Enabling Knowledge Processes in Innovative Environments

ICT as a Trigger for Changes in Knowledge Management

Sara Pavesi
ENABLING KNOWLEDGE PROCESSES
IN INNOVATIVE ENVIRONMENTS

ICT AS A TRIGGER FOR CHANGES
IN KNOWLEDGE MANAGEMENT

Problem definition and purpose of the study
The Continuous Innovation Network

The Continuous Innovation Network (CINet) is a global network that brings together researchers and industrialists working in the field of Continuous Innovation. CINet is a continuation of the European Continuous Improvement Network, started in 1993. In 2000, the mission of EuroCINet was reformulated and its name changed to CINet, a research network on Continuous Innovation. These changes facilitate the dissemination, not just within but beyond Europe, of a new way of thinking about the integrated management and organisation of day-to-day operations, improvement and learning, and innovation and change.

The CINet PhD Network

CINet has developed a PhD network, which promotes research collaboration among PhD students and their institutions on topics of interest to CINet. In detail, the network objectives are as follows:

- To promote the development of research on continuous innovation and its applications to enhance companies' effectiveness and better use of human resources for more sustainable organisation of work.
- To facilitate research integration and mobility on a global level.
- To enhance research quality and, in particular, to promote synergy and collaboration on empirical research.
- To promote a better quality of PhD training and supervision.
- To promoting joint research programmes involving companies and academia offering the prospect of rigorous training and exposure of PhD students.

The CINet is unique for its focus on innovation management as well as for the specific vision that is shared by partner institutions concerning the role and potential contribution to innovation and improvement of human resources at all levels.

Characteristic for the CINet PhD network, relative to other PhD networks, is its strong emphasis on implementation and collaboration with industrial users. Students work in close collaboration with companies to analyse and solve management problems. Research designs involving in-depth empirical studies and action or clinical research are therefore encouraged. The PhD students involved in the CINet receive an intensive training to cope with concrete management issues. All the students who were so far rewarded a CINet-based PhD degree easily found their way to highly valued positions in industrial companies, in research institutes or as consultants.
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1. Problem definition and purpose of the study

1.1 Introduction

“In an economy where the only certainty is uncertainty, the one sure source of lasting competitive advantage is knowledge” (Nonaka, 1991, p.96).

“To be a leader in global manufacturing in the 1990s, a company must excel in two seemingly contradictory ways. First it must constantly build and refresh its individual areas of expertise so it has the critical capabilities needed to stay ahead of the pack. And second, it must get its mix of disciplines to work in the ever changing way needed to prevail in the ever changing competitive advantage” (Leonard-Barton et al., 1994, p.121).

The concept of organisational knowledge, as a valuable strategic asset, has become quite popular recently. Organisations are being advised by management theorists that, in order to remain competitive, they must efficiently and effectively create, capture, harvest, share and apply organisational knowledge and expertise. (Nonaka, 1991, p.96).

Several issues make the concepts of knowledge and knowledge management extremely challenging and difficult to analyse. First of all, knowledge always begins with an individual (Kim, 1993) and it is not a corporate resource. However, personal knowledge can be transformed into organisational knowledge valuable to the company as a whole (Nonaka, 1991). The purpose of knowledge management is to enhance a firm’s performance by designing, implementing, maintaining and improving a system that supports the organisation’s knowledge processes (Davenport et al. 1998). Making personal knowledge available at the company level is the real challenge of knowledge-creating companies that have to deal with the issue of tacit knowledge (Polany, 1966). This exists in mental models, beliefs and perspectives; so ingrained that they are taken for granted and cannot be easily articulated (Nonaka and Takeuchi, 1995). Moreover, knowledge and learning go hand in hand. Defending and enhancing a given knowledge position is most effectively accomplished by continuous organisational learning. The ability of an organisation to learn, accumulate knowledge from its experiences, and reapply that knowledge is, in itself, a skill that can provide competitive
advantage (Zack, 1999b). The question that arises concerns the relationship between learning and accumulated knowledge and innovation. Companies today, to confront themselves with a number of “intertwined changes in their environments” (Boer, 1991) which require the ability to innovate their processes and products but, at the same time, achieve results in terms of efficiency, quality and flexibility. How can accumulated knowledge therefore contribute to manage these changes efficiently and effectively? The question becomes much more critical when seeing the traditional issue of learning as the repetition of tasks (Boston Consulting Group, 1968; Abernathy and Wayne, 1974): if repetition of tasks (and therefore learning) improves company performances, how can learning take place and be exploited in innovative environments where there is much less repetition of tasks?

Finally, in the past, knowledge has been treated somewhat like air: it is ubiquitous, invisible, taken for granted and never explicitly valued or managed. However, in today’s business, firms must explicitly address a range of decisions regarding the creation, development, and maintenance of their knowledge resources and capabilities. The problem is that very little theory has addressed the issue, and moreover there is yet little solid guidance for the practicing manager. The relevance of knowledge is widely recognised (Wernerfelt, 1984; Leonard-Barton et al., 1994; Collis and Montgomery, 1995; Wijnhoven, 1999); but how it can be managed remains an unexplored issue. Recently, however, a growing number of contributions have addressed the processes and infrastructures for sharing and codifying knowledge, especially using new forms of “Information and Communication Technologies” (ICT). These efforts are extremely challenging, but at the same time they have merely addressed the technical applications of ICT (Conklin J. (a), 1996; Bradshaw et al., 1997; Croasdell, 1997), ignoring their impact on the overall organisation.

The thesis considers how knowledge processes can be supported in innovative and knowledge intensive environments, with particular emphasis on the role of ICT. The research especially focuses on managerial activities and decisions that help companies in stimulating knowledge processes; on how those decisions are related, with specific focus on ICT; and how they relate with the innovation strategy of the companies. The research arrives at a set of propositions on sets of managerial activities and decisions: how these decisions are related to each other, what are the expected results according to the innovation strategies of the company, how they contribute to developing new innovation strategies. Two remarks have to be made right at the start: choices concerning ICT in this research are not considered to be the only decisions; they have to be related to all the other managerial decisions for stimulating knowledge processes. ICT will result in a trigger, but is not the only enabler. Secondly the relationship among decisions will be investigated by exploring change: triggered by ICT, the changes in the other decisions, performances and innovation strategies will be investigated and explained.

The thesis stems from a collaboration between the University of Twente and Politecnico di Milano, which have been involved (and still are) in joint EU-funded research projects about topics of common research interest such as organisational learning, knowledge management, and product innovation management. In particular, my collaboration with the team at University of Twente started with the experience of the CIMA project, which is also a very important input for this thesis.
1.2 Goals of the study and research questions

The research interest behind the thesis concerns in particular how knowledge processes can be supported in innovative and knowledge intensive environments, with a particular emphasis on the role of ICT. Knowledge management of intellectual capital has become a central theme in today’s business environment and a commonly cited source of competitive advantage (Garvin, 1993, Drucker 1988). In more detail, the motivations behind the study can be referred to:

- **Globalisation and enlarged competition:** to survive in an increasingly demanding and global environment, companies have to compete on how they exploit their intellectual capital. This entails developing and exploiting tools to manage knowledge in increasingly complex networks of relationships both inside and beyond their borders. (Corso et al. 2002).

- **Emergence of new organisational models:** the shift to process and project-based organisational structures, and the consequent diminished resources for functional departments and other traditional knowledge-creating units, has reshaped the traditional organisation of companies. At the same time, new alliances among customers, idea generators, and sponsor/developer organisations create temporary and permanent dynamic networks between organisations, which can be extremely important, and new knowledge sources (Osterloh and Frey, 2000; Holland et al. 2000).

- **Availability of new ICT technologies:** new Information and Communication Technologies (ICT), and especially those based on web technologies, provide companies with new opportunities for managing knowledge, shifting many of the traditional boundaries to communication and the sharing of knowledge (Pentland, 1995; Newell et al. 2000).

These changes have created new opportunities and pressures: individuals work mainly in multidisciplinary and temporary groups and therefore have less exposure to functional knowledge. Specialists are encouraged to develop skills needed to carry out liaison and other integrative roles as well as to develop specialist skills and in-depth expertise. Moreover, people belonging to a specific unit or organisation are more likely to be employed on a partial and temporary base. Knowledge workers are forced to find answers to their own security and belonging needs, in alternative communities or networks of peers sharing the same professional interests and expertise (Drucker, 1988).

These trends explain why Knowledge Management (KM) has become one of the hottest issues in management research and practice. Contributions come from different streams in literature and have addressed the topic according to their specific interests and backgrounds. The main streams are: organisational learning, innovation management, strategy, knowledge management, and ICT management. Zack (1999a) points out, in particular, how ICT management literature has recently addressed KM as a really challenging issue: many technologies have been developed (i.e. artificial intelligence, push technologies...), but at the same time their application is focused on information management and sharing, and their testing is focused on the functionalities and not on the impact on the organisation and processes. Conversely, literature on organisational learning and innovation management has addressed, in a very conceptual way, the issues of the process of individual and organisational learning (Kim, 1993), of the levels of learning (Argyris and Shon, 1978; McKee, 1992), and how learning is related to improvement in the organisation (Bartezzaghi et al. 1997). Two main issues remain critical: most of the contributions do not operationalise the concept of learning, which
therefore remains a phenomenon difficult to measure and to manage. Secondly, few empirical studies can be found in the literature.

The goal of the thesis is to: *develop*, *operationalise*, *refine* and *extend* a conceptual framework about knowledge management in innovative environments. The approach followed in this thesis is a “system approach” (represented in figure 1.1) since its structure allows the highlighting of the knowledge processes, the decisions taken to manage them, and their context (De Maio et al. 1994). Knowledge (management) processes are considered as “open systems” in the sense that they interact with the external environment through their inputs and outputs. According to this approach, the inputs can be classified into two groups: the Decisions or levers (D), which are the variables that can be controlled by the actors in the system, and the Exogenous variables or contingencies (A) which they cannot influence. The output (performances) is determined by the impact on the system of the decisions taken.

Considering, in particular, knowledge management practices, the levers are all the decisions that managers implement in order to foster knowledge processes (i.e. ICT), while the outputs are the effects of knowledge processes on the organisation.

![Figure 1.1: The "system approach" adopted in the thesis.](image)

Following this approach, the objectives of the thesis are:

- To investigate if sets (or “configurations”) of levers are adopted by companies to stimulate knowledge processes and, if so, their effects on performances.
- To investigate the relationships among levers when one lever in the system changes (in particular if ICT changes) and the effects on performances.
- To investigate the relationship between innovation strategies (as a contingent variable) and configurations of levers (considering the effects on performances).

This leads to the following research questions:

<table>
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<tr>
<th>Research questions</th>
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<tbody>
<tr>
<td>RQ 1: What knowledge management configurations of ICT, organisational mechanisms, and management systems emerge in knowledge intensive, innovative environments, and which performances are related to them?</td>
</tr>
<tr>
<td>RQ2: Is a particular KM configuration aligned with a specific innovation strategy?</td>
</tr>
<tr>
<td>RQ3: How do changes in the configuration of ICT, organisational mechanisms and management systems support a company’s knowledge processes and performances in situations where ICT has been the trigger of this change?</td>
</tr>
</tbody>
</table>
The first research question is focused on three classes of levers: ICT, organisational mechanisms and managerial systems. All these levers are considered in the preliminary theory as relevant to knowledge management. Previous CIMA research has confirmed the relevance of these levers and, specifically for ICT, has recommended further investigation (Gieskes, 2001). The system approach to levers associated with this research question is a really challenging issue, as it introduces the idea that various configurations of levers are successful, and that performance also depends on the contingent situation of the company.

The second research question addresses the analysis of how a company's innovation strategies influence the knowledge management configuration and its performances.

The first two research questions will be answered through static analysis, exploring the variables of the preliminary framework through case studies and analysing the association among the variables. In terms of the first research question, the focus is on the internal the configuration, concerning the second research question it is external but focused on one contingent variable. The third research question requires the analysis of the system in a dynamic setting: one variable (ICT) is changed and the consequent changes to the other variables are explained. This enables the investigation of configurational change and the relationships among variables.
2. The background of the research

This chapter aims to discuss background of the thesis, as highlighted in figure 2.1: the theoretical background, the CIMA project, and further research work related to CIMA. In the thesis all these contributions are described in detail, in the present work, on the other hand, they are only briefly summarised. Especially for what concerns previous research works, the main reference is Gieskes (2001).

Figure 2.1: the theoretical background.

2.1 Theoretical background

2.1.1 Introduction

The main goal of this Section is to describe the theoretical background of the thesis, in order to highlight the starting point of the research and then to facilitate the understanding of its original contribution.
The most difficult issue at this first stage of the research, which is also a large challenge, has been to understand and combine contributions coming from different streams of literature that address the topics of knowledge and knowledge management differently.

Literature, which is relevant for this research, comes from studies on organisational learning (Nonaka, 1991; Senge, 1990; Argyris, 1982). Innovation management is another field related to knowledge management, with a huge number of contributions from fields such as continuous improvement, R&D management, new product development (Bessant et al., 1994; Nobeoka, 1993; Imai et al., 1985), and business process reengineering (Davenport, 1993). Strategic management has emphasised the “resource-based” view of the firm: Hamel and Prahalad’s (1990) core competencies are essentially knowledge-based sources of competitive advantage (Barney, 1991; Shoemaker, 1992). More recent contributions directly address knowledge management and ICT management, especially stressing the role of ICT as a driving force contributing to the relevance and diffusion of knowledge in organisations (Zack, 1999; Storck, 2000; Holsaple and Joshi, 1999). These streams of literature are extremely large and so, in order to focus the overview on the background theory in this chapter, the contributions have been assessed in terms of their relevance:

- What is knowledge and why it is an important asset for companies?
- What are knowledge processes?
- How can knowledge processes be stimulated in innovative environments?

Figure 2.2 represents the framework of this section, highlighting how each stream of literature (and the topics related to the research interest) contributes to the research.

**Figure 2.2: The overall structure of the chapter.**

### 2.1.2 Knowledge as a multidimensional concept
Before starting to describe and analyse the theoretical background, it is important to introduce the concept of knowledge. Knowledge is a very complex concept and it is
rooted in several contributions so that it is very hard to give one single definition. We will therefore resort to a multidimensional definition proposing a set of six complementary definitions that, while not singularly comprehensive, together may give an overview of how the concept of knowledge is used in management literature.

- **Knowledge is based on human belief.** As Nonaka (1991) argues, "Knowledge is a true justified belief". Knowledge is not static, absolute and objective, but rather dynamic, relative and subjective, as it emerges from beliefs that are person-dependent. Knowledge, therefore, always involves a person who knows depending on perspectives and intentions. Organisations, as a consequence, can only learn through individuals (Nonaka, 1991).

- **Knowledge is a purposeful set of information.** Knowledge is more than information and data (Zack, 1998). Data are single observations about facts, so they are not necessarily meaningful; information results from placing data together, including the context, in messages that are meaningful to someone (Zack, 1999,b). Knowing, finally, does not mean only having information about a certain topic, but also using it according to a certain purpose. Thinking is the process that makes information useful.

- **Knowledge is dynamically accumulated over time.** A different body of knowledge (knowledge base-Metcalfe and Gibbons, 1989) at the individual or organisational level derives from different paths or trajectories of accumulation of information. The uniqueness and competitive advantage of an organisation may be explained in terms of the unique process of knowledge acquisition, articulation and enhancement (Dodgson, 1993, Walsh and Ugson, 1991). This knowledge accumulated over time creates firm specific resources (Penrose 1959, Collis and Montgomery, 1995) or core competences (Prahalad and Hamel, 1990) that are the key to understand company strategy and results. The stock of knowledge that one company controls at a certain time also influences its ability to learn. Cohen and Levinthal (1990) introduce to this aim the concept of “absorptive capacity”: the ability of a firm to recognise, create, store and reuse critical knowledge according to the prior level of relevant knowledge (Bhatt, 2001, Teece et.al, 1997).

- **Knowledge circulates at organisational levels.** People do not learn on their own: transfer of knowledge among individuals within a certain community helps in creating knowledge. In communities people come to embody ideas, perspectives, prejudice, language and practices of such a community (Kuhn, 1970). Knowledge circulates through communities. (Dogdson, 1993).

- **Knowledge can be shared in tacit or explicit forms:** Explicit, or "codified", knowledge refers to knowledge that is transmittable in formal, systematic, language. It is discrete, or “digital”, and it is captured in records of the past such as libraries, archives, and databases and is assessed in a sequential basis. According to Polanyi (1966), however, most knowledge remains in tacit forms, deeply rooted in a specific context. It entails knowledge which is difficult to express, formalise or share in an explicit way.

