no-rutinarias. Finalmente, el haber tenido una evaluación superior a los compañeros influye de manera directa en el tiempo dedicado a contribuir a las fuentes no-rutinarias (i.e. comunidades y fuentes con conocimiento más radical).

La Figura 3 resume estos resultados y pone de manifiesto la relación también indirecta que tiene el hecho de ser senior el tiempo dedicado a contribuir, ya que, como hemos visto anteriormente los seniors dedican más tiempo a acceder al conocimiento y, además, perciben de manera general un mayor apoyo por parte de sus superiores.

Figura 3: Resumen del modelo que explica la contribución al conocimiento



Una vez analizados los patrones de movilización y creación individual de conocimiento, y dado que hemos detectado que algunos empleados no saben de la existencia de las unidades de I+D o del conocimiento generado en éstas, es importante analizar de qué depende la movilización este conocimiento, para determinar si existen dos clases de "ciudadanos corporativos" o, diciéndolo de otra manera, para analizar si *los recursos de conocimiento generados en las unidades de I+D e innovación de la empresa recursos "exclusivos" que son*

movilizados principalmente por los seniors de la empresa. Para ello, hemos analizado los resultados de los modelos desde el punto de vista del acceso y contribución a las fuentes con conocimiento radical. La Figura 4 muestra el resumen de los resultados.

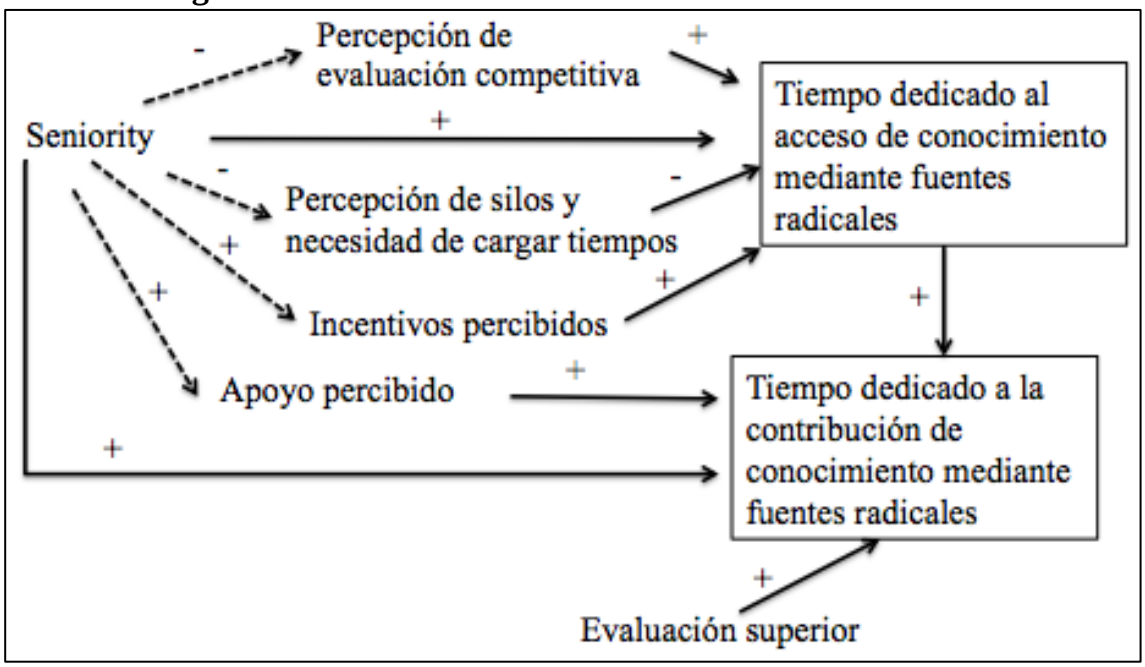
En primer lugar, es importante señalar que ni el acceso ni la contribución a estas fuentes es exclusivo para los seniors y que los juniors de la empresa también acceden y contribuyen a éstas. Sin embargo, los resultados han mostrado que los seniors acceden y contribuyen de una manera más intensa, es decir, las utilizan más frecuentemente y durante un mayor número de horas. Además, hemos visto que el tiempo dedicado a acceder al conocimiento radical influye sobre el tiempo dedicado a contribuir al mismo. Dado que los seniors tienen una mejor accesibilidad a un mayor número de recursos (y dedican más tiempo a acceder al conocimiento), son a su vez más propensos a contribuir con su conocimiento e ideas y actuar sobre estos, lo cual ha sido confirmado en la literatura (Burt, 2004).

Ya hemos mencionado el efecto positivo que tienen la percepción de la existencia de incentivos para acceder al conocimiento, así como el apoyo de los superiores y de haber tenido una evaluación superior sobre la contribución. Sin embargo, el efecto de la percepción de la existencia de barreras sobre el acceso a las fuentes de conocimiento radical tienen unas peculiaridades frente al acceso al resto de fuentes de conocimiento, y es que, de manera general, la movilización de las fuentes radicales es más sensible a la percepción sobre barreras. Es decir, las personas que tienen percepciones negativas sobre el efecto de los silos y de la necesidad de cargar los tiempos en la circulación del conocimiento acceden en menor medida a las fuentes de conocimiento radical. La explicación para esta mayor sensibilidad a la percepción de barreras del acceso a las fuentes de conocimiento radical es que, como hemos visto, estas fuentes se utilizan de manera no-rutinaria, es decir, el uso de estas fuentes no forma parte del trabajo del día a día de los consultores y se acceden de manera esporádica y voluntaria. Por tanto, el hecho de que el acceso a estas fuentes se base más en la voluntad de los individuos hace que sea más sensible a las percepciones individuales. Por el contrario, dado que las fuentes rutinarias (personales e incrementales) son necesarias en el trabajo del día a día de los consultores, el hecho de que se perciba un efecto negativo de las barreras en la movilización del conocimiento influye en menor medida sobre las decisiones de acceder a esas fuentes.

Sin embargo, hay un caso en el que la percepción de la existencia de una barrera afecta de manera inversa al acceso a las fuentes radicales. Los resultados muestran que las personas que perciben que la evaluación competitiva, basada en un banding, dificulta la circulación del conocimiento en la empresa acceden en mayor medida a las fuentes con conocimiento radical y en menor medida a las fuentes con conocimiento más incremental. La explicación para este hallazgo es que las fuentes con conocimiento radical otorgan a los empleados que acceden a ellas conocimiento no-rutinario que les permite diferenciarse de sus compañeros, al contrario de las fuentes con conocimiento incremental que son de acceso

generalizado y que, por tanto, no confieren ningún rasgo diferencial a las personas que acceden a él (Reagans and McEvily, 2003).

Figura 4: Movilización de fuentes conocimiento radical



3.3. Separación entre el trabajo del día a día (explotación) y el trabajo esporádico relacionado con la innovación (exploración)

Para finalizar con la discusión de los resultados e integrar el análisis de la creación y movilización del conocimiento en Alpha desde el punto de vista organizativo e individual, hemos analizado la distinción entre la exploración de nuevo conocimiento y la explotación del conocimiento existente en la empresa. En este sentido, en el análisis preliminar hemos visto que los entrevistados hacían una separación importante entre su trabajo del día a día con los clientes y un trabajo más esporádico que relacionaban con la innovación, como por ejemplo el aportar ideas innovadoras, acceder a fuentes con conocimiento más radical o novedoso de manera voluntaria etc. La siguiente cita ejemplifica estas percepciones:

> "*No estoy segura de si hemos sido informados sobre cómo (…) va a impactar el proceso de innovación en nuestro trabajo del día a día*" (nº entrevista 9).

Además, a lo largo de la segunda fase de la tesis, en la que se ha analizado la creación y movilización del conocimiento desde un punto de vista organizativo e individual también se ha percibido esta distinción entre las actividades de exploración de nuevo conocimiento y las de explotación del conocimiento existente. Desde el *punto de vista organizativo* hemos visto una clara separación, en primer lugar, entre los empleados que trabajan en las unidades de I+D e innovación analizadas, dedicados a la exploración, y el resto de consultores de la

empresa, más enfocados en la explotación del conocimiento existente para dar respuesta a las necesidades del cliente. En segundo lugar, dentro de las propias unidades de I+D e innovación, hemos visto que parte de ellas están dedicadas a la creación de nuevo conocimiento (home base augmenting units) y otras se dedican a la difusión y explotación del conocimiento generado en las primeras (home base exploiting units). Desde el *punto de vista individual* hemos visto una clara distinción entre el trabajo del día a día y la movilización de fuentes rutinarias por parte de la mayoría de consultores (con conocimiento personal e incremental) y el trabajo más esporádico y exploratorio mediante la movilización de fuentes no-rutinarias (con conocimiento de comunidades y radical). Además, hemos visto que los seniors contribuyen en mayor medida a las fuentes no-rutinarias (exploración) y los juniors a las rutinarias (explotación).

Esta distinción entre exploración y explotación ha sido ampliamente estudiada en la literatura, la cuál señala la importancia para la innovación de gestionar la tensión que emerge entre estas actividades contradictorias y complementarias al mismo tiempo (Andriopoulos y Lewis, 2009). Mientras la explotación permite la creación de una base de conocimiento común y la replicación y difusión de las innovaciones ad-hoc, la exploración permite desarrollar la base de conocimiento de la empresa para el futuro. Además, es importante gestionar esta tensión ya que un enfoque exclusivo en una de las opciones llevaría a la empresa a un círculo vicioso que puede llevar al estancamiento de las opciones de desarrollo futuro (si se opta solo por la explotación del conocimiento existente) o a poner en riesgo los beneficios inmediatos de la empresa (si se opta solo por explorar nuevos caminos).

La literatura ha señalado que la gestión de la tensión entre exploración y explotación es compleja puesto que las demandas de una actividad y otra son "contradictorias", ya que la primera requiere de una mayor libertad de actuación y la segunda de mayor eficiencia. Así, se han distinguido dos mecanismos para llevar a cabo las dos actividades: uno opta por la simultaneidad en el tiempo y el segundo por ciclos temporales entre periodos de exploración y explotación (Gupta et al., 2006). Asimismo, dentro del primer mecanismo, se han diferenciado dos tácticas para conseguir una organización "ambidiestra": a) la diferenciación y creación de una estructura dual que aísle una actividad de la otra (p.e. unos empleados se dedican a la exploración exclusivamente y otros a la explotación), que tiene el inconveniente de que puede impedir la coordinación entre ambas y crear aislamiento, y b) la integración, que puede incrementar la complejidad de la gestión y aumentar la confusión entre los individuos (Andriopoulos y Lewis, 2009).