- **Knowledge is created at the boundaries of old through an incremental process** (McDermott, 1999). The process of creating knowledge relies on combination, comparison and synthesis of what people already know in terms of experience, abilities, information and explicit knowledge. The output of the process of learning is new knowledge. Although knowledge can allow radical changes and discontinuous innovation, the process of learning through which knowledge is acquired is always somehow continuous and incremental (Hedberg, 1981).
2.1.3 The organisational learning contribution

As a result of the definitions of knowledge provided, most of the literature focuses on the definition and analysis of the process of organisational learning, and considers knowledge as a result of this process. Therefore, to understand the concept of knowledge and its typologies, it is useful to deepen some characteristics of learning: the definitions of learning, the perspectives of learning (Shrivastava, 1983) and the distinction between individual and organisational learning. To get a more detailed analysis of organisational learning issues, refer also to Gieskes’ PhD thesis (2001). Moreover, considering the innovation management literature, main contributions refer to the levels of learning, and learning in innovative contexts. Summarising the contributions of organisational learning and innovation management, several issues can help in setting the stage of research about knowledge processes and knowledge management:

- Organisational learning influences people’s behaviours, and can also impact on the cognitive level. Single and double loop learning levels reflect this distinction.
- The organisation learns by the learning of its members. Individual and organisational learning are related.
- What organisations and individuals learn in the organisation is very much dependent on what is already known (or believed) by other members of the organisation, and on what kinds of information are present in the organisational environment. Individuals store knowledge in their individual memory, while memory of the organisation is reflected in shared mental models (theories in action).
- Learning as a cycle happens also in innovative environments, but it presents certain peculiarities to overcome the temporal, spatial and organisational barriers: the improvement phase deals with abstraction and generalisation, embodiment, dissemination and application; and it is carried out moving from the single loop to the double loop level.

2.1.4 The strategic management contribution

The main contribution of strategic management to the research interest of the thesis comes from the “resource based view of the firm”. As Nonaka (1994) points out, the resource-based view (RBV) can be seen as an essential link between organisational learning literature and knowledge management literature. (Barney, 1991; Penrose, 1959; Peteraf, 1993; Prahalad and Hamel, 1990; Schumpeter, 1934; Teece et al., 1990; Wernerfelt, 1984). According to the RBV, core competencies of the firm are the real strategic asset (Prahalad and Hamel, 1990). Core competencies are the collective learning in the organisation, which have to be identified within the company, and not in the market. (Leonard Barton, 1992). The contribution of RBV to knowledge management is related to the following issues:

- First of all to the role of knowledge. RBV focuses on core competences, but does not focus on knowledge within the company or in its units, which remains implicit. The critical link is made explicit by Leonard Barton (1992): the core capability of a firm is its knowledge, which characterises the company and creates competitive advantage.
- The types of knowledge: if the core capability of the company is its knowledge, it has to be rare, imperfectly imitable and non-substitutable according to the RBV. The challenge is to identify within the company which knowledge represents these characteristics.
- The role of dynamic capabilities: the RBV does not fully describe how certain firms gain competitive advantage in situations of rapid and unpredictable change (Teece et al.
In such a context, the challenge is to rely on the dynamic capabilities by which firm managers “integrate, build, and reconfigure internal and external competencies to address rapidly changing environments” (Teece et al. 1997).

- **The role of Top management:** finding and leveraging on the core competences of the company is mainly a management task (Nonaka, 1994). On the other hand, as literature on organisational learning has highlighted, learning occurs at every level of the company. Managers have to build organisational and technological mechanisms in order to foster learning throughout the company.

- **Focus on enablers:** the purpose of RBV is to stress the importance of core competence within the company, and to leverage on it to gain competitive advantage. Only few contributions (Meso and Smith, 2000) have tried to formalise the enablers of creating core competence (i.e. Wernerfelt, 1984).

### 2.1.5 The knowledge management and ICT management contributions

Many definitions of Knowledge Management have been proposed, including:

- KM is the systematic, explicit, and deliberating building, renewal, and application of knowledge to maximise an enterprise’s knowledge-related effectiveness and returns from its knowledge assets (Wiig, 1995).
- KM is getting the right knowledge to the right people at the right time so they can make the best decision (Pettrash, 1996).
- KM is bringing tacit knowledge to the surface, consolidating it in forms by which it is more widely accessible, and promoting its continuing creation (Birkett, 1995).
- KM is a set of policies, procedures and technologies employed for operating a continuously updates linked pair of networked databases (Anthes, 1991).
- KM is the processes of capturing, distributing, and effectively using knowledge (Davenport and Völpel, 2001).
- KM is the process of capturing the collective expertise and intelligence in an organisation and using them to foster innovation through continued organisational learning (Nonaka, 1991; Quinn et al. 1996; Davenport et al. 1998).

All these definitions underpin issues which partially derive from streams of literature already highlighted (organisational learning, strategic management), and that can be further developed by calling on other contributions (i.e. knowledge management, ICT management). In particular: 1) *The classification of knowledge* 2) *The phases of knowledge processes* 3) *The enablers of knowledge processes*.

#### 2.1.5.1 Classification of knowledge

Literature provides classifications of knowledge, which are extremely important from a knowledge management point of view allowing different categories of enablers (with specific reference to ICT) to be implemented to stimulate different types of knowledge. In figure 2.3 these classifications are summarised. In the thesis a detailed description of each classification is reported.
<table>
<thead>
<tr>
<th>Type of classification</th>
<th>Types of knowledge (Dimensions of the classification)</th>
<th>Main References</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ontological</td>
<td>Individual, Group, Unit, Company, Interfirm knowledge</td>
<td>Nonaka and Takeuchi, 1995; Nonaka, 1994;</td>
</tr>
<tr>
<td>According to the</td>
<td>Declarative (know what), Procedural knowledge (know how), Causal (know why); Self motivated creativity (care why)</td>
<td>Quinn et al. (1996, b); Albino et al. (2001); Stein (1995); Wijnhoven (1999)</td>
</tr>
<tr>
<td>level of specificity</td>
<td>General and Specific knowledge</td>
<td>Zack, 1990; Court, 1997</td>
</tr>
<tr>
<td>According to the</td>
<td>Embrained (knowledge about); Embodied (knowledge how) Encultured (achieving shared understandings); Embedded (residing in systemic routines); Encoded knowledge: (conveyed by signs and symbols).</td>
<td>Fiol and Lyles (1985) and Argyris (1978) and Senge (1990); Zuboff (1988); Ouchi (1980) Nelson and Winter (1982), Levitt and March (1988), Prahalad and Hamel (1990); Henderson and Clark, 1990.</td>
</tr>
<tr>
<td>level of embedment in the organisation</td>
<td>Component and Architectural knowledge</td>
<td>Henderson and Clark (1990); Henderson and Cockburn (1994); Iansiti (1994)</td>
</tr>
<tr>
<td>According to the</td>
<td>Knowing which information is needed (know what) Knowing how information must be processed (know how) Knowing why information is needed (know why) Knowing where information can be found to achieve a specific result (know where) Knowing when information is needed (know when)</td>
<td>Spek and Spijkervet (1996) Liebowitz (1999)</td>
</tr>
</tbody>
</table>

Figure 2.3: Classifications of knowledge.

2.1.5.2 The knowledge process

Descriptions of the knowledge process are very much related to contributions in literature addressing phases of learning (Huber, 1991; Davenport et al. 1998; Quinn et al., 1996; DiBella et al., 1996). According to Huber (1991), the overall knowledge process is resolved in processes and subprocesses (as shown in figure 2.4), which have been variously addressed by several streams of literature. In this extract, only a brief description of the processes is reported, while a detailed analysis of each subprocess is included in the thesis.

**Knowledge acquisition** is the process by which knowledge is obtained. Huber (1991) formalises five subprocesses by which the organisation can acquire knowledge. They differ according to the scope (organisation, unit, individual), to the actors involved in the
process (internal, external), to the process itself (creation of knowledge, assimilation of knowledge.

<table>
<thead>
<tr>
<th>Processes</th>
<th>Subprocesses</th>
<th>Subprocesses</th>
</tr>
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<tbody>
<tr>
<td>1.0 Knowledge acquisition</td>
<td>1.1 Congenital learning</td>
<td>Organisational experiments;</td>
</tr>
<tr>
<td></td>
<td>1.2 Experiential learning</td>
<td>Organisational self-appraisal;</td>
</tr>
<tr>
<td></td>
<td>1.3 Vicarious learning</td>
<td>Experimenting organisations;</td>
</tr>
<tr>
<td></td>
<td>1.4 Grafting</td>
<td>Unintentional or unsystematic learning;</td>
</tr>
<tr>
<td></td>
<td>1.5 Searching and noticing</td>
<td>Experience-based learning curves;</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Scanning; Focused search; Performance monitoring</td>
</tr>
<tr>
<td>2.0 Knowledge distribution</td>
<td>2.1 Initiation</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2.2 Implementation</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2.3 Ramp up</td>
<td></td>
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<tr>
<td></td>
<td>2.4 Integration</td>
<td></td>
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<tr>
<td>3.0 Knowledge interpretation</td>
<td>3.1. Cognitive maps and framing</td>
<td></td>
</tr>
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<td></td>
<td>3.2. Media richness</td>
<td></td>
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<td></td>
<td>3.3 Information overload</td>
<td></td>
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<td></td>
<td>3.4 Unlearning</td>
<td></td>
</tr>
<tr>
<td>4.0 Organisational memory</td>
<td>4.1 Storing and retrieving information</td>
<td></td>
</tr>
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<td></td>
<td>4.2 Computer based organisational memory</td>
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</table>

Figure 2.4: Phases of knowledge processes (from Huber, 1991, p.90).

**Knowledge distribution**: A critical issue in any organisation is how to distribute knowledge to places where it is needed and can be applied (Porter and Roberts, 1976; Huber, 1982). It can also be described as knowledge transfer or knowledge diffusion to emphasise that the movement of knowledge within the organisation is a distinct experience, not a gradual process of dissemination, and depends on everyone involved (Szulanski, 1995). Szulanski (1995) discusses the impediments to the transfer of knowledge within the firm. Some barriers depend on the characteristics of knowledge transferred: causal ambiguity is related to tacitness of knowledge and imperfect understanding of idiosyncratic features of the new context in which knowledge is put in use. It is related to a higher cost of transfer. Another element affecting the stickiness of the transfer process is unproveness (Szulanski, 1995): people working in the process do not have proven record of past usefulness of knowledge. Other barriers depend on the characteristics of the source of knowledge in terms of lack of motivation (losing ownership, lack of reward, no time) or the reliability not being perceived. Similar characteristics can be attributed to the recipient: lack of motivation, Not Invented Here syndrome, lack of retentive capacity and especially absorptive capacity (ability to assimilate and apply new knowledge- it is a function of pre-existing stock of knowledge), to which the cost of transfer is strongly linked. Finally, some barriers depend on characteristics of the context: namely, a barren organisational context and arduous relationship (in terms of ease of communication, especially when knowledge is tacit).

Another important issue concerning knowledge distribution is the directions of knowledge transfer. Bartezzaghi et al. (1998) discuss the direction of knowledge transfer
in Continuous Product Innovation process (CPI). All the directions among phases highlighted in the model constitute a very strong potential for learning and for innovation, but which can only be exploited by an active effort to design and implement adequate mechanisms to enable this transfer of knowledge.

**Knowledge interpretation:** Daft and Weick (1984) define interpretation as “a process through which knowledge is given meaning” and also “the process of translating events and developing shared understandings and conceptual schemes” (p.286). According to Huber (1991), the extent of shared interpretation is influenced by several factors.

**Organisational memory:** As Kim (1993) pointed out: memory is the peculiar part of the learning process, but little research (and in particular empirical research) has been carried out on this issue. Huber (1991) observes how the other phases of knowledge management are strongly dependent on organisational memory: for instance knowledge acquisition depends on attention directed by previous learning stored in memory, and knowledge distribution is affected by decisions using information and knowledge contained in organisational memory.

Literature about organisational memory mainly refers to storing, retaining and the maintenance of knowledge, and the main contributions are listed in Stein, 1995 (p.20). Several observations emerge from literature about organisational memory: firstly it is important to note that retention is not enough to enhance and develop organisational memory. Maintenance and retrieving are equally important: memories are only maintained if an organisation has access to its knowledge and expertise, for example minimising the level of turnover. Conversely, the availability of an organisational memory is not enough to foster retrieving. An inquirer has to be motivated to retrieve knowledge (Stein, 1995).

2.1.5.3 The enablers of knowledge processes.

Many contributions in literature address the enablers of knowledge process as the Knowledge Management System (KMS). These contributions can be seen as belonging to two main streams: the technical perspective and the socio-technical perspective. The technical perspective holds that a knowledge management system is an advanced assembly of software, and its associated hardware infrastructure, for supporting knowledge work, and/or organisational learning through the free access and increased sharing of knowledge (Hibbard, 1997; Crock et al. 1998; Lotus, 2000). In this perspective, knowledge is managed through the combination of key technologies: computer mediated collaboration, electronic task management, messaging, video conferencing and visualisation, group decision support, web browsing, data mining, search and retrieval, intelligent agents, document management. According to this technical perspective, knowledge is equal to information (McDermott, 1999), and it has to be made explicit and encoded (Blacker, 1995).

As Carayannis (1998) states, while information technology can be considered as a value-adding technological infrastructure, knowledge management can be viewed as a socio-technical system of tacit and explicit business policies and practices. These are enabled by the strategic integration of information technology, business processes, and intellectual, human and social capital. In the thesis, the socio-technical perspective is followed. In
order to analyse enablers, the thesis will principally reviews three classes of levers: organisational mechanisms, managerial systems and especially ICT. The enablers have been classified according two dimensions: a) The phase of the knowledge process they support: in terms of knowledge acquisition, knowledge capitalisation (organisational memory) and knowledge transfer (knowledge distribution-Huber, 1981) and b) The scope of the cluster1 of people involved in the KM process: 1) Cluster Intra (it could be only one person or a group of people belonging to the same organisation); 2) Cluster Group (a cluster of persons belonging to different organisations, but that are part of the same group); 3) Cluster Inte (this cluster extends to the people who do not belong to the same organisation, nor to the same group of firms).

First of all, organisational mechanisms and managerial systems are addressed, while the review of ICT will be developed separately given the relevance to this research work.

Organisational and managerial mechanisms for knowledge management

In this section, the main contributions from literature, in terms of organisational mechanisms and managerial systems, will be reviewed while considering the phases of the knowledge processes and the cluster they support. The major enablers coming from those contributions are summarised in figure 2.5. In the thesis a deeper description of the enablers and relative literature is provided (Zack; 1999a; Hansen et al., 1999; Holsapple and Joshi, 2001; Becerra-Fernandez and Sabherwal, 2001; Lam, 2000; Osterloh and Frey, 2000; Jarvenpaa and Staples, 2001).

---

1 We use the word ‘cluster’: it gives the idea of a group of people involved in the KM process, but is aseptic towards both the formal (i.e. teams) and the informal nature of the group itself (i.e. communities or networks of practice). This dimension of classification helps in highlighting how the enablers support the dispersion of knowledge processes (Wijnhoven, 1999).
<table>
<thead>
<tr>
<th>Clusters</th>
<th>Knowledge management phases</th>
<th>Knowledge acquisition</th>
<th>Knowledge transfer</th>
<th>Knowledge capitalisation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cluster Intra</td>
<td>X teams&lt;br&gt;recruiting&lt;br&gt;focus groups&lt;br&gt;experimentation</td>
<td>mentoring and storytelling&lt;br&gt;T-shaped approach&lt;br&gt;chief knowledge officer&lt;br&gt;communities</td>
<td>rules, goals, standard supporting teams&lt;br&gt;distribution of knowledge within the group&lt;br&gt;diversity&lt;br&gt;chief knowledge officer&lt;br&gt;communities</td>
<td></td>
</tr>
<tr>
<td>Cluster Group</td>
<td>parallel structures, inter-unit climate, goal congruence&lt;br&gt;core team, formalisation, procedural justice&lt;br&gt;cross fertilisation and cross functional integration&lt;br&gt;task design, group composition, organisational context, relation with internal and external processes&lt;br&gt;leadership&lt;br&gt;community of creation</td>
<td>interpersonal exchange of people&lt;br&gt;methodologies for partners selection&lt;br&gt;clarification of roles&lt;br&gt;responsibilities and incentives&lt;br&gt;leadership&lt;br&gt;cross fertilisation and cross functional integration,&lt;br&gt;task design, group composition, organisational context, relation with internal and external processes&lt;br&gt;community of creation</td>
<td>communities of practice</td>
<td></td>
</tr>
<tr>
<td>Clusters</td>
<td>Cluster Inter&lt;br&gt;individual motivations&lt;br&gt;reputation aspects&lt;br&gt;community of practice</td>
<td>individual motivations&lt;br&gt;reputation aspects&lt;br&gt;community of practice</td>
<td>Communities of practice</td>
<td></td>
</tr>
</tbody>
</table>

Figure 2.5: Literature Review on Organisational Mechanisms and KM.

The role of ICT to support knowledge processes
Many contributions (Zack, 1999a; Hendricks, 1999) agree on the fact that ICT, and in particular web based technologies and Lotus Notes can support knowledge processes (Liebowitz, 1999).

Reviewing the literature about ICT according to the provided framework (phases of knowledge processes and cluster supported), it appears that most contributions focus on classification of technologies to support knowledge processes phases either independently from the supported cluster (mainly ICT literature focused on the technology and not on its application in the organisation) or related to the Intra cluster. In particular, some contributions have analysed only one phase (Merlyn and Valikangas, 1998; Hendricks, 1999), others have analysed the effect on all the phases of the knowledge process (Ruggles, 1997; Stein and Zwass, 1995). In all the cases, it is important to point out that most of the technologies enable the management of explicit knowledge (Berini, 2000). In
terms of the other clusters, only recent contributions have highlighted specific applications of ICT functionalities for “group” and “inter” clusters. The lack of contributions in this area in partially due to the only recent growth in the importance of dispersed settings and related investments. In the thesis, a preliminary discussion of the role of ICT in supporting the phases of knowledge processes is provided, considering the main functionalities of technology. Then, a brief description of the literature contributions about ICT supporting the activities of “Intra”, “Group” and “Inter” is highlighted.

<table>
<thead>
<tr>
<th>Clusters</th>
<th>Knowledge acquisition</th>
<th>Knowledge transfer</th>
<th>Knowledge capitalisation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Focus on</td>
<td>- links to internal and external data sources, information filtering, natural language</td>
<td>- internet based forums, groupware, case based reasoning, war rooms and talk rooms</td>
<td>- structures, temporal languages, models, scripts, frames, production rules, conceptual graphs, knowledge maps (contacts, documents, events), thesaurus, dictionary, lessons learned, pattern matching recognition methods (fuzzy logic), knowledge servers, push technologies</td>
</tr>
<tr>
<td>description of</td>
<td>processing, intelligent summarising capabilities, intelligent agents and search engines,</td>
<td></td>
<td></td>
</tr>
<tr>
<td>functionalities</td>
<td>knowledge charts and users profiles, associative list of words, concept maps, random through exercises</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cluster Intra</td>
<td>- artificial intelligence, DSS, Geographical information system, knowledge discovery techniques</td>
<td>- artificial intelligence, integration between ERP and KMS, groupware and virtual communities, communication forums</td>
<td>- artificial intelligence, knowledge based schemata, document management systems, intelligent agents</td>
</tr>
<tr>
<td>Cluster Group</td>
<td>- fuzzy group support, data warehousing, communication tools</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cluster Inter</td>
<td>- ebusiness systems, data mining, communication tools</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Figure 2.6: Literature Review on ICT and KM.
In figure 2.6, ICT to support knowledge processes is reviewed: in the first row, the technologies to support knowledge processes without reference to the cluster are addressed, and then the ones specifically indicated for clusters are provided.

2.2. The contribution of preliminary research works

The preliminary research works contributing to the thesis in terms of research results, research setting, investigating framework and literature are:

- The CIMA project (ESPRIT 26056). One of the aims of the CIMA (Continuous Improvement for global innovation MANagement) project was to develop a methodology to support companies in managing learning and continuous improvement (CI) in Product Innovation (PI) Processes. The CIMA project pursued the specific objective of developing, testing and disseminating a methodology to support Product Innovation knowledge transfer within and among firms.

- Gieskes’ PhD thesis (2001) which aimed at refining results from the CIMA project with regard to variables and their relationships within the model of Learning and Continuous Improvement in Product Innovation.

The focus of this book is not the description of the specific research works, but the brief report of the their contribution to the thesis. In more detail:

- The design of the research methodology. In the CIMA research, both in-depth case studies and preliminary action research have been carried out. The investigation protocol and questionnaire developed in the explorative part of the research, and the experience in managing action research projects, has been extremely important to design the methodology for the present research. This experience has been useful both for in-depth cases and for action research in establishing the really relevant questions, to make the language in questions really clear and to choose usable scales to measure the variables.

- The reference framework: providing an overview on a preliminary set of variables, and the relationships among them, concerning learning in product innovation processes.

- Definition of relevant levers in terms of measured effects on learning behaviours. Only some of the levers indicated in the CIMA project (Boer et al. 2002) stimulate learning behaviours, others have been refined, and new ones introduced. In particular ICT appears to be effective, but it might well be that renaming it, or investigating it in more detail, in new research will show a higher impact than that detected by Gieskes (2001).

- The existence of barriers hindering learning behaviours. A number of barriers relate to preconditions for learning. Examples are managerial commitment, motivation for learning, slack, communication and information loops. Such barriers are not the inverse of levers, as the implementation of levers is not sufficient to overcome them.

- Frequency of learning behaviours to measure effectiveness of levers on knowledge processes. The relationship between behaviours and knowledge subprocesses has been assumed. With this assumption, it is possible to operationalise the effectiveness of levers on knowledge processes in terms of frequency of learning behaviours: in reality it measures to what extent people involved in knowledge processes are engaged in acquisition, transfer and sharing, storage and retrieval of knowledge. The model coming from Gieskes (2001), which is a relevant input for the thesis, is shown in figure 2.7.
Using this as a starting point, the thesis focuses on:

- **Innovative environments.** Previous research was concentrated on product innovation processes, this research moves on to innovative environments, including other typologies of projects (i.e. professional project of consultancy companies).

- **Knowledge processes.** The objects of the thesis will be knowledge processes and knowledge management processes. Therefore, some definitions and specifications of the topic need to be provided, starting from the theoretical background.

- **The overall configuration of levers to foster knowledge processes**, with specific reference to ICT tools within the configuration.

- **Some contingent variables.** Deriving from the CIMA project, research has been carried out in terms of analysing behaviours and levers in specific contingent situations (Chapman et al. 2001). In this thesis a limited set of contingent variables will be considered in order to analyse their impact on the configuration of levers adopted.

![CIMA identified relationship Potential impact](image)

**Figure 2.7: The refined CIMA model (Gieskes, 2001, p.171).**
3. The research design

In order to describe the research design, it is important to highlight: its structure and phases, the main research questions of each phase, and their relationships, the main research propositions, the research investigation methodologies adopted.

3.1 The overall structure of the research work

This PhD thesis is aimed at answering three research questions:

RQ 1: **What knowledge management configurations of ICT, organisational mechanisms, and management systems emerge in knowledge intensive, innovative environments, and which performances are related to them?**

  RQ 1.1: Which are the *functionalities of levers* fostering knowledge processes?
  RQ 1.2: Which *KM configurations* (in terms of ICT, organisation and management tools) are successful in terms of performances of the knowledge process?
  RQ 1.3: What are the effects of each *KM configuration of levers on performance*?
  RQ 1.4: Which *types of managed knowledge* characterise each configuration?
  RQ 1.5: Are the configurations of levers adopted in consultancy companies also valid in other knowledge-intensive industries?

RQ 2: **Is a particular KM configuration aligned with a specific innovation strategy?**

  RQ 2.1: Is a KM configuration associated with a specific innovation strategy?
  RQ 2.2: Does an innovation strategy influence the success of a knowledge management configuration?

RQ 3: **How do changes in the configuration of ICT, organisational mechanisms and management systems support a company’s knowledge processes and performances in situations where ICT has been the trigger of this change?**

  RQ 3.1: What changes to the overall knowledge management configuration are stimulated by the change of one of the levers (i.e ICT functionalities)?
  RQ 3.2: What are the effects of configurational change on performances?
RQ 3.3: What barriers to change and its effectiveness emerge?
RQ 3.4: Does the configurational change influence the innovation strategies adopted by a company?

In order to address these research questions, the research has been organised in different phases as depicted in figure 3.1.

**Preliminary research and background theory**
The major contributions of this phase refer to background theory concerning organisational learning and knowledge management, which have been used to an extent in the CIMA project and in CIMA-related research work (Gieskes, 2001), and are to an extent original to the present work. These research results provide material to develop a background theory, a preliminary framework, and preliminary propositions that will be addressed in the explorative research. The output of this phase are: a multidimensional definition of knowledge, a definition of knowledge management, a framework of the knowledge process based on its phases, the classification of types of knowledge, a categorisation of the levers of learning in terms of ICT, management systems and organisational mechanisms, the human behaviours influenced by knowledge, the identification of critical issues that enhance knowledge processes in innovative contexts: abstraction and generalisation, double loop learning, experimentation, and unlearning. Moreover, for what specifically concerns previous research, the main contribution is a refined model for learning in product innovation in terms of: the identification of all the possible levers (under different headings) for fostering knowledge processes, the identification of learning behaviours of people operating in knowledge processes, an operationalisation of learning performances in terms of improvement performances, people performances, and business performances, a list of contingent variables, which influence knowledge processes, the concept of barriers to learning, which are not the inverse of levers.

![Figure 3.1: The phases of the overall research.](image)

Despite these contributions, a number of issues remain unexplored which can be addressed through new research questions.
First of all, the need for a “system approach” to knowledge management in terms of relevant variables enabling knowledge processes. Preliminary theory has mostly focused the attention on one class of variables at a time, without developing an approach that considers all the variables together.

The topic of functionalities and forms of levers is related to the previous issue. The functionality of an enabler can be considered as the purpose for which it is designed (Stein and Zwass, 1995). In order to realise a functionality, several “forms” or solutions can be shaped for each lever (Mintzberg, 1985).

The role of contingent variables. The effectiveness of levers on behaviours can also depend on the contingent situation of each company (Chapman et al., 2001).

The relationship between the knowledge process and the operational process. In case studies during the CIMA project it emerged that levers implemented to support operational processes can potentially also stimulate knowledge process. Nevertheless, Gieskes (2001 pp.168) found that “…an effective configuration of levers for managing the innovation process may be different from an effective configuration of levers for stimulating the learning process…” so that the two levels of analysis are separated.

The relationship among variables. Most of the previous research has been dedicated to the identification of relevant variables in the CIMA model. So far, results can only provide a few insights into the relationships among them.

The levels of evolution of knowledge management. Companies involved in the previous research show different “maturity” levels in the evolution of their learning processes, and in the way knowledge management practices support them.

**Explorative research**

It is a mainly empirical phase of this research work that addresses RQ1, RQ2 and, to an extent, RQ3. In more detail, in order to answer RQ1, firstly an exploration of knowledge management configurations in a specific research setting (successful consultancy companies) has been carried out, exploiting the experience of companies operating in this industry in managing and formalising knowledge processes. Then, the validity of results in two other professional knowledge intensive contexts (telecommunication companies) has been assessed. Turning to RQ2, first of all the association between successful KM configurations and innovation strategies has been analysed. Following this, in order to detect the alignment, cases with poor performances, where there were missing associations, have been analysed in order to investigate whether the missed association can be considered the cause of the poor results. In considering RQ3, the time dimension has been added to the research: companies where changes in the knowledge management configuration occurred (in particular due to implementation of new ICT functionalities), have been investigated and analysed. In order to perform the above research activities, two phases of explorative research have been carried out. Firstly, stage 1, which mainly addressed RQ1 and RQ2 in the consultancy industry setting. The “multiple explorative case studies” methodology was applied using eight cases. The second stage, focusing on the two telecommunication (TLC) companies, has two important characteristics: first of all the companies operate in a different industry from consultancy, allowing a check on the validity of propositions derived for consultancy companies being applicable to other highly professional knowledge-intensive environments (RQ1). Secondly, they were investigated using a “longitudinal case study” methodology. Results from an investigation into one moment in time, ignoring the time dimension, can be used as static cases. In one
stage of the investigation², the knowledge management configuration was related to poor performances: analysing if the missing association between innovation strategies and knowledge management configuration could be considered to be the cause of poor results, thus allowing one to check the alignment (RQ2). Then, by considering the analysis of changes in the configuration, and their relationship with performances over time, one can begin to answer RQ3.

**Action research**

*Action research* is aimed at refining a selection of research propositions. In particular, the propositions related to the specific empirical setting of the companies involved in the action research were addressed. The main goals of this part of the research were to refine the propositions about the links between configurational change and performances in the specific context, and to investigate barriers to change and to effectiveness of change on performances. From this overall architecture of the research work, and the aims expressed in the research questions, it is evident that there is an ongoing combination of the conceptual and empirical levels of the investigation.

From the preliminary research and background, a preliminary framework based on preliminary theory is derived. Such a framework is essentially at a conceptual level albeit based on empirical evidence explained through theory. Two main processes will be designed and carried out in the thesis. From *conceptual to empirical level*: applying the framework in order to refine the research propositions. From this process it is possible to operationalise the framework, although the results will remain related to a specific research setting and cannot be generalised. The process of *interpretation*: involves the explanation of the empirical results through theory. Through this process it is possible to refine the propositions and the framework before the next phase of the research. Naturally, interpretation has to take into account the extent of generalisability of the empirical results, which strongly depends on the investigation methodology adopted (in particular with regard to the external validity, Yin, 1994). Results from the two processes provide contributions to theory and managerial practice. A synoptic table of the research structure and the line of reasoning is provided in figure 3.2. In this figure the three stages of the research, and their relationship with the research questions and methodology adopted, are represented.

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² Although the investigation of these cases is longitudinal, the check of the alignment is assessed in a static mode: the configuration, the innovation strategies and the performances are measured in one stage. The dimension of time is introduced only to address RQ3.
3.2 The methodology in the research

This chapter justifies the methodological choices that have been made. It is important to underline that while in this chapter the main choices are explained, in each subsequent chapter the investigation methodology (in terms of investigation protocol, questionnaire, and research setting) is described in much more detail.

In order to introduce the different methodologies, a framework is derived starting from Yin (1994); case studies can be classified according to three dimensions as represented in figure 3.3:

- According to the approach: case studies can be explorative, descriptive or explanatory. Explorative cases are used to answer research questions that investigating which phenomena happen in specific situations, descriptive cases for describing such phenomena, explanatory cases in arguing why they happen.

![Figure 3.3: The typology of case studies.](image)

- According to the time: they can be retrospective or longitudinal. Retrospective cases represent a picture of the company as the result of previous actions; a longitudinal case, on the other hand, refers to different pictures taken over time, in order to study the evolution of variables.
- According to the number: single cases are usually explorative or descriptive, multiple case studies, on the other hand, support the process of explanation of some of the variables involved.

To address RQ1 and RQ2, the analysis is mainly explorative, based on multiple retrospective cases (see figure 3.3, point 1). The aim is to investigate the successful KM configurations. The outcomes from these cases are mainly descriptive and related to the context. Two issues are challenging at this stage of the research:

- The research setting: the research setting should be identified so as to allow the comparison with results from this first stage of explorative research.
The methodology design should achieve the prerequisites for validity of case study research (Yin, 1994): construct validity, internal validity, external validity, and reliability.

In order to address RQ3, on the other hand, the time dimension is required. Therefore, the investigation, which is still explorative, moves on to multiple, explorative and longitudinal cases (figure 3.3, point 2).

Finally, the third stage of the research is mainly for “explaining” what happens within knowledge management configurations and in knowledge processes when one of the levers (i.e. ICT) changes. In this case, the methodology adopted concerns one case study, with explicative purposes, and longitudinal given that the time dimension is extremely relevant. Nevertheless, action research presents the peculiarity of “participation”, which differentiates it from case studies, and requires further discussions.

The explorative research has been first carried out through multiple case studies. Case study methodology has been selected to answer the RQ1 and RQ2 for several reasons: 1) The explorative peculiarity of the research 2) The relationship with other steps of the research and the methodological recommendations coming from them. In the CIMA-related research, a preliminary set of variables has been explored through in-depth case studies and then operationalised into methodology. Propositions underlying this preliminary framework and the included variables have already been investigated through a quantitative approach (Gieskes, 2001, pp.196-198). 3) The focus on many variables and difficulty in defining the independent variable. As indicated by Gieskes (2001), many variables are involved in knowledge processes modelling, in terms of levers, barriers, performances and contingencies. Due to the high number of variables, it is not always possible to formulate propositions on the cause-effect relationships especially because the independent variable is not always clear in advance. 4) The difficulty in measuring intangible variables (De Maio et al. 1994).

The reasons for adopting longitudinal case studies are twofold: 1) The relevance of “time dimension”. Outcomes concerning RQ1 and RQ2 will be obtained from the multiple case studies. These results concern the characteristics of the configuration, and its links with performance and innovation strategies. Analysis over time of configurational change requires moving from static to longitudinal cases, analysing what happens at each step of the investigation and the drivers and characteristics of change over time. 2) The explorative characteristics and relationship with action research approach. The goals of the action research approach are to refine propositions coming from explorative analysis and to investigate barriers to change, through explaining how changes take place. Further, the existence of a preliminary set of propositions, coming from the static and longitudinal case studies, improves the reliability of the action research case study.