Con todo esto en mente, nuestro análisis ha puesto en evidencia que, desde el punto de vista organizativo, Alpha es una empresa ambidiestra puesto que realiza de forma simultánea tanto la exploración de nuevo conocimiento como la explotación del existente. Por lo que respecta a la táctica seguida para gestionar esta tensión podemos decir que, desde el punto de vista organizativo, la empresa aplica la táctica de la diferenciación, ya que separa por una parte a los consultores que trabajan en las unidades de I+D e innovación, dedicados

principalmente a la exploración, y el resto de consultores que explotan el conocimiento existente en su día a día con los clientes.

Desde el punto de vista individual, cada individuo no puede realizar de forma simultánea los dos tipos de actividades, sino que se aplica el mecanismo de intercalar ciclos de explotación con ciclos más cortos de exploración. Sin embargo, desde una perspectiva agregada también existe cierta dualidad entre juniors y seniors, ya que los primeros están dedicados principalmente a la explotación y los segundos adoptan de manera cada vez más intensa actividades más exploratorias. Esto significa que, si incluimos la variable "tiempo", esta dualidad va desapareciendo progresivamente y se tiende a una mayor integración de estás funciones o actividades en el individuo. Es decir, a medida que los juniors se convierten en seniors su enfoque se va expandiendo y los individuos van adoptando cada vez una perspectiva más integradora entre explotación y exploración. Además, a medida que la táctica de diferenciación se va suavizando con la "seniority" y los individuos perciben una gestión más integradora de la tensión entre explotación y exploración, mejoran las percepciones sobre el sistema de conocimiento de la empresa, lo cuál a su vez puede crear un círculo virtuoso que refuerza la movilización voluntaria del conocimiento no-rutinario más ligado a la innovación.

4. Conclusiones y Aportaciones de la tesis

Como hemos visto, el objetivo general de la tesis era iluminar algunos aspectos del proceso de creación y movilización del conocimiento, que son clave en la capacidad innovadora de las KIBS. Hemos abordado este objetivo desde dos perspectivas: a) desde la perspectiva organizativa, tomando la empresa en su conjunto como objeto de análisis y analizando la organización de la I+D y la innovación en ésta; y b) desde una perspectiva individual, mirando a los patrones individuales de movilización del conocimiento, tomando a los consultores de la subsidiaria Española de la empresa como objeto de estudio.

En primer lugar, desde un *punto de vista organizativo*, hemos visto que Alpha, una gran empresa referente en la consultoría y servicios tecnológicos que sirve de arquetipo de las KIBS, dispone de una infraestructura de unidades de I+D e innovación especialmente dedicadas a la creación de nuevo conocimiento. El análisis de dichas unidades han puesto en evidencia que la organización de la I+D y la innovación en las grandes KIBS tiene muchos puntos en común con la organización de las grandes empresas manufactureras intensivas en tecnología, en lo que respecta a las funciones que desempeñan (i.e. I+D genérica, aplicada, a medida, y difusión a pequeña y gran escala), las razones para su localización (i.e. acceso a la ciencia y tecnología o acceso a mercados y led users), o su rol en el proceso de difusión de la innovación que se ajusta al descrito por Rogers (1995). Este resultado pone de manifiesto la necesidad de repensar la teoría sobre innovación en servicios generalmente aceptada, que defiende que la innovación en este sector se genera principalmente de manera ad-hoc y en co-creación con

los clientes, subestimando la importancia de la I+D organizada en unidades funcionales especializadas.

Sin embargo, también hemos visto que existen en la empresa una serie de unidades dirigidas a la difusión del conocimiento a pequeña y gran escala que no son habituales en el sector de las manufacturas (Miles, 2008; Gadrey and Gallouj, 1998), ya que éstas realizan una implementación ad-hoc ajustada a las necesidades de cada cliente, en las que las innovaciones incrementales tienen una importancia relativa mayor. Así, el proceso de difusión de la innovación en las KIBS depende en mayor medida del papel de los individuos y en la creación y movilización de todo el conocimiento realizado por los consultores para dar respuestas creativas a cada cliente toman una importancia relativa mayor.

Sin embargo, ya sea como consecuencia del mayor dinamismo de la infraestructura de I+D analizada, de su complejidad, o de que se trata de una estructura en proceso de creación, hemos observado que poca gente en Alpha tiene una perspectiva general de dicha infraestructura. Como explicación alternativa a dicho desconocimiento, hemos analizado si los patrones de movilización y acceso a los recursos existentes en la empresa varía entre los empleados de la empresa. En otras palabras, hemos analizado si existen dos tipos de "ciudadanos corporativos" en la empresa con oportunidades diferentes de movilizar conocimiento.

Por ello, en segundo lugar hemos analizado el *papel individual* de los consultores en la creación de nuevo conocimiento y en la movilización y difusión del conocimiento existente (incluyendo el creado por las unidades de I+D), estudiando sus patrones de acceso y contribución a las distintas fuentes de la empresa. En este sentido, hemos detectado que los seniors en las KIBS juegan un papel clave como "knowledge brokers" ya que tienen una participación más intensa en las dos actividades principales que desempeñan estos individuos (Muller et al. 2013). Este resultado contradice en parte a algunos autores que han realizado análisis de redes sociales informales en las empresas y que han encontrado que los seniors tienen muchas veces un papel periférico en dichas redes (Allen et al., 2007).