As widely described in literature, the action research approach requires much more description, (Coughlan and Coghlan, 2002; Gummesson, 2000; Reason, 1998) but there are various approaches. A detailed description of the action research approach adopted in this research work, and how it is related with the approaches found in literature, is reported in the thesis (chapter 8). According to Coughlan and Coghlan (2002), action research is “research in action” and not “research on action”. In this thesis, several
characteristics of the research have led to the adoption of a participative approach: 1) The overall research objective. The thesis aims at developing actionable, thus rich, knowledge about the knowledge processes and knowledge management systems. 2) The third research question, which is fundamentally about change and its effects on performances and knowledge processes. 3) The complexity of the topic. The number of variables (implicit or already explicit at the beginning) and their changes over time require a strong involvement of the researcher in order for these variables and changes to be understood and explained. 4) The overall structure of the research. The action research case is not an isolated experience. It is part of the overall research work involving explorative case studies to develop the first interpretative model and preliminary research propositions.
4. The identification of the knowledge management configurations

4.1 Introduction

As described in Chapter 3, this chapter aims at addressing RQ1, in the setting of consultancy companies. Specifically research question 1 is:

What knowledge management configurations of ICT, organisational mechanisms, and management systems emerge in knowledge-intensive, innovative environments, and which performances are related to them?

1. Which are the functionalities of levers fostering knowledge processes?
2. Which KM configurations (in terms of ICT, organisation and management tools) are successful in terms of performances of the knowledge process?
3. What are the effects of each KM configuration of levers on performance?
4. Which types of managed knowledge characterise each configuration?
5. Are the configurations of levers adopted in consultancy companies also valid in other knowledge-intensive industries?

In this chapter RQ1.1 to RQ1.4 will be addressed, while the validity of the outcomes in other knowledge-intensive industries (RQ1.5) will be analysed in Chapter 6. In more detail Chapter 4 aims to:

- Describe the processes through which knowledge, in its different forms, is acquired, transferred, shared, stored and retrieved; in so doing identifying the main learning behaviours and learning performances.
- Identify which organisational mechanisms, Information and Communication Technologies (ICT) and managerial tools are implemented to influence knowledge processes.
- Identify if a discrete number of distinct overall approaches to knowledge management emerge, each characterised by a set of consistent levers (configuration of levers).

In order to address these issues, a process-based model for knowledge management is developed in the following sections. Such a model is a “conceptual” hypothesis (in the
form of a framework) on the relationships between knowledge process, outcomes, and enablers. Results from the application of the model in eight case studies (all in consultancy companies) are used in the operationalisation of this framework. The explanation of empirical results through theory provides a validation of the framework and its operationalisation for the considered research setting, and allows the development of new insights into the existence and characteristics of knowledge management configurations.

4.2 A process perspective for knowledge management

Analysis of the existing literature (Zack, 1999b) allows one to define knowledge management within a “process management” view (figure 5.2). Through the case studies, the model can be operationalised. Within this perspective, it is possible to define:

- **Knowledge processes**: the interrelated set of activities, by means of which, inputs – data, information, knowledge, are transformed into outputs – (new) knowledge. According to literature (e.g. Huber, 1991) three main activities can be identified, and labelled: acquisition, capitalisation and reuse, transfer and sharing of knowledge (figure 5.2). 
  - **Acquisition of knowledge**, which includes assimilation and creation. Assimilation is the phase through which new knowledge is added to the knowledge base within the organisation. Creation is addressed as an internal activity; the knowledge generated is completely new, coming from the innovative work of a member, a team, or an organisation, on a specific subject.
  - **Capitalisation and reuse of knowledge**: capitalisation is the activity of the process in which knowledge coming from different individuals and parts of the organisation is classified, integrated, and stored in the knowledge base (Meyer and Zack, 1996). Reuse is a twofold activity, since it should support the research and identification (retrieval) of knowledge, and the application of knowledge in a new, different, context.
  - **Transfer and sharing of knowledge**: an important feature of the “knowledge management process” is moving knowledge from where it is produced or created to where it is actually needed and used. This phase should support the extraction of specific knowledge, and the transfer of it when it is required.

- **Performances**: indicating the effects of the knowledge process on the operational process due to “knowledge at work”. According to previous research the performances of knowledge management can be operationalised in terms of knowledge process performances (frequency of learning behaviours), people performances, and business performances.
Levers or enablers: tools and instruments that management can use to stimulate knowledge processes. According to the definition provided in Chapter 2, knowledge management is the process of designing, implementing, maintaining, and improving a system of levers (Information and Communication technologies, Management systems and Organisational mechanisms) through which an organisation fosters and focuses individual and group behaviours in terms of assimilation and generation, transfer and sharing, capitalisation and reuse of knowledge, in both tacit and explicit forms that are useful to the organisation. In figure 4.1, the three main classes of enablers, which are the object of the present research, are shown:

- ICT (e.g. document management, Data Base Management systems, search engines, communication technologies). ICT reflects all the technological applications that a company can use to acquire, capitalise and reuse, transfer and share, information and knowledge throughout the organisation.

- Managerial systems (e.g. performance management systems, management methods and tools, rewarding systems, training systems, human resource management policies) include all the tools, methodologies and practices that managers can implement within the organisation in order to manage resources (people, technologies, information, and finance) and, at the same time, foster knowledge processes.

- Organisational mechanisms (e.g. structures, roles, integration mechanisms) include all managerial decisions concerning allocation and coordination of resources, the definition of jobs and responsibilities, tasks, authorities, and responsibilities which can influence both the goal-oriented processes and the knowledge processes. It is very important to note that, although the first part of the analysis is aimed at investigating which specific classes of enablers are implemented by the case companies, the underpinning perspective is always a “systemic perspective”: each enabler is not analysed as an isolated decision, but is assessed in relation with the other implemented enablers in order to investigate recurring sets of enablers.

Contingencies: a set of variables which are external to the knowledge (management) process but influence it in terms of the effects of the levers on knowledge processes and their performances.
Starting from this framework, some propositions that result from the described framework can be highlighted for this research:

P.P.1: Different configurations of levers (ICT, organisational mechanisms and managerial systems) lead to different performances.

P.P.2: Different configurations of levers (ICT, organisational mechanisms, and managerial systems) support the management of different types of knowledge.

In this chapter, these preliminary propositions, still very open, will be refined in line with results from the explorative research in the eight consultancy companies.

4.3 The research setting

In Chapter 3, a description of the methodology chosen to address the research questions was provided, explaining how the multiple case studies fit the explorative purposes of RQ1 and RQ2. The selection of the eight consultancy companies for the case studies has been driven by three main criteria: coherence with research questions purposes; focus on configurations and practicalities of the investigation.

In the following discussion, a brief description of the characteristics of the research setting, and of the reasons for this selection, is provided:

1. Knowledge-intensive companies: As the research focus is on knowledge processes, companies involved should rely on knowledge as a strategic asset.

2. Focus on inter-project learning: In the companies, families of projects classified according to industry, customer or discipline are considered. Experience and learning from other projects can support managers in approaching present ones (De Maio et al. 1994).

3. Professional service organizations: According to Sverling (2000), consultants can be asked by the customer to provide different “products” as an output of the collaboration: a) problem setting and scenario, where the consultant is asked to provide possible “to be” situations according to the strategies and organisation of the customer; b) methodology, where the consultant provides a methodology to support the customer in making decision (problem setting and problem solving); c) solution, where the consultant provides the effective IT or organisational design. In all the cases, knowledge is the core output of the process (Sadler, 2001; Werr and Stjiernberg, 2001; Quagli, 2001).

4. Focus on successful companies: The main assumption underpinning the selection of these companies was that if they are successful companies, and knowledge process is their core activity, then the knowledge processes should be being well managed. The analysis on the levers implemented by such companies should lead to the identification of successful configurations.

5. Focus on dispersed projects: Literature especially emphasises the role of ICT in the case of dispersed projects (Wijnhoven, 1999; Quagli, 2001), for increasing communication among members of teams who are not co-located.

6. Focus on projects where the customer is external: In order to simplify the analysis, my research has concentrated on “external customer projects”.

40 Enabling knowledge processes in innovative environments
4.4 The investigation framework

The case studies have been carried out through interviews with project managers from the consultancy companies. The case study protocol was organised, after a first contact, through interviews (carried out by two researchers) with the person responsible for the Organisation unit, and then with the responsible ICT person and one project manager. All the interviews were carried out using a semi-structured questionnaire. A reporting tool was attached to each section of the questionnaire in order to facilitate the organisation of collected information and the analysis of results.

According to Yin (1994), four elements should be considered and evaluated when conducting case studies:
1. **Construct validity**: in order to ensure construct validity, each question in the questionnaire was supported by a set of prompts in order to create a common understanding of possible answers. Furthermore, the reporting schemes for each group of questions, helped to make explicit the purpose of such questions and the required information.
2. **Internal validity**: the analysis has been carried out in multiple cases, and the propositions have been continuously refined.
3. **External validity**: the research setting has been selected in order to involve companies where the knowledge process is extremely relevant to achieving their expected business results. Following this, the framework and research propositions will be applied in two further case studies in order to investigate the possibility of generalising the results to other knowledge-intensive professional organisations.
4. **Reliability of the research**: the availability of prompts for each question contributes to the reliability.

4.5 The operationalisation of the framework

The first major result from the case studies concerns the operationalisation of the model as outlined in Section 4.2. In the following sections, the different variables will be discussed.

4.5.1 The enablers

All the companies involved in the explorative research have implemented different enablers to foster knowledge processes. In figure 4.2, the adoption of different levers by companies in the sample is represented.

In terms of the functionalities of ICT, companies implement tools to foster knowledge transfer and sharing and storage and retrieval. Turning to Management systems, organisations adopt methodologies for analysis, standardisation, performance measurement, job rotation, and training and mentoring. Finally, in terms of organisational mechanisms, managers implement structures and roles in order to standardise practices, to diffuse responsibility or to own KM at a managerial level. Different categories of levers are used for the various functionalities. To realise the desired functionalities of the levers implemented, several different solutions have been adopted by the companies.
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<tr>
<th>Levers</th>
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<td><strong>ICT for transfer and sharing</strong></td>
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<td>Collaboration</td>
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<td><strong>ICT for capitalisation and reuse</strong></td>
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<td>Mentoring</td>
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<td><strong>Organisational Mechanisms</strong></td>
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<td>Standardise KM Practices</td>
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<td>Own KM at a management Level</td>
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<td>To diffuse Responsibility</td>
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Figure 4.2: Operationalisation of knowledge management levers in the sample.

4.5.2 The performances

The explorative research has also aimed to investigate the performances of knowledge management. The effectiveness of knowledge management can be measured at three levels of analysis:

1. **Knowledge process effectiveness** (KPE) represents the effectiveness of enablers in stimulating knowledge processes in terms of acquisition and generation, capitalisation and reuse, transfer and sharing of knowledge. Results from previous research have shown that levers are related to the frequency of learning behaviours (Gieskes, 2001), which is now assumed to be a measure of the effects of the configuration of levers on the knowledge process. The learning behaviours that have been measured through a Likert scale 1-5, are listed below:

   B1: Individuals use the organisation’s strategic goals and objectives to focus and prioritise their improvement and learning activities.
   B2: Individuals use their own activities as opportunities to develop knowledge.
   B3: Individuals use part of available time/resources to learn.
   B4: Individuals integrate knowledge within all the different phases of the project in which they are involved.
   B5: Individuals transfer knowledge among different projects.
   B6: Individuals abstract knowledge from experience, and generalise it for application on new projects.
   B7: Individuals embed knowledge, making the knowledge available to others by incorporating it in vehicles that can be more widely disseminated and retained over time.
   B8: People try to assimilate and internalise knowledge from external sources.
2. **People performance** (PP). People performances are related to an individual’s position and interaction with other individuals within the company. According to empirical analysis, in many situations, the existence of knowledge management practices has improved the quality of working life in terms of work satisfaction, self-esteem, and the sense of belonging, and so reducing labour turnover of consultants.

3. **Process and Business performances** (BP), represent the effects of the knowledge management system on the performance of the company. Nevertheless, when addressing the specific questions, managers indicated different particular performance dimensions as responsible for their success.

<table>
<thead>
<tr>
<th>Company → Performance</th>
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<td>Knowledge process effectiveness</td>
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<td></td>
<td>B6</td>
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<th>People performances</th>
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<tr>
<td>Better use of time</td>
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<td>Work satisfaction</td>
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<td>Self esteem</td>
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<tr>
<td>Sense of belonging</td>
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<tr>
<td>Reduction of labour turnover</td>
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<th>Business performances</th>
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<td>Time to Market</td>
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<td>Efficiency</td>
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<tr>
<td>Customisation and customer satisf.</td>
<td>X</td>
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<tr>
<td>Lesser spin-off Risks</td>
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</table>

**Figure 4.3:** The business performances of consulting companies.

In figure 4.3, the synoptic table summarises the results concerning the three classes of performances.

**4.5.3 The contingencies**

From the interviews in the consultancy companies, it was found that managers especially highlighted three of the contingent variables as influencing the knowledge (management) processes, and these are:

- **Degree of dispersion:** dispersion emphasises the need for knowledge management, in a network of competencies.
Level of complexity of the solution and of the project: Some companies (A, D, E, G) in the sample are focused on strategic consultation. Other companies (B, F) are focused on operative consulting. Finally, other companies (C, D, H) deliver a complete service, from strategic analysis to implementation. In discussions with managers it emerged that the requirements, in terms of knowledge (management) processes and the strategic priorities, for these contingent situations are different: strategic consulting companies focus on “customisation and innovativeness of solutions”, operative consulting companies focus on “efficiency and time to market”.

Labour churn: the turbulence in labour market and the turnover in human resources (churn) are considered to be a third driving force for knowledge management.

As in the case of performances, a more detailed analysis of companies’ contingencies will be developed according to emergent configurations (Section 4.6). More specifically, through the functionalities of levers the configurations will be detected and, then, the main characteristics in terms of performance and contingencies will be discussed.

4.6 The identification of knowledge management configurations of consultancy companies

From the analysis of the functionalities of levers, three main configurations for knowledge management emerge from empirical case studies. These approaches can also be described according to the forms of the levers implemented to realise the functionalities, the associated performances and contingencies, and the types of knowledge enabled.

4.6.1 The three approaches: functionalities and forms of levers

According to the functionalities of levers identified in Section 4.5 and represented in figure 4.2, three configurations emerge. Each configuration is briefly described, associating to functionalities also the forms of levers implemented to realise them.

Focus on standard KM practices (B, F)

Companies adopting this configuration try to standardise and support knowledge management process mainly through centralising Knowledge Management responsibility and the establishment of a new unit, with two main duties: developing and establishing methods and tools to support and enhance the knowledge management process within the organisation; and supporting and assuring coherence of almost every activity of the process: acquisition, capitalisation and reuse, transfer and sharing. For what concerns the configurations of enablers and performances emerging:

- Organisation mechanisms stimulate the standardisation of KM practices. ICT supports the storing of solutions and procedures, and the asynchronous and distant communication. Management systems foster: the specialisation of people over time (i.e. no job rotation, career path…), the development of knowledge professionals as specialists, and the standardisation of knowledge practices (i.e. procedures).
- Performances: if a company adopts a centralised approach, it is successful in terms of time to market, efficiency (business performances), high sense of belonging, and use of time (people performances). The most frequent behaviours are the embedding of knowledge into technological vehicles (B7), and the abstraction and generalisation of knowledge (B6).
Focus on hierarchical KM practices (D, E, H)
Companies D, E, and H in the sample, have adopted a different configuration for knowledge management. Knowledge is managed at a high level of the hierarchy, by building a "community of partners" (Wenger and Snyder, 2000). Partners are responsible for the control and management of knowledge that is perceived to be one of the key sources of power and competitive advantage. With their dual role, of project managers and knowledge owners, partners support and control the process of generation, retrieving and capitalisation of knowledge, from and to the specific projects. At the same time, they are gatekeepers of knowledge assimilation from other parts of the group or from external sources.

A clear division is therefore made between partners, who are full members of the "knowledge community" and therefore responsible for management of corporate knowledge, and the rest of the organisation who learn from their own experiences or from partners’ contingent advises. For what concerns the enablers and performances:
- Organisational mechanisms stimulate the direct supervision of the KM process in order to position ownership of the responsibility for KM at a management level. ICT supports the synchronous communication by managers, who often act in a virtual community, and asynchronous communication for workers. ICT is also used to make knowledge of workers explicit. The management systems foster assimilation of “lesson learnt” from workers but do not facilitate the development of specialised competencies in workers.
- Performances: if a company adopts an oligarchic approach, it is successful in terms of customisation and customer satisfaction, solution innovation, time to market (business performances), use of time, sense of belonging and work satisfaction (people performances). The most frequent behaviours are abstraction and generalisation (B6), and transfer of knowledge within and among processes (B4 and B5).