Desde la perspectiva de la participación individual en la movilización de conocimiento, nuestros resultados integran no sólo el uso de las redes informales de la empresa, sino de las más importantes fuentes de conocimiento, poniendo en evidencia que los seniors son centrales en su movilización. Así, hemos probado que los seniors en las KIBS movilizan más intensamente todos los tipos de fuentes de conocimiento, pero más específicamente las no-rutinarias (i.e. con conocimiento radical y conocimiento de las comunidades).

Así, podemos señalar dos aportaciones de nuestros resultados: 1) en las KIBS, la categoría de "senior" es un indicador de una gran importancia para identificar a los "knowledge brokers", y 2) algunos de los aspectos señalados en la literatura como parte de la personalidad de los "knowledge brokers", como por ejemplo una mayor motivación, están correlacionados con la categoría, ya que los seniors tienen una mejor percepción del sistema de conocimiento de la empresa y, por

tanto, no se trata exclusivamente de características intrínsecas a la personalidad. Estos resultados contribuyen a la literatura relacionada con los KB, ya que ésta se ha fijado principalmente en características de la personalidad de los individuos, como por ejemplo el carisma, dando un papel menos relevante a aspectos organizativos, como la categoría.

Finalmente, nuestros resultados han mostrado que las KIBS como la analizada son empresas ambidiestras (Andriopoulos and Lewis, 2009), puesto que realizan actividades de exploración y explotación de manera simultánea. Sin embargo, las tensiones que emergen entre los estilos contradictorios de gestión de ambas actividades son retos importantes para las KIBS. Nuestros resultados muestran que, a nivel organizativo, Alpha gestiona esta tensión adoptando una táctica de diferenciación, manteniendo las actividades de exploración realizadas por las unidades de I+D e innovación separadas del trabajo del día a día de la mayoría de consultores, más enfocado en la eficiencia y en la explotación del conocimiento existente en nuevos contextos (i.e. nuevos clientes). En este sentido, podríamos decir que podemos encontrar dos tipos de ciudadanos corporativos (Kanter, 2006): los consultores enfocados en la exploración y los dedicados a la explotación. Al mismo tiempo, a nivel individual, hemos probado que a medida que los consultores crecen en la jerarquía y se convierten en seniors, su enfoque se expande poco a poco, movilizando cada vez de manera más intensa fuentes no rutinarias de conocimiento más relacionadas con la exploración. Así, observamos que existe una distinción entre las actividades principales de juniors y seniors, con una creciente integración de las dos actividades a nivel individual, a medida que los seniors van realizando de manera voluntaria actividades más exploratorias. En otras palabras, si adoptamos una visión más dinámica que incluye una variable de tiempo (antigüedad) o una visión dinámica de la carrera profesional, la táctica de diferenciación entre explotación y exploración se reduce de manera progresiva y los seniors perciben mayor integración entre las dos. Como conclusión final, nuestros resultados sugieren que, si la mejor percepción individual del sistema de conocimiento de la empresa es consecuencia de la gestión más integradora de la tensión entre explotación y explotación a nivel individual, esta táctica crea un círculo virtuoso que refuerza la movilización de conocimiento, especialmente el contenido en las fuentes no rutinarias (i.e. comunidades y radical).

Como consecuencia de lo anterior de los resultados aquí expuestos, creemos que esta tesis hace las siguientes contribuciones:

1. Contribuye a la literatura sobre gestión del conocimiento, del capital intelectual y de la innovación, ya que adopta una perspectiva integradora necesaria para la acumulación de conocimiento, combinando una visión estática de los "stocks" con una visión dinámica de los "flows" de la creación y movilización de conocimiento, así como una visión amplia de la gestión del conocimiento y del capital intelectual que influye aspectos socio-técnicos de la innovación (p.e. confianza, choques culturales, apoyo organizativo, prioridades en competencia…).

2. Provee de evidencias adicionales que apoyan que las KIBS tienen diferencias y similitudes importantes con las grandes empresas manufactureras intensivas en tecnología, corroborando investigaciones anteriores que apoyan la necesidad de adoptar una visión de síntesis al análisis de estas empresas (Gallouj and Windrum, 2009).
3. Contribuye a la literatura sobre innovación en servicios mediante un análisis organizativo de las infraestructuras de I+D e innovación en las KIBS, poniendo en evidencia la necesidad de repensar la teoría tradicional que subestima la existencia de estas unidades en servicios.
4. Contribuye a la literatura sobre fuentes de conocimiento y movilización del conocimiento con un análisis conjunto de la movilización de las fuentes más importantes disponibles en las empresas, adoptando la literatura sobre knowledge brokers como perspectiva integradora.
5. Prueba el papel central de los seniors como knowledge brokers en las KIBS, en contraste con algunas investigaciones sobre redes informales de conocimiento que los han considerado figuras periféricas.
6. Contribuye a la literatura sobre knowledge brokers al sobrepasar un análisis basado en las características individuales de la personalidad (e.g. carisma), adoptando un enfoque organizativo y desarrollando una metodología que puede ser de utilidad para detectar a los knowledge brokers mediante el análisis de características observables de los individuos, como la categoría, la antigüedad, su evaluación, y otras variables relacionadas con percepciones individuales. Además, la tesis establece una relación entre las características de la personalidad tradicionalmente analizadas en la literatura y la categoría profesional.
7. Contribuye a la literatura sobre la interrelación entre exploración y explotación, al analizar el balance entre estas actividades desde distintos niveles de análisis, incluyendo el nivel micro, poniendo en evidencia la importancia de adoptar una perspectiva dinámica (e.g. antigüedad o una visión dinámica de la carrera profesional) en el análisis de estas tensiones.