Focus on diffused KM practices (A, C, G)
Companies A, C and G in the sample adopted a third configuration aimed at diffusing the responsibility for knowledge management throughout the organisation to workers involved in the operational processes. The underpinning idea is that every person should act as a knowledge engineer, developing and improving knowledge related to the specific operational process in which they are involved. In this way a person is responsible for capturing, capitalising, sharing and reusing knowledge, based on insights and experiences gained during the work. Everyone is therefore assigned a "dual role": on the one hand, a worker is involved in the operational process, performing operations according to their role; on the other hand, the same worker should capitalise and store what they have learnt, making explicit the result of individual learning. For what concerns enablers and performances:
- Organisational mechanisms stimulate the involvement of people throughout the organisation in knowledge management activities, while ICT mainly supports synchronous communication and collaboration. Managerial systems aim to make operational activities into opportunities to learn, providing occasions for learning during activities. People are evaluated and rewarded, to an extent, according to learning activities.
Performances: if a company adopts the decentralised approach, it is successful in terms of customisation and customer satisfaction, and solution innovation (business performances), work satisfaction, sense of belonging, self-esteem and reduction of labour turnover (people performance). The most frequent behaviours are seeing their activities as opportunities to develop knowledge (B2), and using spare time to generate knowledge (B3).

4.6.3 Types of knowledge managed in the configurations

The types of knowledge managed in the companies can be framed as follows:

1. The level of explicitness of knowledge. The epistemological classification of knowledge has been explained in the theory (Polanyi, 1966; Nonaka, 1991; Quinn et. al. 1996).

2. The knowledge object. The business process of consultancy companies can be modelled as a problem solving process (Werr and Stjernberg, 2001; Corso et al. 2002). This can be analysed in terms of a solution to the problem (i.e. the output of the process itself) (know what), the methodology followed to solve the problem (i.e. problem solving) (know how), and conditions in which to frame and solve the problem (i.e. problem setting) (Galbraith, 1973; Mintzberg, 1985) (know why).

3. The level of abstraction and generalisation of knowledge: the third dimension of classification represents the level of abstraction and generalisation of knowledge that can be contingent or generalised. Contingent knowledge represents knowledge about a specific case and is not related to other similar cases. Generalised knowledge derives from the process of abstraction and generalisation, and it comes from identification of classification schemes that are important components of the meta-models of the company (Bartezzaghi et. al. 1997). Each class defines the frame in which similar patterns of cause-effect relationship occur.

The case companies in adopting different KM configurations, focus their activities on different types of knowledge:

- First of all, most of the companies concentrate on making solutions explicit. This is a clear attempt to make knowledge concerning solutions efficiently retrievable.
- Not all the companies generalise solutions. The process of generalisation of solutions implies the identification of similarities in the cases and the identification of classes (i.e. to build a meta-model). Generalisation of solutions was interpreted by the consultants as a way to facilitate the retrieval of cases, which otherwise would have been only a database of not-related histories.
- In terms of knowledge about methodologies, the profile is different for the various configurations. Companies that focused on standardised KM practices make a strong effort to make explicit and generalise methodologies. Their focus on efficiency and reuse of past solutions requires the systematisation, classification and availability of solutions and methodologies that they can adopt. Companies focused on hierarchical KM practices are primarily concentrated on storing methodologies in a tacit form, and do not pay attention to developing common methodologies. Companies focused on diffused KM practices keep most knowledge concerning methodologies tacit. An interesting situation was found at company A, which keeps methodologies tacit, but at the same time is able to generalise them. This result has been primarily reached through the identification of experts. The methodology adopted by a certain expert, in a specific field or discipline, becomes the generalised methodology.
Companies that focus on diffused KM practices can manage knowledge concerning the motivation and issue, albeit in a tacit and contingent form. Managers explained how consultants in these companies develop knowledge about cause-effects relationships thanks to their understanding of the overall project, and to their deep participation in the problem solving process.

4.7 The interpretation of results

In previous sections, an analysis of the configurations of levers found in the case studies has been carried out. The main goal of this section is to explain and embed these results in theory.

Theoretical contributions on organisational structural dimensions (Mintzberg, 1985; Davenport et al. 1998) are often used to develop organisational typologies (Earl and Scott, 1999; Hansen et al., 1999), and therefore can be referred to in describing the characteristics of a KM configuration:

A. Horizontal decentralisation. Mintzberg (1985) addresses “horizontal decentralisation” to the extent to “which non managers control decision processes” (p.186) in a continuum from centralisation in one person, through centralisation in staff units (analysts), to diffusion in experts and finally in operators. Considering the relationship between knowledge (management) processes and business processes (Hansen et al. 1999; Earl and Scott, 1999), such horizontal decentralisation can describe the extent to which the responsibility for knowledge management is centralised in specific roles (in particular staff roles) or specialised units, or, alternatively that it is combined with responsibility for operational activities.

B. Vertical decentralisation represents the extent to which knowledge (management) activities are delegated down through the levels of the company hierarchy. In other words, this dimension deals with the number of hierarchical layers that are formally involved in knowledge processes and with the intensity of their control. Mintzberg (1985) relates vertical decentralisation to the delegation process in the line, and mainly refers to the formal part of the decision-making process (making choices and giving authorisation) rather than the informal one (advice and execution of activities).

C. Coordination mechanisms. Knowledge processes are supported by different coordination mechanisms (Mintzberg, 1985), which are fostered by the implemented configuration of levers. Mutual adjustment and skill standardisation are related to people and to relationships among them. Output standardisation is mainly related to performance measurement and reward systems. Work process standardisation and direct supervision include the procedures, norms, and rules used to carry out the job within the

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3 The interpretation of results, as noted in chapter 3, has two main consequences from the methodological point of view: first of all it validates the framework and its operationalisation for the considered research setting, and then it allows the development of new insights from results concerning the existence and characteristics of knowledge management configurations.

4 As described previously in this chapter, knowledge processes involve the activities of acquisition, capitalisation and reuse, transfer and sharing of knowledge. Knowledge management activities, on the other hand, involve the activities of selection, implementation and management of levers to stimulate knowledge processes.
organisation. Literature shows how ICT functionalities support all these coordination mechanisms in different ways (Liebowitz, 1999).

The configurations of enablers derived from the case studies can therefore be explained in terms of the characteristics described in this section as represented in figure 4.4.

- **Centralised approach.** The configuration focused on standard KM practices corresponds to the centralised approach. It is characterised by low horizontal decentralisation, as most of the responsibility for knowledge processes is owned by a unit of analysts. Sometimes a CKO is appointed, and the organisation should ensure the development of adequate competencies (Earl and Scott, 1999). The level of vertical decentralisation in this approach depends on the hierarchical level of those analysts in charge of managing knowledge activities. The main coordination mechanism adopted is standardisation (of work processes and output) that is principally enabled through the use of ICT to store solutions, which have been collected, analysed and generalised by the analysts (Mitzberg, 1985). People retrieve these solutions through distant and asynchronous ICT functionalities.

- **Oligarchic approach.** The configuration focused on hierarchical practices corresponds to the oligarchic approach. This configuration is characterised by low vertical decentralisation as knowledge activities are not delegated at all by managers. Horizontal decentralisation is medium, as responsibility is retained by managers having a dual role. It is interesting to note that the coordination mechanisms supporting this configuration reflect the organisational design choices: mutual adjustment within the community of managers, and direct supervision and work processes standardisation between managers and consultants concerning solutions and methodologies.

- **Decentralised approach.** The configuration focused on diffused KM practices corresponds to the decentralised approach. This configuration is characterised by high horizontal decentralisation with all the people involved in operative processes also having responsibility in knowledge processes. Vertical decentralisation is also high. Coordination mechanisms are based on mutual adjustment and skills standardisation, also enhanced by ICT, which is an enabling infrastructure for communication and collaboration.
<table>
<thead>
<tr>
<th>Theoretical characteristics</th>
<th>Centralised approach</th>
<th>Oligarchic approach</th>
<th>Decentralised approach</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Horizontal decentralisation</strong></td>
<td>Low horizontal decentralisation</td>
<td>Medium horizontal decentralisation</td>
<td>High horizontal decentralisation</td>
</tr>
<tr>
<td></td>
<td>Specialised units</td>
<td>Support staff</td>
<td>Widespread responsibility</td>
</tr>
<tr>
<td><strong>Vertical decentralisation</strong></td>
<td>Medium vertical decentralisation</td>
<td>Low vertical decentralisation</td>
<td>High vertical decentralisation</td>
</tr>
<tr>
<td></td>
<td>Hierarchical approach</td>
<td></td>
<td>Cooperative</td>
</tr>
<tr>
<td><strong>Coordination mechanisms</strong></td>
<td>Standardisation of work processes</td>
<td>Direct supervision Standardisation Of work Processes</td>
<td>Embedding of knowledge through relational vehicles</td>
</tr>
<tr>
<td></td>
<td>Standardisation of output</td>
<td>Embedding of knowledge through mixed vehicles Synchronous communication</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Embedding of Knowledge through technical vehicles</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Organisational mechanisms</strong></td>
<td>Standardisation of KM practices</td>
<td>Direct supervision of KM process. Keeping responsibility of knowledge processes at a managerial level</td>
<td>Involvement of all people throughout the organisation in knowledge management activities.</td>
</tr>
<tr>
<td><strong>Managerial systems</strong></td>
<td>Specialisation of people over time Standardisation of knowledge practices</td>
<td>Analysis and standardisation</td>
<td>Performance measurement, job rotation, mentoring and training, job rotation</td>
</tr>
<tr>
<td><strong>ICT</strong></td>
<td>Storing solutions and procedures Asynchronous and distant communication</td>
<td>Synchronous communication for managers and asynchronous communication for workers. Virtual community only for managers</td>
<td>Synchronous communication and collaboration</td>
</tr>
<tr>
<td><strong>Knowledge process performances</strong></td>
<td>Embedment of Knowledge in Technological Vehicles (B7) Abstraction And Generalisation of Knowledge (B6)</td>
<td>Abstraction and Generalisation (B6), Transfer of Knowledge Within And Among Processes (B4 And B5)</td>
<td>Business Activities are seen as opportunities to develop Knowledge (B2) Use of spare time to generate Knowledge (B3)</td>
</tr>
<tr>
<td><strong>People performances</strong></td>
<td>Use of Time</td>
<td>Use of Time, Sense of Belonging, Work Satisfaction</td>
<td>Sense of belonging, Work Satisfaction, Self Esteem, Reduction of Labour Turnover</td>
</tr>
<tr>
<td><strong>Business performances</strong></td>
<td>Time To Market, Efficiency</td>
<td>Customisation and Customer Satisfaction, Innovation in The Solution, Time To Market</td>
<td>Customisation and Customer Satisfaction, Innovation in the solution</td>
</tr>
</tbody>
</table>

Figure 4.4: The configurations for KM.
5. The role of innovation strategies for knowledge management

5.1 Introduction

The main goal of this chapter is to highlight the results reached in the thesis for what concerns the second research question. Specifically, addressing research question 2:

**RQ2**: Is a particular KM configuration aligned with a specific innovation strategy?

  - RQ2.1: Is a KM configuration associated with a specific innovation strategy?
  - RQ2.2: Does an innovation strategy influence the success of a knowledge management configuration?

The aim is to investigate the association between innovation strategies and knowledge management configurations, focusing on successful consultancy companies. To achieve this, two main tasks are carried out: 1) Operationalise the innovation strategies adopted by consultancy companies; 2) Analyse whether a KM configuration is associated with an innovation strategy.

The reason of the choice of the innovation strategies as a contingent variables is twofold: firstly, because learning and knowledge process practices change completely when the level of innovation increases (Bartezzaghi et al. 1998; Hedberg, 1981; McKee, 1992). Secondly, because, during the case studies in the consultancy companies, managers indicated that the level of innovation embedded in the products/services offered is a critical variable in driving knowledge processes and the design of a knowledge management configuration.

5.2 The dimensions of innovation strategies

A central concern of studies about innovation strategies is the relationship between the exploration of new possibilities and the exploitation of old certainties (March, 1991).
Exploration includes things captured by terms such as search, variation, risk taking, experimentation, play, flexibility, discovery, and innovation. From a strategic point of view, an organisation is an exploiter when it refines and extends existing capabilities in order to become or remain competitive in its strategic position. On the other hand, it is an explorer when it engages in experimentation with new alternatives (Hitt et al., 1997; Zack, 1999b). Using these definitions, some observations can be drawn about the relationship between exploitation and exploration, and their relationship to knowledge management.

First of all, exploitation and exploration strategies are related to the degree of innovation, classified as either incremental or radical innovation (Zack, 1998). Incremental innovation tends to reinforce the competitive positions of established firms since it builds on their core competencies (“competence enhancing”). Radical innovation, in contrast, creates unmistakable challenges for established firms, since it limits the usefulness of their capabilities, i.e. of both architectural and component knowledge (Wheelwright and Clark, 1992; Henderson and Clark, 1990; Foster, 1986). From the knowledge management point of view, radical and incremental innovation infer a different type of knowledge base for the projects carried out. In the cybernetic model of learning suggested by McKee (1992), the organisation utilises information inputs to develop projects that change existing organisational norms and technologies. This means that the knowledge processes, when a company pursues a radical innovation strategy, are more difficult, as projects are distinct in terms of causes and effects, each of them presenting context-specific variables which are hardly transferable, and creating a separation in terms of time and space from previous projects and future applications (Bartezzaghi et al. 1997). In such a situation, to successfully perform knowledge processes, theory points out to the practices of abstraction and generalisation (Bartezzaghi et al. 1997), double loop learning (Argyris, 1978; McKee, 1992), experimentation (Huber, 1991) and unlearning (Hedberg, 1981) as extremely relevant (Chapter 2). Due to their relationship with knowledge processes, exploitation and exploration can be considered as the first dimension in classifying innovation strategies (Zack, 1999c, p.134).

The second dimension concerns the primary sources of innovation. Innovation can be internal if it is mainly driven by actors and forces within the organisation. Innovation can also come from external sources, exploiting knowledge coming from publications, universities, government agencies, consultants, suppliers, and customers (Imai et al. 1985; Clark and Fujimoto, 1991; Afuah and Bahram, 1995). Internal sources provide knowledge which can be unique, specific, and difficult to appropriate if tacitly held (Zack, 1998; Lubit, 2001). Knowledge from outside is more costly to obtain, more widely available to competitors, but at the same time, it can result in new and unique insights (Zack, 1999c) if combined with internal knowledge. 

5.3 The innovation strategies of the consultancy companies

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5 In the thesis, the perspective of relying only on external sources of innovation is not considered. This perspective is related to learning as adaptation in line with stimulus-response theory (Daft and Weick, 1984) which has been described in Chapter 2. It is therefore assumed that if innovation is externally sourced, knowledge has to be interpreted and combined with internal knowledge.
The purpose of this section is to provide an operationalisation of the innovation strategies followed by consultancy companies.

**Exploration versus exploitation strategy for consultancy companies**

As discussed already, exploration and exploitation are related to the degree of innovation embedded in projects carried out by the organisation (Gopalakrishnan et Biertly, 2001). In the consultancy companies, the level of innovativeness of the solution depends on the newness of the problem, and of the output developed (in terms of solution, methodology or scenario as described in Section 4.3) (Werr and Stjernberg, 2001; Hansen et al. 1999). Hansen et al. (1999) state that consultancy companies can focus on “providing high-quality, reliable and fast information-system implementation” (p.109). In this situation, they are primarily concentrated on the implementation of a solution (usually IT systems). Their strategy stresses achieving large overall revenues, and a one-off investment in a knowledge asset and then reusing it many times over (exploitation strategy). Alternatively, other companies may aim at “providing creative, analytically rigorous advice on high-level strategic problems” (p.109). Firms offering this service are focused on maintaining high profit margins by charging high fees for highly-customised solutions to unique problems (Hansen et al. 1999) (exploration strategy).

**Internal versus external sources of innovation**

In terms of consultancy companies, the internal and external sources of innovation are considered in relation to the boundaries of the organisation:

- **Universities and suppliers** can be typical sources of innovation.

*Customer and the role of consultants.* The customer is a very important source of innovation for the consultant, and the interaction between them, which has been modelled in literature on management consulting, has been identified as having two different approaches. The expert model (Schein, 1987) requires that the client has made up his mind on what the problem is, what kind of help is needed, and to whom to go for this help. This implies that the consultant has to solve a problem that has been clearly identified by the customer, but who cannot solve it. In this situation, the main source of innovation is internal, as the consultant has to provide a solution in line with the problem set by the customer. The process model (Schein, 1987) is defined as a set of activities on the part of the consultants that helps the client to perceive, understand, and act upon the process events that occur in the client’s environment in order to approve the situation as defined by the client. In this model, the customer owns the process throughout the whole consultation work, and the consultant has only a supportive function. In this event, most of the knowledge about the solution is external, as the customer has a more active role in the project, although this can be successfully developed through the knowledge of the consultant (which is principally related to the methodology). In figure 5.1, the operationalisation of innovation strategies for consultancy companies is illustrated.
Figure 5.1: The innovation strategies for consultancy companies.

According to the model represented in figure 5.1, the assumptions are that:

- The innovation strategy of a company can be classified according to the level of innovation. Companies primarily adopt an exploration strategy when they develop projects, which include radical innovations (technological, market, organisational). Companies pursue an exploitation strategy if they develop incremental innovations, which tend to reinforce their competitive positions.