ANEXO METODOLÓGICO

Modelo 1: Acceso al conocimiento

$$A_X = \beta_0 + \beta_1 \text{Seniority} + \beta_2 \text{Sex} + \beta_3 \text{Tenure} + \beta_4 \text{CompetitiveEvaluation} + \beta_5 \text{Chargeability} + \beta_6 \text{Silos} + \beta_7 \text{Hierarchy} + \beta_8 \text{Culture} + e$$

Donde:

A_X es el número de horas semanales dedicadas a acceder al conocimiento mediante los distintos tipos de fuentes. La misma expresión es replicada para las distintas variables dependientes, es decir, para el acceso a los distintos grupos de

fuentes de conocimiento (X = I: fuentes incrementales o herramientas de gestión del conocimiento codificadas, P: fuentes personales, C: comunidades, y R: fuentes radicales o unidades especiales).

Seniority es una variable dicotómica igual a 1 si el encuestado es "senior" (en el sentido amplio, incluyendo seniors, senior managers y senior executives) y 0 en caso contrario;

Sex es una variable dicotómica igual a 1 si el encuestado es mujer y 0 si es hombre;

Tenure es el logaritmo neperiano del número de años que el encuestado ha trabajado en la empresa;

CompetitiveEvaluation ("el modelo de evaluación competitiva, basado en un banding, dificulta la obtención de determinados tipos de información"), *Chargeability (*"es difícil obtener ayuda de un compañero si éste no puede cargar su tiempo"), *Silos (*"la separación en unidades de negocio, industrias etc. dificulta las relaciones personales") y *Hierarchy* ("existen problemas para acceder al conocimiento de compañeros con nivel jerárquico superior") son variables con una escala Likert de 4 niveles, igual a 1 si el encuestado no está de acuerdo con la existencia de cada una de esas barreras y su efecto negativo en el acceso al conocimiento e igual a 4 si está totalmente de acuerdo con la existencia de la barrera.

Culture ("la cultura de colaboración en la empresa facilita el acceso al conocimiento de los compañeros") es una escala Likert de 4 niveles igual a 1 si el encuestado no está de acuerdo con la existencia de una cultura de colaboración que promueve el compartimiento del conocimiento e igual a 4 si está totalmente de acuerdo con su existencia; y

e es el término de error.

Modelo 2: Contribución al conocimiento

$$C_X = \beta_0 + \beta_1 \text{Seniority} + \beta_2 A_I + \beta_3 A_P + \beta_4 A_C + \beta_5 A_R + \beta_6 \text{Eval} + \beta_7 \text{Support} + \beta_8 \text{Tenure} + \text{Lambda}_X + e$$

Donde:

C_X es el número de horas semanales dedicadas a contribuir con conocimiento a los distintos tipos de fuentes. La misma expresión es replicada para las distintas variables dependientes, es decir, para la contribución a los distintos grupos de fuentes de conocimiento (X = I: fuentes incrementales o herramientas de gestión del conocimiento codificadas, P: fuentes personales, C: comunidades, y R: fuentes radicales o unidades especiales).

Seniority es una variable dicotómica igual a 1 si el encuestado es "senior" (en el sentido amplio, incluyendo seniors, senior managers y socios) y 0 en caso contrario;

A_I, A_P, A_C, y A_R, son el número de horas por semana que el encuestado dedica a acceder a cada uno de los grupos de fuentes de conocimiento;

Eval es una variable dicotómica igual a 1 si el encuestado declara que ha sido evaluado “at the very top” o “significantly above” en relación al grupo;

Support es una variable ordinal del 1 al 4 que indica el grado de apoyo que el encuestado percibe de sus superiores para contribuir con sus ideas y conocimiento a la empresa,

Tenure es el logaritmo neperiano del número de años que el encuestado ha trabajado en la empresa;

Lambda es un término de corrección de Heckman, que corrige un posible sesgo de selección, ya que pensamos que es muy probable que los empleados que han dado respuesta a nuestro cuestionario sean aquellos que tienen una mayor propensión a contribuir con sus ideas y conocimiento de manera voluntaria a la empresa; y

e es el término de error.

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APPENDIX 1: Structure of the interviews. Analyzed issues.

A. Innovation strategy and results

1. Alignment with strategic objectives
2. Formalization
3. Stability (both in time and resources)
4. Financing
5. Effective innovation results:
    a. New products and/or services
    b. Marketing innovation
    c. Organizational innovation
6. Most relevant innovations
7. Financial and economic effects of innovation
    a. Incomes/sales.
    b. Clients
    c. Business/market perspectives
    d. Market value
8. Non-financial effects of innovation
    a. Working climate
    b. Productivity
    c. Motivation

B. Knowledge, idea sources and information management

B1. Internal sources (different from R&D)

1. Project knowledge documentation
2. Access to and retrieval of project-specific knowledge
3. Final project assessment (success/failure causes)
4. Knowledge-sharing (best-practices)
5. Management control activities
6. Analysis of additional project outcomes
7. Quality monitoring and auditing
8. Physical location and knowledge transfer
9. Knowledge-creation and -transfer support
10. Individual innovative idea generation

B2. External sources

11. Market research and information gathering
12. Knowledge contextualization across boundaries
13. Coordination of "gatekeepers"
14. Open sources
15. Acquisition of external technology and knowledge
16. Cooperation with other organizations
    a. Public Sector
    b. Market sources (competitors, other companies…)
    c. Other companies of the global MNC
    d. Clients
    e. Providers
17. Commercialization process

B3. R&D

C. Mapping Knowledge Relationships Across Boundaries

1. Climate of trust
2. Cooperation and problem sharing

3. Analysis of innovation capabilities
4. Capability maps
5. External capability maps (e.g. universities)
6. Comparison of capabilities against competitors
7. Customer studies
8. Promotion of variety within groups

D. Human Capital Management

1. Awareness of the innovation strategy
2. Involvement with the innovation strategy
3. Autonomy
4. Decision-making
5. Motivation mechanisms towards innovation
6. Confidence (leadership)
7. Individual learning and training
8. Reflection and learning from experience
9. Organizational culture regarding failure
10. Retention of employees and expertise
11. Minimization of knowledge loses and leakages
12. Individual creativity
13. Support for creativity (mentoring)
14. Appraisals
15. Rewarding of innovation performance
16. Rewarding of knowledge dissemination
17. Internal mobility
18. Archive of CVs
19. Specialist knowledge: Experts

E. Knowledge Protection

1. Protection mechanisms
2. Awareness of protection issues

F. Information management based on ICTs

1. Corporate information strategy
2. ICT access policy
3. Common IT infrastructure
4. ICT support for collaborative work
5. Development of the IT strategy
6. Inputs of employees to IT development
7. Experimenting new tools
8. Information navigation support
9. Utility of available ICT services

G. Other issues

1. Not sufficiently supported activities for innovation
2. Potential negative effects of innovation and introduced KM Practices for innovation
    a. Economic/financial results
    b. Employees wellbeing
    c. Company processes
    d. Interpersonal relations

APPENDIX 2: Units for R&D and Innovation (non exhaustive)

Nr	Area	Type of unit	Location	Creation
1	Various	Technology R&D Unit	Chicago, US	N/A
2	Various		Silicon Valley, US	N/A
3	Various		Sophia Antipolis, France	+/- 20 years ago
4	Various		Bangalore, India	2006
5	Various		Beijing, China	2012
6	Analytics	Strategic Centers → also offering end-to-end experiences and, hence, part of the Network for R&D Diffusion	Barcelona, Spain	2011
7	Analytics		Dublin, Ireland	2010
8	Analytics		Singapore	2012
9	Health		London, UK	2009
10	Health		Chicago, US	N/A
11	Social Media		Silicon Valley, US	2011
12	Management Consulting		Singapore	2008
13	Information Management		Mumbai, India	N/A
14	Open Source		Bangalore, India	N/A
15	Broadband		Rome, Italy	N/A
16	Manufacturing		Chicago, US	N/A
17	Manufacturing		Milan, Italy	N/A
18	Manufacturing		Shanghai, China	N/A
19	Media and Entertainment		Bangalore, India	N/A
20	Media and Entertainment		Rome, Italy	N/A
21	Media and Entertainment		New York, US	N/A
22	Transportation Services		New York, US	N/A
23	Financial Services		Chicago, US	N/A
24	Financial Services		Beijing, China	2012
25	Automotive and Industrial Manufacturing		Detroit, US	2010
26	Product Innovation	Collaboration R&D Center	Melbourne, Australia	2011
27	SAP		Australia	2012
28	SAP		Germany	N/A
29	SAP		Beijing, China	2012
30	SAP		Tokyo, Japan	2012
31	SAP		Singapore	2012
32	SAP		Centurion, South Africa	2012
33	Oracle		California, US	N/A
34	Oracle		Tokyo, Japan	2009
35	Oracle		London, UK	2008
36	Oracle		Bangalore, India	2006
37	Oracle		Istanbul, Turkey	2009
38	BEA		California, US	2007
39	Various	Network for R&D Diffusion	Chicago, US	N/A
40	Various		Milan, Italy	N/A
41	Various		Sao Paulo, Brazil	N/A
42	High Performance		New York, US	N/A
43	High Performance		London, UK	N/A
44	Payments and Innovation		Sophia Antipolis, France	2008
45 +	More than 50 Delivery Centers	Network for Delivery and Implementation	World wide	N/A