- The innovation strategy of a company can be classified according to the source of innovation. A company can rely only on internal sources of innovation, or leveraging on external sources (suppliers, customers, competitors…)

- Consultancy companies dealing with new problems, developing new solutions (to them) or highly customised solutions to unique problems, and that are focused on high profit margins, pursue an exploration strategy.

- Consultancy companies that reuse past solutions, develop high quality, reliable and fast implementation, and that are focused on revenues, pursue an exploitation strategy.

- The role of the consultant in the interaction with the customer, a dimension in the operationalisation of the involvement of external sources, can strongly determine the characteristics of the solution developed.

- A consultancy company relies on internal sources of innovation if the consultants are the main actors in all phases of the consultancy process, and the customer is not involved in the development of the output. Companies implementing expert models of consultancy, principally rely on internal sources of innovation without leveraging on the customer as a source of innovation.

- A consultancy company relies on external sources of innovation if consultants interact with other actors in order to develop the consultancy process and to achieve an innovative output. Companies implementing process models of consultancy involve external sources of innovation.
External sources of innovation for consultancy companies are universities and suppliers

The preliminary proposition, to be refined through the RQ2, is:

\[ P.P.3 \text{ The innovation strategies adopted by companies influence the knowledge management configuration implemented and its effects on performances.} \]

The main goal of the following sections is to analyse empirical results in order to see if the innovation strategies adopted by the companies in the sample are associated with knowledge management configurations discussed in Chapter 4, and to explain this association. Using this methodology, the proposition can be refined.

5.4 A contingent approach for knowledge management configurations

The main goal of this section is to highlight the innovation strategy of the companies involved in the sample, in order to investigate whether a relationship exists between the innovation strategy implemented and a knowledge management configuration. Managers of consultancy companies have been interviewed with the aid of a questionnaire. The innovation strategy has been assessed through the first part of the questionnaire, addressing the business areas (in terms of relevance, dispersion, evolution over time), strategic priorities (in terms of industry and strategic positioning of the company compared with main competitor), the type of consultancy service provided (strategic vs. operative), the level of complexity of the output provided (solution or methodology), of the portfolio and of the system, and finally the role of the consultants and others (i.e. the customer) involved in the management consulting projects.

The innovation strategies of the companies are reported in figure 4.2. It is important to note that this is a qualitative positioning, and that there are no effective absolute measures on the two axes and boundaries between internal and external sources, and between exploitation and exploration strategies. Companies adopting a centralised approach (B and F) focus their strategy on the use of standard solutions and methodologies, and their priority is related to turnover. Their intervention is often related to the implementation of new IT systems (i.e. ERP) and they own the problem and interact with the customer, especially in the change management phase of the intervention. The opposite situation applies to companies adopting the decentralised approach (A, C and G). Their focus is on providing highly customised solutions, which are characterised by higher levels of innovation than solutions provided by companies adopting a centralised approach. These companies are focused on the interaction and collaboration with the customer, who is usually involved in the process of developing the new solution, methodology, or scenario. In order to achieve this goal, they need the ability to understand the customer’s problem, to design an ad hoc solution and a change management path for its implementation, without leading this phase. The key performance indicator for these companies is not turnover but margin. In terms of the relationship with external sources of innovation, these companies establish a more interactive relationship with the customer. For companies implementing an oligarchic approach (E, D and H), the innovation strategy is somewhere in the middle. These

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6 The first two preliminary propositions were referred to RQ1.
companies can provide strategic consultancy, but can also support the implementation phase depending on the requirements of the customers.

Figure 5.2: The positioning of consultancy companies.

Further observations can be made with regard to the type of knowledge that the company provides to its customers.

From the analysis of cases, it is possible to find a relationship between knowledge released to the customer, the type of knowledge managed by consultants, and the innovation strategy pursued by the company. If the focus moves from reuse and implementation of existing solutions (as the centralised approach) to the development of new solutions (as in the oligarchic), the innovation strategy moves from exploitation to exploration. Moreover, if the focus moves from releasing solutions (existing and new ones), based on generalised knowledge (as in the centralised and oligarchic approaches), to the development of new methodologies and in some cases scenarios based on contingent knowledge (as in the decentralised approach), the source of innovation changes: from predominantly internal (with strong contributions from universities and suppliers) to principally external based on a strong interaction with the customer. Some situations emerge:

- **Focus on existing solutions based on generalised knowledge.** If consultancy companies own knowledge about solutions and methodologies, which is generalisable and is actually generalised, they can be extremely efficient in reusing and releasing existing solutions (centralised approach). Companies can adopt an exploitation strategy and, owning a large knowledge base, they can rely on internal sources. However, the relationship with universities and suppliers is important to improve and update the knowledge base.

- **Focus on new solutions and methodologies:**
  - **Focus on new solutions based on generalised knowledge.** If consultancy companies own generalised knowledge about solutions, methodologies and motivations⁷, they adopt an exploration strategy aiming to develop new solutions and methodologies. In this situation, the consultant is the expert, and the customer contributes in the development of the new solution by providing the specificity of the context to

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⁷ Knowledge about methodologies and motivations is either generalised or contingent.
customise or innovate the solution. Here, the customer is considered a relevant source of innovation (together with universities and suppliers) to improve and update the knowledge base. The consultant plays the expert role.

- Focus on new solutions and methodologies, based on not generalised (contingent) knowledge. If the knowledge management system does not foster the generalisation of knowledge (knowledge is contingent), consultancy companies can adopt an exploration strategy that aims to develop new solutions, but at the same time the customer owns the process and the consultant’s role is mainly supportive (process model) and strongly based on knowledge about methodology and motivations.

5.5 Summary of results

In this chapter, the second research question has been addressed, in terms of relationships between the innovation strategies of consultancy companies and the knowledge management configuration implemented, and a set of propositions has been derived. The results are summarised in figure 5.3.

However, some points still remain unresolved:
1. Firstly, most of the analysis about contingencies in this research has focused on innovation strategies. However, as noted in Chapter 4, other contingent variables also seem to influence the specific knowledge management configuration.
2. A second important issue that emerges from the explorative research at this stage is the possibility of developing a dynamic approach to knowledge management. As discussed in Chapter 4, case studies provide a picture of the investigated variables at a certain moment, and do not provide insights into the dynamic interaction between innovation, other contingencies, knowledge processes, and knowledge management. The analysis of knowledge management configurations over time increases the understanding of evolution of the internal knowledge management configuration and of the effects of change on the innovation strategy.
<table>
<thead>
<tr>
<th>Relevant variables driving the alignment</th>
<th>Centralised approach</th>
<th>Oligarchic approach</th>
<th>Decentralised approach</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Type of knowledge</strong></td>
<td>Exploitation strategy</td>
<td>Exploration strategy</td>
<td>Exploration strategy</td>
</tr>
<tr>
<td></td>
<td>Internal sources</td>
<td>Internal sources</td>
<td>External sources</td>
</tr>
<tr>
<td><strong>Innovation strategy</strong></td>
<td>Expert</td>
<td>Expert</td>
<td>Expert</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Facilitator</td>
</tr>
<tr>
<td><strong>Role of the consultant</strong></td>
<td>Existing solutions</td>
<td>New solutions and methodologies</td>
<td>New solutions, methodologies and scenarios</td>
</tr>
<tr>
<td><strong>Output delivered to the customer</strong></td>
<td>Generalised, explicit knowledge about solutions and methodologies</td>
<td>Generalised explicit knowledge about solutions and knowledge about methodologies (either contingent or generalised)</td>
<td>Contingent explicit knowledge about solutions, methodologies and motivations</td>
</tr>
<tr>
<td><strong>Type of knowledge managed by the consultant</strong></td>
<td>Generalised explicit knowledge about solutions and methodologies</td>
<td>Generalised explicit knowledge about solutions and knowledge about methodologies (either contingent or generalised)</td>
<td>Contingent explicit knowledge about solutions, methodologies and motivations</td>
</tr>
<tr>
<td><strong>Business performances</strong></td>
<td>Time to market, efficiency revenues</td>
<td>Customisation and Customer satisfaction, innovation in the solution, efficiency</td>
<td>Customisation and customer satisfaction, innovation in the solution</td>
</tr>
<tr>
<td><strong>People performances</strong></td>
<td>Use of time</td>
<td>Sense of belonging, work satisfaction, self esteem, Reduction of labour turnover</td>
<td>Sense of belonging, work satisfaction, self esteem, reduction of labour turnover</td>
</tr>
<tr>
<td><strong>Knowledge process performances</strong></td>
<td>Embedment of knowledge in technological vehicles (B7) Abstraction and generalisation of knowledge (B6)</td>
<td>Abstraction and generalisation (B6), transfer of knowledge within and among processes (B4 And B5)</td>
<td>Business activities are seen as opportunities to develop knowledge (B2) Use of spare time to generate knowledge (B3)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Business activities are seen as opportunities to develop knowledge (B2) Use of spare time to generate knowledge (B3)</td>
</tr>
</tbody>
</table>

Figure 5.3: The relationship between innovation strategies and knowledge management configurations.
6. Refining the results through the longitudinal case studies

6.1 Introduction

In Chapters 5 and 6, RQ1 and RQ2 were addressed. This has resulted in the confirmation and operationalisation of the preliminary framework for knowledge management in innovative environments, the confirmation of existence of successful internal configuration of levers (centralised, oligarchic and decentralised approaches) embedded in theory, and their association with specific performance and innovation strategies in the consultancy industry. Some other issues need to be discussed in order to refine these results and fully answer the research questions:

1. Firstly, concerning the application of results to other industries. Thus, a refinement of the propositions resulting from RQ1 will be carried out in terms of limits of their applicability.
2. Alignment. In Chapter 6, the association between configurations and innovation strategies has been identified in successful companies. This result can be refined by investigating performances in the event of a missing association. The outcome will contribute to fully answering RQ2.
3. Changes over time. This is related to RQ3: in particular to changes in the functionalities of ICT, and their effects on the overall configuration, on performances, considering the role of contingencies.

6.2 The research methodology and the research setting

The development of two further case studies (Company I and L) is intended to meet explorative goals.

Company I is a global leader in the networking market. In recent years, Company I has entered the optical business, and one of the many acquisitions in this field is a Business Unit of a leading Italian company. The case study focused on the integration of sales
people from the old company into the new Business Unit. The research setting is the
selling force of the Italian company, before and after the acquisition by Company I.

Company L operates worldwide in the mobile phone industry (the focus of the case is on
software development activities. The analysis has been focused on the software
development process, which takes place in a distributed, multi-site project and presents the
need for support in order to facilitate the acquisition, transfer and sharing, and
capitalisation and reuse of required knowledge.

Several steps characterise this investigation:

- *Explorative phase*, with the same investigation questionnaire and protocol as in the
  previous cases.
- The second stage concerned the *development of suggestions for improvements* (in terms of
  new levers in the configuration).

Finally, after some time (approximately six months in both cases) an *exploration of the new
configuration* took place in the companies, and the effects on the organisation assessed.

Another issue concerns the roles of the researcher and managers involved in the different
stages of the analysis. The researcher is almost always the only one playing an active role.8
Managers are either interviewed or support the researchers in collecting data, especially
during the first explorative phase.

The process of developing analysis involves the following stages:
A. In order to answer RQ1: for what concerns company I, Configurations I.1 (Italian
company before the acquisition), I.2 (Company I before the acquisition) and I.3
(Company I after the acquisition) will be discussed. Company L was investigated
considering configuration L.1 (Company L at the beginning).
B. In order to answer RQ2: configuration I.3 was considered (Company I after the
acquisition), and configuration L.1.
C. In order to answer RQ3 the changes due to the implementation of new ICT
functionalities in the configuration of both companies.

### 6.3 The adoption of km configurations in other professional environments

The main goal of this section is to validate the results of Chapter 6 also in other
professional knowledge-intensive organisations (RQ1).

**Research question**
The subquestion relevant for this part of the research is RQ1.59: are the configurations of
levers adopted in consultancy companies also valid in other knowledge-intensive
industries?

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8 In line with case study theory (Yin, 1994)
9 The first research question is “What knowledge management configurations of ICT, organisational
mechanisms, and management systems emerge in knowledge-intensive, innovative environments, and
which performances are related to them?”
For this, the knowledge management configuration implemented in company I and L need to be investigated, in particular:
A. Which functionalities of levers foster knowledge processes in Companies I and L?
B. Which KM configurations (in terms of ICT, organisation and management tools) are implemented? Are they coherent with the configurations derived from empirical analysis in Chapter 5, and explained through theory?
C. What are the performances of these configurations?

Analysis of cases, discussion of results and conclusions
The goal of this subsection is to interpret the cases studies at Companies I and L, comparing the validity of results with other professional knowledge-intensive industries.

The configurations mapped through the case studies are summarised in figure 6.1. From the analysis of the case studies, some observations can be made. Firstly, the configurations are characterised by the functionalities of levers, (and their relative forms), identified and described in Chapter 4 as centralised (I.2 and I.3) and decentralised (L.1 and L.1) approaches. In particular, the decentralised approach, in both companies, emphasises the recreation of the context for knowledge management. ICT, in this approach, is a communication and collaboration means, and it is a prerequisite for recreating the missing context resulting from having dispersed workers. However, it is not enough to foster knowledge processes: the organisational mechanisms and managerial systems have to support the horizontal and vertical decentralisation in terms of structure, roles, responsibilities and coordination mechanisms (in particular incentives). The centralised approach, on the other hand, is focused on the content: people contribute in building a knowledge base, which is usually managed and updated centrally (low horizontal decentralisation). ICT then supports the asynchronous retrieval of accumulated knowledge.

In the analysis of each configuration of levers, certain characteristics of the new research setting emerged, which explain some of the specific choices made by the companies. Starting from the characteristics of the research setting three elements mainly distinguish it from the previous one: 1) the focus on functional units instead of the overall company projects 2) the focus on processes where knowledge is not the core output but is embedded into products clearly determining their quality; and 3) the level of consolidation of knowledge management practices.
<table>
<thead>
<tr>
<th>Configuration</th>
<th>ICT</th>
<th>Managerial systems</th>
<th>Organisational mechanisms</th>
<th>Configuration</th>
<th>Performances</th>
</tr>
</thead>
</table>
| **I.1:** Italian company before acquisition | Communication through traditional means: phone, fax or email | Same as business activities | Diffused responsibility: people play a dual role | Decentralised approach: high vertical and horizontal decentralisation | • Frequent transfer and sharing (B4 and B5), generation (B2 and B3).  
• High satisfaction in work  
• High loyalty of the customer |
| **I.2:** Company I before acquisition | Storage and retrieval through Internet and Intranet services. Huge knowledge base | Rewarding systems based on business activities results | Standardisation: a group of people dedicated to knowledge management activities | Centralised approach: low horizontal decentralisation and medium vertical decentralisation, coordination mechanisms based on standardisation of work processes and output, focus on explicit solutions | • Frequent generalisation (B6) and embedment into vehicles (B7).  
• Good use of time  
• High turnover and gross margin |
| **I.3:** Company I after acquisition | Storage and retrieval through Internet and Intranet services. Huge knowledge base | Rewarding systems based on business activities results | Standardisation: a group of people dedicated to knowledge management activities Role of sales overlay | Centralised approach: low horizontal decentralisation and medium vertical decentralisation, coordination mechanisms based on standardisation of work processes and output, focus on explicit solutions | • Poor generalisation (B6) and embedment into vehicles (B7).  
• Rather frequent transfer and sharing (B4 and B5).  
• High labour turnover  
• Low loyalty of the customer |
| **L.1:** Company L | Communication and collaboration through conferencing facilities; knowledge exchange and co-working facilities | Plan for knowledge transfer, concurrent engineering | Diffused responsibility: people play a dual role. Role of tutors | Decentralised approach: high vertical and horizontal decentralisation, coordination mechanisms based on mutual adjust, skill standardisation and output standard, focus on methodologies and issues | • Frequent transfer and sharing (B4) and generation (B2 and B3). To be improved all the others (especially B5).  
• To be improved innovativeness and time to market |

Figure 7.4: The KM configuration of companies I and L.

1. The first difference raises the issue of the relationship between the functional unit and the overall company. Organisational mechanisms, managerial systems, and ICT are usually
not decisions of the functional unit, and not completely developed within the budget of this unit: they are usually integrated with the overall decisions at the company level. For example, in the case of Company I, the choice to rely on the KM system of Company I was taken at the company level, and not in the new business unit.

2. The issue concerning the role of knowledge in the final output of the process, raises the question of relationship between knowledge processes and operational processes, and the related levers. In the two companies, levers implemented to foster knowledge processes in most cases are the same levers used to foster operational processes. This is especially true in the case of decentralised approach: the issue of formalisation of the knowledge process becomes critical. (as was the case in Company L (Gieskes, 2001).

3. The partial overlapping of levers in the operational processes and in the business processes can be partially explained also through the level of consolidation of knowledge processes in the companies. Knowledge management topics are now becoming a critical issue for companies. It is possible to introduce the “evolution of knowledge management systems” scenario to be explained through a longitudinal (or action research) approach.