APPENDIX 3: Survey Instrument

ENCUESTA SOBRE LOS FLUJOS DE CONOCIMIENTO EN LA EMPRESA Y SUS EFECTOS SOBRE LA INNOVACIÓN

Datos demográficos personales			
Indique por favor cuál es su caso:			
Área	❑ Consulting ❑ Technology Solutions ❑ Business Process Outsourcing ❑ Corporate Functions	**Categoría profesional**	❑ Analista ❑ Consultor ❑ Manager ❑ Senior Manager ❑ Senior Executive
Edad	❑ 18 - 65 años	**Años en la empresa**	❑ < 1, 1, 2…>20
Sexo	❑ Mujer ❑ Hombre	**Realiza Teletrabajo**	❑ Sí ❑ No

Apartado A: Utilización y acceso a las distintas fuentes de conocimiento

La decisión de acceder a una fuente de conocimiento u otra depende de diversas cuestiones (p.e. tiempo, problema concreto, condiciones de acceso, nivel de experiencia etc). Además, el tipo de conocimiento que se busque es clave para recurrir a una fuente u otra. Por ejemplo, es de esperar que la fuente de conocimiento más adecuada no sea la misma cuando se necesita saber más sobre un cliente (en las áreas de la práctica), sobre un usuario interno (en las Funciones Corporativas), o sobre el uso de una nueva tecnología.

A1: Indique la frecuencia de uso (nunca, ocasionalmente, frecuentemente, casi siempre) de las distintas fuentes cuando precisa mayor conocimiento sobre las variables que se indican. (Para las 14 fuentes)

a) Frecuencia de uso de las diversas fuentes cuando precisa mayor conocimiento sobre un cliente (p.e. experiencias, proyectos pasados, …)

b) Frecuencia de uso de las diversas fuentes cuando precisa mayor conocimiento sobre la industria (p.e. hábitos de consumo, tecnología, mercado y competencia, regulación…)

c) Frecuencia de uso de las diversas fuentes cuando precisa mayor conocimiento específico (p.e. tecnología, legal, financiero, marketing)

d) Frecuencia de uso de las diversas fuentes cuando precisa mayor conocimiento sobre metodología y credenciales (p.e. gestión del cambio, innovación…)

A2: Indique la razón fundamental que desincentiva el uso de las distintas fuentes.

	Desconocimiento	**Desconfianza**	**Complejidad**	**Otra razón**
Knowledge Exchange	❑	❑	❑	❑
Portales internos /Sharepoints	❑	❑	❑	❑
Herramienta específica de su área	❑	❑	❑	❑
Manuales de uso	❑	❑	❑	❑
Supervisor	❑	❑	❑	❑
Compañeros de proyecto o área	❑	❑	❑	❑
Compañeros de otro proyecto o área	❑	❑	❑	❑
Grupos / Comunidades internas	❑	❑	❑	❑
Departamento de Research	❑	❑	❑	❑
Otros departamentos internos (e.g. marketing, legal, financiero)	❑	❑	❑	❑

Programa de Innovación del país	❑	❑	❑	❑
Red global de innovación	❑	❑	❑	❑
Tecnologías de la Información	❑	❑	❑	❑
Internet	❑	❑	❑	❑
Redes Sociales	❑	❑	❑	❑

A3: Estime en los últimos 6 meses el número de horas de trabajo semanales dedicados a la <u>búsqueda de información</u> mediante las distintas fuentes. (Número de horas por semana)	
Herramientas de gestión del conocimiento	Desplegable de <1h - >20h
Relaciones personales	Desplegable de <1h - >20h
Comunidades	Desplegable de <1h - >20h
Departamentos especializados	Desplegable de <1h - >20h
Fuentes externas	Desplegable de <1h - >20h

Apartado B: Acceso al conocimiento de las relaciones personales internas.

Una de las fuentes de conocimiento más importantes son las relaciones con los distintos compañeros de la empresa. Por favor, responda a las siguientes cuestiones vinculadas al acceso al conocimiento de sus relaciones personales en la empresa.

B1: Indique la <u>importancia</u> que tienen los siguientes aspectos para que usted <u>confíe</u> en el conocimiento de un compañero.

	Nada importante	**Poco importante**	**Bastante importante**	**Muy importante**
Categoría profesional	❑	❑	❑	❑
Años de experiencia	❑	❑	❑	❑
Reconocimiento oficial como experto	❑	❑	❑	❑
Reconocimiento no oficial como experto (p.e. ha sido recomendado por alguna otra persona)	❑	❑	❑	❑
Su experiencia personal previa	❑	❑	❑	❑
Indique, en el caso de que lo hubiera, otro motivo de confianza importante……..				

B2: Indique la <u>frecuencia de uso</u> de los siguientes <u>canales</u> para compartir conocimiento en sus relaciones personales internas.

	Nunca	**Ocasional-mente**	**Frecuente-mente**	**Casi siempre**
Teléfono	❑	❑	❑	❑
Email	❑	❑	❑	❑
Herramientas de colaboración	❑	❑	❑	❑
Encuentros cara a cara formales (p.e. reuniones de grupo)	❑	❑	❑	❑
Encuentros cara a cara informales (p.e. en espacios comunes)	❑	❑	❑	❑

B3: Indique su <u>grado de acuerdo</u> con las siguientes proposiciones en relación al acceso al conocimiento a través de sus relaciones personales.