Moreover, in terms of the effects of the configuration on performances as reported in figure 6.1, it emerges that configurations I.1 and I.2, closely reflect the same dimensions of performances as reported in Chapter 4 for decentralised and centralised approaches. Configurations I.3 and L.1, on the other hand, have the same lever functionalities of centralised and decentralised approaches, but the performances show relevant areas for improvement. This raises the question as to whether the configuration is aligned with the innovation strategy or not (Section 6.4).

### 6.4 The analysis of the alignment between innovation strategy and configurations

In Chapter 5, the association between knowledge management configurations and innovation strategies was discussed, with the analysis focused on successful companies operating in the management consulting industry. This section is focused on RQ2, investigating the alignment between innovation strategies and knowledge management configuration.

**Research question**

As discussed in Chapter 5, RQ2 can be formulated as “Is a particular KM configuration aligned with a specific innovation strategy?” To be more specific:

RQ2.1 Is a KM configuration associated with a specific innovation strategy?
RQ2.2 Does an innovation strategy influence the success of a knowledge management configuration?

Alignment implies that a relationship between innovation strategies, KM configuration, and performances exists. Therefore, the second subquestion focuses on cases of poor performances where such an association is not in place: if the missing association between innovation strategies and knowledge management configuration can explain the level of
performances, then the innovation strategy influences the success of the knowledge management configuration (alignment).

Analysis of cases, discussion of results and conclusions
The configurations I.3 and L.1 have been described in Section 6.4 in terms of levers, and have been related to the performances. In this section, the areas for improvement, in terms of these configuration and the innovation strategies of the companies, are discussed. By relating the innovation strategies to the configurations and their performances, some results can be drawn that concern alignment:

- In the case of Company I (configuration I.3), the centralised approach only supports, in this case, the efficient retrieval of explicit knowledge about products, but without stimulating sales people to contribute to the development of the knowledge base. On the other hand, innovation strategy should foster sales people in customisation of solutions (“develop total solutions for the customers”). The misalignment between the centralised approach implemented in Company I, and the innovation strategies pursued by the sales unit explains the poor performances (in terms of knowledge process performances, people performances and business performances) of the configuration.

- In the case of Company L, the functionalities of the configuration do not sufficiently support the new requirement to involve external sources of innovation emerging from the newly dispersed context in which the company is operating. More elaborated and formalised functionalities have to be implemented, facilitating communication, collaboration, and identification of experts.

Focusing on the analysis on Company I, certain characteristics of the relationship between the knowledge management system and the overall innovation process can be outlined. As Company I does not consider sales people as a potential source of innovation, the centralised approach is mainly implemented as a system to facilitate the storage and retrieval of knowledge from other units (for example knowledge concerning the product from R&D). Such a system is not designed to acquire knowledge from sales people, who do accumulate knowledge about the customer but as a consequence do not embed it in the KMS. The decentralised approach, as implemented in I.1, on the contrary enhanced communication between dispersed workers operating in the same process phase, or in different phases, of the product innovation process. The flows of knowledge enhanced by the KM configurations can be represented using the model of Continuous Product Innovation outlined by Bartezzaghi et al. (1998): the centralised approach (configuration I.3) fosters storage and retrieval of solutions from the R&D unit by downstream phases of PI, or between similar phases in different PI processes (without involving sales people). It is interesting to note that, in this configuration, the source of innovation is the R&D unit, and knowledge stored in the knowledge base is not refined by other units in the PI process.

6.5 The longitudinal cases research

In order to address RQ3, the cases of Companies I and L were carried out over time.
Research question
RQ.3 can be phrased as follows: “How do changes in the configuration of ICT, organisational mechanisms and management systems support a company’s knowledge processes and performances in situations where ICT has been the trigger of this change?”

To be more specific:
RQ3.1: what changes to the overall knowledge management configuration are stimulated by the change of one of the levers (i.e ICT functionalities)?
RQ3.2: what are the effects of configurational change on performances?
RQ3.3: what barriers to change, and its effectiveness, emerge?
RQ3.4: does the configurational change influence the innovation strategies adopted by a company?

The aim of the longitudinal case studies is to address these questions with explorative goals, in order to provide preliminary theory (and propositions) that can be refined through action research (Chapter 7).

Analysis of cases, discussion of results and conclusions
As described in Sections 6.3 and 6.4, the two companies have different knowledge management configurations (I.3 and L.1), which need to be enhanced in order to improve the overall performances (knowledge process performances, people and business performances).

Company I
The managers of Company I indicated that the company was not successful in terms of return on sales of “total solutions”, poor innovative ideas coming from sales people, and a high turnover in sales overlay staff. Several reasons for these performances have been uncovered:
A. Knowledge activities are perceived as separated from main process activities. The sales people are the target of the knowledge management tools. But the knowledge base, which is extremely large, does not reflect the characteristics of sales people and the search engine is almost ineffective. As a consequence, sales people have difficulties in retrieving the right piece of information from the intranet
B. Misalignment between new knowledge management configuration and innovation strategies. People in configuration I.1, were used to being involved in the PI process with a relevant role in innovation. Through the implementation of the new knowledge management system, which mainly concerns knowledge about products available on catalogue they no longer recognise their contribution in the innovation process.
C. Moreover, in Company I barriers concerning a lack of familiarity with web tools have not been recognised.

In order to improve the situation the managers decided to improve a)the structure of the knowledge base; and b) the transfer functionalities. The basic assumption is that facilitating the access to really useful knowledge would stimulate all the roles involved in selling activities in knowledge retrieval and reuse. Mapping the configuration several changes in the configuration (I.4) have been assessed in order to reach performances as described in figure 6.2.
Company L

In Company L, people have great difficulties in carrying out knowledge processes and business process (software development), due to the high level of globalisation of activities and high dispersion of competencies.

Company L decided to improve the knowledge management system through implementing new ICT functionalities, which characterise the configuration L.2), described in figure 6.2.

<table>
<thead>
<tr>
<th>Configurations</th>
<th>Functionalities of levers</th>
<th>Configuration</th>
<th>Barriers</th>
<th>Performances</th>
<th>Innovation strategies of the unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Configuration I.3: Company I after acquisition</td>
<td>Storage and retrieval Reward systems on business activities results Standardisation</td>
<td>Centralised approach</td>
<td>Low familiarity with web tools Separation between knowledge and business process</td>
<td>Poor generalisation (B6) and embedment into vehicles (B7). More frequent transfer and sharing (B4 and B5). Low loyalty of the customer</td>
<td>Sales overlay is still focused on development of “total solutions”</td>
</tr>
<tr>
<td>Configuration I.4 Company I after implementation of new ICT</td>
<td>Storage and retrieval: possibility of contributing to knowledge base; training, focus on Intranet as a working tool, personalisation of interface. Recognition of expertise for sales overlay in development of total solutions.</td>
<td>Centralised approach: low horizontal decentralisation, medium vertical decentralisation, coordination mechanisms based on standardisation Low familiarity with web tools Recognition of roles Lack of power in providing knowledge</td>
<td>Improvement of: Generalisation (B6) Transfer among processes (B5) Embedment into vehicles (B7) Generation of knowledge (B2 and B3). Higher loyalty of customer, Better work satisfaction Higher turnover at the beginning</td>
<td>Development of an integrated sales force able to: sell standardised products and innovative “total solutions” in short time and good costs.</td>
<td></td>
</tr>
<tr>
<td>Configuration L.1: Company L</td>
<td>Communication and collaboration, Plan for knowledge transfer, CE, platforms, Diffused responsibility</td>
<td>Decentralised approach</td>
<td>Frequent transfer and sharing (B4) and generation (B2 and B3). To be improved B5 and all the others.</td>
<td>Exploration of new solutions. Mainly internal sources of innovation</td>
<td></td>
</tr>
<tr>
<td>Configuration L.2: company L after implementation of new ICT</td>
<td>Communication and collaboration through more powerful tools embedded also in business practices, identification of experts, community development</td>
<td>Decentralised approach</td>
<td>Not invented here syndrome Difficulties in carrying out teamwork Type of knowledge</td>
<td>Frequent transfer and sharing (B4) and generation (B2 and B3). Frequent transfer among processes (B5) and assimilation from external sources (B8). High quality of working life Lower travel costs</td>
<td>Exploration of new solutions. Involvement of external sources</td>
</tr>
</tbody>
</table>

Figure 6.2: Configurational changes and their effects in Companies I and L.
Certain observations emerge from these results that will be useful in developing the action research approach:

- Firstly, in the two cases studies, the configurations have been changed through the implementation of new ICT functionalities. Nevertheless, in both cases, changes in the other levers also occurred: in Company I, in terms of training, and the definition of roles in knowledge and business processes in order to facilitate the standardisation of work processes and output. In Company L, changes have been seen in the definition of roles according to expertise, and in community development in order to foster mutual adjustment and skill standardisation. Overall, the functionalities of levers reflect the characteristics of configurations highlighted in Chapter 4, realising a centralised approach (I.4) and a decentralised approach (L.2).
- The configurational change and the solutions implemented are mainly aimed, in both companies, at enhancing the adoption of innovation strategies.
- Barriers to change have emerged from discussions with managers.
- The relationship between the operational and knowledge processes. Firstly, it seems that companies try to limit their investment related to configurational change, and therefore choose to implement levers which have also direct effects on operational processes. Moreover, the stress on operational processes resulted, in both the case studies (I.3 and L.1), as a constraint on knowledge processes especially in terms of time priorities and combination of activities.
- Although the change is designed only within the functional unit, the effects of the knowledge management system can influence the overall organisation.

### 6.7 Summary and conclusions

The chapter has been organised according to the research questions to be addressed. The cases studies enabled the knowledge management configurations emerging in consultancy companies, to be explored in other professional knowledge-intensive organisations. The same configurations emerged in the new research sample, with the same detected effects on performances. In Chapter 5, the association between innovation strategies and knowledge management configurations was analysed for successful consultancy companies. The two cases described in this chapter enabled the verification of the low-level performances in the event of non-association. The case studies have used a longitudinal approach. This allowed the variables in the process to be analysed at several moments in time. The most significant result is the fact that, within a configuration, if one lever changes (specifically ICT), the other levers also change.
7. The analysis of configurational change

7.1 Introduction

The chapter addresses the third research question:

**How do changes in the configuration of ICT, organisational mechanisms and management systems support a company’s knowledge processes and performances in situations where ICT has been the trigger of this change?**

- **RQ3.1:** what changes to the overall knowledge management configuration are stimulated by the change of one of the levers (i.e. ICT functionalities)?
- **RQ3.2:** what are the effects of configurational change on performances?
- **RQ3.3:** what barriers to change and its effectiveness emerge?
- **RQ3.4:** does the configurational change influence the innovation strategies adopted by a company?

7.2 The action research methodology

Literature about action research is extremely complex, and approaches the issue from several perspectives (Reason, 1998; Argyris, 1997; Adler and Shani, 2000). From more recent contributions that address the issue of developing theory through an action research approach (Coughlan and Coghlan, 2002; Adler and Shani, 2000), a model for the analysis of the case was developed (see figure 8.1). Starting from the main characteristics of participative research, and in particular table tennis research (Adler and Shani, 2000), a framework for the methodology adopted in this thesis is operationalised as shown in figure 7.1. In the model, two levels of analysis are distinguished, which correspond to different roles performed by the researcher. In the first layer, the researcher is part of the team acting in the company and driving the analysis, application, and refinement of the model together with practitioners. In the second layer, the researcher conceptualises the first layer activities as well as the interaction with and among the practitioners in a sort of double loop learning (as noted in Argyris, 1997). Other characteristics of the model include:
Performance of the process takes place in real time and with real issues. (Adler and Shani, 2000).

The research team consists of both practitioners and traditional researchers from different disciplines (Adler and Shani, 2000; Reason, 1995).

The action research takes place in the natural work setting (Torbert, 1990; Reason, 1995; Cooperrider, 1996; Argyris, 1997).

The action research needs to manage political dynamics (Heron and Reason, 1997; Adler and Shani, 2000).

The very important issue is the development of intermediate theory. The action research process is made up of continuous plan-do-check-act loops at the two levels. The actionable knowledge developed at each stage is intermediate theory, whose quality strongly depends on how the overall action research process is planned and carried out.

In order to enhance the plan-do-check-act loop at each stage it is particularly important to build up a system of performance indicators.

In the thesis, several characteristics of the research have led to the adoption of a participative approach: the research objective, the complexity of the topic (in terms of number of variables and their changes over time), and the overall structure of the research (based on explorative research and then action research to refine propositions).

7.3 The development of the case of company K

This section aims at describing the action research case, in terms of characteristics of the company and its goals, in terms of the knowledge management system implemented, in terms of achieved results, in terms of the process followed in carrying out the research.
Introduction and goals
The company where the study was developed (referred to as “company K”) is a leading telecommunications service provider (mobile phone services) in Italy. Formerly with a market monopoly, the company has had to cope in the recent years with an increasing number of competitors. The action research case is focused on company K’s indirect sales network for servicing SMEs. To address the specific needs of SMEs, company K has established a specific indirect sales network, consisting of more than 150 agencies (referred to as company K business promoters—or TBP) and 1000 agents. This SME business is very important for company K, with a yearly turnover of more than €1000 million.

The context reflects a high level of complexity: on one side, the economic relevance of the business is very high and presents high potential growth; but on the other side the sales network is difficult to manage with a large number of agents that company K cannot directly control as they are employed by entrepreneurs.

At the same time, in 2000, the strategic priorities were very clear, and very much related to the performances of the salespeople, namely: to consolidate and maintain Company K’s market share (60% in the business), to improve the quality of sales; to face increasing market churn; to reduce the high turnover in sales personnel. In particular, the company aims to improve the competencies of the salespeople in order to provide “complex services sales”, which are customised and innovative according to the characteristics and requirements of the customer. The strategic priorities of Company K reflect a high level of innovation in the solution provided (exploration strategy) due partly to the contribution of salespeople in the customisation phase. Moreover, due to the relevant role of the customer in the sales process, an aim of the company is to facilitate the integration of external sources of innovation. In order to reach such objectives, the company has decided to implement, together with their consultants (referred to as “Company Z” from now on), a community that facilitates sales people in exchanging knowledge about products, services, market, and competitors through a portal.

Two main types of constraints have emerged since the beginning of the development: contextual and personality factors. The former concerns the organisation of the sales force of Company K: the number of customers, their size (SME with low technical competences), no specific area allocation to salespeople, and their contractual position (they are employed by TBP centres). These elements contribute to creating a strong competition among the salespeople, them having a poor alignment with Company K’s goals, and providing few levers for the departments of Company K to manage them directly. This was strengthened by the fact that, at the beginning of the project, it was not clear who was or had to be the real sponsor of the project: the HR department, the marketing department, or the sales department. The personality factors, on the other hand, reflect the behaviours of salespeople. It is interesting to note that one main element characterises their approach towards work: the need to be the first. Salespeople are strongly committed to be the best, and to be more visible and competitive. As a result, they are only interested in information, procedures, and practices that help them come out on top.
The description of the functionalities of the portal
The knowledge management configuration has been developed by starting with the implementation of new ICT functionalities, referring to a portal supporting a community of salespeople. The characteristics of the portal developed by Companies K and Z, as it stood after about one year (February 2002), are built around three main integrated functionalities: informative functionality, training functionality and social functionality. The portal is organised in five channels: news, training, offer, desktop and community.
In the news channel Company Z reports everyday on the most useful and interesting news (competitors commercial and patrimonial situation, joint ventures and acquisitions, information about technological innovations with mobile telephones and relative services). The training channel provides training courses to develop selling skills and competences. These courses are accessible though the web (e-learning) and are certified by Cepas (Italian certification company for sales, recognised by the EU). The offer channel collects information concerning Company K products and services and those of its competitors. The desktop channel includes an agenda, a dynamic collection of tools, presentation and ideas to better manage the work of salespeople and “the expert”, a support service concerning commercial and fiscal issues. The community channel is a space that provides an opportunity for members of the portal to get to better know each other, and discuss and analyse common experiences and perspectives. A final important issue concerning the characteristics of the portal is the program Pro-Activity. It is a program for providing scores to those users (salespeople) who have contributed to the development of information/knowledge accessible through the portal. Such scores correspond to a position in a general classification and eventually they are related to a premium prize. Salespeople can earn points through participating in courses, through providing interesting information for the community, and through solving another agent’s problem. This mechanism is particularly coherent with the personality of salespeople given their aim of being the “best in the class”. At the same time, the competition helps in facilitating the sharing of information.

The results
Impacts concerning business and people performances, six months after the implementation of the community, have been measured by the researcher and by Company Z. The number of accesses to the community has grown incredibly. From the 20th of February 2001, when the tool was introduced, the number of salespeople connected had grown to 1250 by the 15th of September 2001. In terms of the frequency of access, it has been found that 40% of the agents access the community every day, and they are connected on average for 22 minutes, but this value increases when training sessions are periodically run. Finally in terms of visitor session: the number of contemporaneous accesses is highest during the night. It is clear that people dedicate part of their spare time to getting information or to discussing their work with other members of the community. Through interviews within the company, Company K has measured some changes in performances even after six months: reduction of personnel turnover (from 50% to 17%), development of a professional profile by the agents and better sales forecasting.