	Totalmente en desacuerdo	**Parcialmente en desacuerdo**	**Bastante de acuerdo**	**Totalmente de acuerdo**

La separación en unidades de negocio, industrias etc. dificulta las relaciones personales	❑	❑	❑	❑
La cultura de colaboración en la empresa facilita el acceso al conocimiento de los compañeros	❑	❑	❑	❑
El modelo de evaluación competitiva, basado en un banding, dificulta la obtención de determinados tipos de información	❑	❑	❑	❑
Es difícil obtener la ayuda de un compañero si éste no puede cargar su tiempo	❑	❑	❑	❑
Existen problemas para acceder al conocimiento de compañeros con nivel jerárquico superior	❑	❑	❑	❑

B4: Indique el <u>grado de dificultad</u> en acceder a los siguientes conocimientos en sus relaciones personales.

	Muy difícil	**Bastante difícil**	**Bastante fácil**	**Muy fácil**
Conocimiento sobre un <u>cliente</u> (p.e. experiencias, proyectos pasados, …)	❑	❑	❑	❑
Conocimiento sobre la <u>industria</u> (p.e. hábitos de consumo, tecnología, mercado y competencia, regulación…)	❑	❑	❑	❑
Conocimiento <u>específico</u> (p.e. tecnológico, legal, financiero, marketing…)	❑	❑	❑	❑
Conocimiento y experiencias relacionados con la <u>metodología y credenciales</u> (p.e. gestión del cambio, innovación…)	❑	❑	❑	❑

Apartado C: Aportaciones a las fuentes de conocimiento internas y colaboración

La renovación de la base de conocimiento de la empresa es clave para incrementar su capacidad futura para responder a los problemas de los clientes/usuarios internos de manera innovadora. Por favor, responda las siguientes cuestiones vinculadas a sus aportaciones a la base de conocimiento, a través de las distintas fuentes, y a la colaboración con sus compañeros.

C1: Cuando un compañero acude a usted para encontrar la solución a un problema, ¿le ofrece su <u>ayuda</u>? Indique la respuesta que corresponde a la <u>situación más frecuente.</u>

- ❑ Siempre
- ❑ Sí, siempre que no requiera excesivo tiempo
- ❑ Sí, siempre que pueda cargar mi tiempo
- ❑ Sí, pero sólo si conozco al compañero personalmente
- ❑ Sí, pero sólo si he recibido ayuda del compañero anteriormente

C2: Indique la <u>frecuencia</u> (nunca, ocasionalmente, frecuentemente, casi siempre) con la que <u>aporta conocimiento</u> a las distintas fuentes sobre las variables que se indican (Desplegable con las 14 fuentes).

a) Frecuencia de uso cuando quiere aportar su conocimiento y experiencias valiosas relacionadas con un <u>cliente</u> (p.e. de un proyecto pasado)

b) Frecuencia de uso cuando quiere aportar su conocimiento y experiencias valiosas relacionadas con la <u>industria</u> (p.e. hábitos de consumo, tecnología, mercado y competencia, regulación…)

c) Frecuencia de uso cuando quiere aportar su conocimiento <u>específico</u> (p.e. tecnológico, legal, financiero, marketing…)

d) Frecuencia de uso cuando quiere aportar sus experiancias relacionadas con la metodología y credenciales (p.e. gestión del cambio, innovación…)				
e) Frecuencia de uso cuando quiere aportar sus ideas innovadoras u otras experiencias relacionadas con la innovación				
C3: Estime para los 6 últimos meses el número de horas de trabajo semanales dedicadas a la aportación de conocimiento mediante los distintos canales.				
	Número de horas por semana			
Herramientas de gestión del conocimiento	❑ Desplegable de <1 hora hasta >20 horas			
Relaciones personales	❑ Desplegable de <1 hora hasta >20 horas			
Comunidades	❑ Desplegable de <1 hora hasta >20 horas			
Departamentos especializados	❑ Desplegable de <1 hora hasta >20 horas			
C4: Indique el grado de importancia que tienen los siguientes incentivos como motivación para aportar su conocimiento e ideas a la empresa.				
	Nada importante	**Poco importante**	**Bastante importante**	**Muy importante**
Oportunidad de repensar el problema o verlo desde una nueva perspectiva	❑	❑	❑	❑
El reconocimiento oficial de la empresa (e.g. estatus formal de experto, recompensas…)	❑	❑	❑	❑
El reconocimiento de sus compañeros (p.e. ganar credibilidad, visibilidad, agradecimiento…)	❑	❑	❑	❑
La posibilidad de poder obtener ayuda cuando la necesite	❑	❑	❑	❑
El fortalecimiento de las relaciones interpersonales entre compañeros	❑	❑	❑	❑
La implantación de la idea	❑	❑	❑	❑
Indique, en caso de haberlo, otro incentivo importante que le motive a aportar su conocimiento …….				
C5: Indique el grado de acuerdo con las siguientes proposiciones.				
	Totalmente en desacuerdo	**Parcialmente en desacuerdo**	**Bastante de acuerdo**	**Totalmente de acuerdo**
Conozco cuál es el canal más adecuado para aportar mis experiencias e ideas	❑	❑	❑	❑
La información del uso que se va a dar a mis ideas es un incentivo para aportarlas	❑	❑	❑	❑
Mis supervisores me incentivan a que aporte mis experiencias a la empresa	❑	❑	❑	❑
La falta de tiempo es un freno para aportar ideas y experiencias	❑	❑	❑	❑
Conclusión. Añada cuantos comentarios desee sobre lo analizado en los apartados anteriores.				