The action research process
In order to begin the analysis of the case over time, it is necessary to explain in more detail the action research process that was adopted. The action research has been carried
out by the researcher acting together with both Company Z and Company K, in the
different phases of development of the portal. The interaction between the researcher and
the companies was organised as shown in figures 7.2.

<table>
<thead>
<tr>
<th>Researchers and practitioners</th>
<th>Researchers</th>
</tr>
</thead>
</table>
| Preliminary meetings with company K and Z:  
to check the goals of the company, to analyse preliminary barriers  
for the development of the knowledge management configuration | Development of preliminary list of propositions to refine |
| Periodic meetings of researchers together with company Z (once a month):  
in order to check the evolution of the functionalities of the portal  
over time, and the performances (especially concerning the  
performances of the portal and the knowledge process  
performances).  
During the meetings, the impact of the functionalities of the portal  
(and of the overall configuration) on salespeople behaviours have been analysed and discussed | Development of preliminary theory about the interaction of levers within the  
configuration and its effects on knowledge process  
performances. |
| Meetings of researchers together with Company K and Z (once every two months):  
in order to assess the effects of the overall configuration not only on  
salespeople behaviours, but also on people and business  
performance, and the problems of the company in integrating the  
configuration in the overall company structure. | Development of preliminary theory about configurational change and its effects on  
people and business performances, theory about effects of the configuration  
on innovation strategies. |
| Survey on the portal to get feedback from salespeople (appendix 4)  
five months after the introduction of the system | Check the use of the portal,  
check knowledge process  
performances and people  
performances |
| Telephone interview to sales people to gain feedback on the  
usability and usefulness of the KM configuration (three months after  
the introduction of the system) | Check the use of the portal,  
check knowledge process  
performances and people  
performances. |
| Monitor the portal through a password, and interact with managers  
of company Z in order to understand the choices made (for three  
months). | Check the use of the portal,  
check knowledge process  
performances and people  
performances, develop preliminary theory about the interaction of levers  
within the configuration. |
| Participation in public presentations of Company K (after 10 months) | Check the external  
promotion strategy of the  
company.  
Check the innovation  
strategy of the company |

Figure 7.2: The interaction between the researchers and practitioners in the action research

7.4 The phases of the development of the knowledge management system

The first step of the research has been, together with the managers of Company K, to
discuss the propositions concerning the configurational change to be refined, considering
the propositions developed in the longitudinal case studies (Chapter 6). The process of configurational change in the case of Company K (which in this case is the implementation of a new knowledge management system) can be modelled as four phases, described in detail in this section.

Concept of the portal
The main idea by the company was to develop a tool to develop salespeople’s knowledge about products, services, market and competitors. Thus, in this first phase, the work team, which included managers from both the company’s sales departments and Company Z, focused on learning and information tools for delivering “useful” knowledge to salespeople. Although a careful activity for software selection was carried out, and a prototype developed, most of the consultants’ efforts in this phase were not devoted to the technology but rather to understanding and building a relationship with salespeople. Firstly, members of the team joined some of the agents in their daily work for two weeks in order to understand their task, needs and habits; then a very open and flexible prototype was developed that was discussed and refined with the agents; and finally workshops, meetings, and a road show were organised to build awareness and train the salespeople. The result of this phase was knowledge, developed by Company Z and Company K, about: the typical behaviour, personality, and priorities of salespeople; the type of knowledge/information they need to carry out their job; and their difficulties in using web-based tools. Merchandising and communications events were also heavily used in this phase to build ownership and sense of belonging.

Introduction of the portal
During the second phase, the team aimed to create a community of salespeople free from hierarchical relationships. The facts that all the agents were given full access, that the site was maintained by an independent company outside the firewall, and that the rules of the official ICT infrastructure of Company K were not in place in the management of the portal, played a key role. One of the key issues in this phase was to overcome user resistance related to the lack of IT skills: online and offline ad hoc training was offered, and extremely “easy-to-use” and light functionalities were developed. The consultancy company forced the IT developers to focus on “usefulness” and “flexibility and lightness” rather than on graphics and technical sophistication. A dedicated team of people was in charge of scanning knowledge sources, translating them into readily usable “knowledge pills” and publishing and stimulating discussion (especially concerning competitors’ products, services, and technical characteristics).

The team in charge of scanning knowledge and managing the portal involved several personnel from both Company K and Company Z. However, they were not perceived as hierarchical references: some of them were seen as facilitators (Company Z), others as the sponsors (Company K): Company K- responsible for customer development, Company K- portal responsible, and in company Z the responsible of management of the relationship with users of the portal, the access manager, the tutor and the community development manager (who is the gatekeeper between company K and company Z, analysing the community in terms of quality, satisfied requirements, periodical access; and

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According to the characteristics of the case, the propositions to refine concern the decentralised approach.
forwarding these results to Company K. He is also responsible for “improvement and innovation” of the functionalities of the community). The clear definition of roles within the knowledge management configuration will help Company K to improve the functionalities of the levers of the configuration in line with new perceived requirements emerging from the community, and at the same time, facilitates the creation of common references for salespeople acting in different organisations.

The points competition stimulated people to read reports and attend online courses. Official certificates were provided for courses attended. Although prizes and certifications played a role, the most important stimulus for participation was that the salespeople would to be recognised as “first in class”. Interviewed salespeople stated that being high up in the classification became a powerful source of status in the community and self-esteem. Soon the contest, and the system, became very popular in the community. Although interaction was mainly through the web, “real” meetings and conventions played a key role in the development and consolidation of the community.

Consolidation of the knowledge management system
The aim of the third phase of the development is twofold: to consolidate participation in the community, and to create a strong connection between the company and the community in terms of increasing the sense of belonging. The requirement to understand the rational of company strategies and policies that could influence their activities emerged from the community. The work team developed improvements for the portal: firstly, a specific “offer channel” where all the information about products/services of Company K and of its competitors could be easily accessed and retrieved, and moreover provided more managerial training courses both online and offline. This required a formalisation of dedicated roles within Company Z. Further, a “direct line with marketing” service, a dedicated set of online conferences where the person responsible for company K’s marketing B2B activities discussed the strategies and practices, and answered questions from the community, was established. The availability of such enablers builds up a strong sense of belonging to the company. People from the company’s marketing department progressively became more aware of the very high potential of the system to become a source of knowledge about the market and competitors. Online surveys now provide marketing with quick and useful insights and information that they use to improve their offers. Although developed as a learning tool for salespeople, the portal and the community were awarded as the best marketing tool in 2001 by the ADICO association (Italian association of commercial and marketing directors). The contribution of the system to the sales process is today becoming more evident as communication is shifting from reporting information and experiences, to collaborative searches of possible solutions to problems. The performance competition now offers high points for the joint solution of common problems within the community.

The next steps and challenges: integrating the system in the company organisation
The work team is now carrying out a fourth phase, which is a real challenge for the community. In the earlier phases, the community was kept separated from the rest of the organisation. This has protected it from hierarchical intrusiveness and misalignments from the real goals of salespeople. However, at this stage, the managers of Company K
are challenging to gain recognition of the community within the company organisation itself. As the system has progressively been recognised, and eventually rewarded as a powerful marketing tool, more and more people in the company are asking for the extension of the system to involve more users and cover more market segments. Salespeople are increasingly asking for the system to include more operative functionalities to support them not only in terms of knowledge sharing, but also as working tools supporting their daily administrative and operational process even when they are at the customer’s site. To facilitate this, wireless functionalities have been added to the system allowing the salespeople to receive documents and notifications when not connected to a fixed workstation. The work team is aware of the implications of this pressure in terms of the needs for a tighter integration with the company’s official information infrastructure, and is worried about the possible implications and constraints of this. Further, as more users become involved and functionalities become more sophisticated, costs will rise and the system cannot be maintained purely on the budget of the sales department. This means that a more rigorous estimation and quantification of the performances and the effects of business process will be required.

Finally, there is a growing concern about the role played, or rather “not played”, in the system by the salespeople’s employers. So far, these have not been involved, and initially they “accepted” the system because it provided them with free training and helped in lowering the turnover.

7.5 Discussion of the action case and results

7.5.1 The evolution of the internal configuration of levers

In the previous section, the phases of development in the knowledge management system have been described, in terms of the main goals, the levers implemented, and specific results. In figure 7.3 the configurational change is represented. The target configuration has the functionalities of a “decentralised approach”. Analysing the changes from one phase to another it emerges that the change is incremental, adding or refining the functionalities without changing the overall approach, which is aimed at creating and diffusing the responsibility for knowledge processes among the salespeople. In terms of system evolution, the work team of Company K and its consultants (Company Z) have been flexible in building a knowledge management system: functionalities of the system have been added and refined only when a specific need emerged directly from the users. Therefore, the key driver to the success of the initiative can be termed as the ability of the work team to continuously perceive and understand the needs of the community, and to rapidly provide organisational and technological solutions enabling such requirements.
<table>
<thead>
<tr>
<th>Phase</th>
<th>ICT</th>
<th>Organisation mechanisms</th>
<th>Management systems</th>
<th>Key performances</th>
</tr>
</thead>
</table>
| 1. Concept of the portal | • Awareness through prototype | • Involvement of Company Z in the design and development of the platform.  
• Definition of Company K portal responsibilities (marketing and training competence) | • Off line training  
• Focus group to find “useful” knowledge for agents  
• Preliminary investigation to analyse characteristics of sales process and agents  
• Preliminary meetings to promote and create awareness (off show) | • Strong commitment of company K  
• Interest of agents |
| 2. Introduction of the portal | • Informative, training and communication functionalities  
• Technews, training on IT and technical characteristics of product, moderated forum | • Definition of roles in Company K and Company Z.  
• Improvement and development team allocated. | • Relationship between the portal and off line initiatives  
• Training courses  
• Publication of useful knowledge in order to stimulate discussion  
• Pro activity program  
• Tutorship for the use of the portal  
• Participation of company K responsible in offline programs | • Assimilation of knowledge  
• Increased self-esteem |
| 3. Consolidation of the knowledge management system | • Creation of offer channel  
• Development of “direct line with marketing” | • Stronger involvement of Company K roles  
• Business marketing responsible involved. | • External meetings and conferences involving Company K managers  
• “Direct line with marketing”  
• Large number of meetings and conventions among sales people  
• Premium prizes for solution of problems | • Sharing of knowledge  
• Abstraction and generalisation  
• Satisfaction on approaching the customer  
• Greater sense of belonging |
| 4. Next steps and challenges | • Development of wireless applications  
• Evolution of the tool as a working tool  
• Integration of the KM system in company K knowledge management system | • Involvement of Company K Human Resources unit  
• Involvement of TBPs | • External presentations of the project  
• Evaluation of company K internal channels for presentation  
• Measure of effectiveness results in order to evaluate the impact on company K sales performances | • Sense of belonging  
• Recognition within the company  
• Low staff turnover |

Figure 7.3: The functionalities and solutions of levers in the configurational change.

From this perspective, the ICT solution can be also understood: the technological and graphical choices are very simple, but at the same time very flexible. The organisational and managerial mechanisms are designed to: facilitate knowledge processes (enhancing the use of the portal, stimulating the transfer of knowledge by each salesperson,
stimulating knowledge sharing, creating alignment with corporate goals, creating awareness of being a community) and build a structure to manage the knowledge management system (to monitor the evolution of users’ needs from the knowledge process point of view, and measure the results and promote them within the community and in Company K at large). The interesting issue is that all the enablers have been designed and refined together with the ICT portal, and not separately. This flexibility, which is one of the keys of success of the knowledge management system, hinders the diffusion of the system itself: the system has been developed only for salespeople, using the budget of the sales unit and improved according to requirements of users.

7.5.2. The development of the community

The goal of Companies K and Z was to develop a community of salespeople supported by an implemented knowledge management configuration. Literature addresses the issue of the relationship of the community with the formal organisation in terms of the process of creation, as communities are not created but rather evolve outside the domains of formal management practices. Managers can only support and facilitate (or not) the process of creation through the implementation of enablers. Considering the configuration of levers, in the first two phases, the focus of the implemented enablers was on the process of creation - building the awareness of the community, in term of interests, practices, routines and language. The managers acted only as sponsor of the initiative. In the final phases, the focus is on building integration mechanisms with the formal organisation.

<table>
<thead>
<tr>
<th>Phase of development</th>
<th>Concept of the portal</th>
<th>Introduction of the portal</th>
<th>Consolidation of the KM system</th>
<th>Next steps and challenges</th>
</tr>
</thead>
<tbody>
<tr>
<td>B1: Individuals use the organisation’s strategic goals and objectives to focus and prioritise their improvement and learning activities</td>
<td>--</td>
<td>--</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>B2: Individuals and use selling activities as opportunities to develop knowledge</td>
<td>-</td>
<td>+</td>
<td>++</td>
<td>++</td>
</tr>
<tr>
<td>B3: Individuals use part of available time/resources to learn</td>
<td>-</td>
<td>+</td>
<td>++</td>
<td>++</td>
</tr>
<tr>
<td>B4: Individuals integrate knowledge among all different phases of the selling process</td>
<td>--</td>
<td>--</td>
<td>0</td>
<td>+</td>
</tr>
<tr>
<td>B5: Individuals transfer knowledge among different processes in selling company K products</td>
<td>-</td>
<td>0</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>B6: Individuals abstract knowledge from experience and generalise it for application on new processes</td>
<td>-</td>
<td>0</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>B7: Individuals embed knowledge into vehicles</td>
<td>-</td>
<td>0</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>B8: People try to assimilate and internalise knowledge from external sources</td>
<td>++</td>
<td>++</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Figure 7.4: The frequency of behaviours of sales people.
The effects of the configurational change, and the characteristics of the community developed, also emerge through the analysis of performances in the case. The frequency of salespeople behaviours evolved into different directions as indicated in figure 7.4. At the beginning the focus of the work team was on providing “useful” knowledge to salespeople, then Company K fostered the awareness of the community and the flows of knowledge transfer within the community itself, despite the fact that the members belong to different organisations (one in competition with the other), and without dealing with the issue of recognition and relationship with the existing Company K organisation. In the final two phases, the company challenged the connection between the community and the organisation, facilitating the interpretation of causal links. In order to address this issue, the managers of Company K have had to deal with: the strategic potential of the community, the integration of the community into the overall KM system of Company K, and finally the development of the portal as a working tool. The challenge is not to denature the characteristics of the community itself (subsection 7.5.7).

7.5.3. The type of knowledge

In Company K, the type of knowledge supported changed over time. The map of changes over time in the types of knowledge supported by the configurations is represented in figure 7.5.

<table>
<thead>
<tr>
<th>Phase of development</th>
<th>Concept of the portal</th>
<th>Introduction of the portal</th>
<th>Consolidation of the knowledge management system</th>
<th>Next steps and challenges: integrating the system in the organisation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knowledge object</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Issue/motivation</td>
<td></td>
<td></td>
<td>Explicit contingent</td>
<td>Explicit contingent</td>
</tr>
<tr>
<td>Methodology</td>
<td>Tacit Contingent</td>
<td>Explicit Contingent</td>
<td>Explicit Generalised within the community</td>
<td>Explicit Generalised within the community</td>
</tr>
<tr>
<td>Solution</td>
<td>Tacit Contingent</td>
<td>Explicit Contingent</td>
<td>Explicit Generalised within the community</td>
<td>Explicit Generalised within the community</td>
</tr>
</tbody>
</table>

Figure 8.5: The change of types of supported knowledge.

The type of knowledge involved in the community changes over time. Initially, knowledge about solutions, customers and sales methodologies, was stored tacitly by salespeople through direct interaction with customers. In phase 2 (Introduction of the portal), as a result of performance measurement, salespeople began to assimilate knowledge and to generate tacit knowledge, which was stored in everyone’s memory. Company Z transferred explicit knowledge to the community about possible solutions by scanning potential external sources of knowledge. Histories and experiences are transferred, conversely, by the salespeople (knowledge about methodology) concerning both the approach to the customer and the usability/usefulness of the portal. It is important to point out that, at this stage, abstraction and generalisation had not taken place in the
community; knowledge remained contingent. In the following phase, tacit and explicit knowledge creation was fostered by joint solutions to common problems through ICT. The availability of knowledge concerning the causes of specific events and choices, and support in recognising and explaining such links, was the real challenge of this stage. Managers in Company K were therefore changing their role from that of sponsors to one of facilitators of the process. During the final stage, performance measurement and increased promotion strengthened this process. Connecting the community to the company facilitated the better understanding of cause-effect relationships.

One issue that is extremely relevant is the relationship between knowledge assimilation, transfer, and sharing acting through the portal and the community; and creation of tacit knowledge in interacting with the customer. Through the transfer of issues and methodologies, fostered by the portal in phase 3, the creation of knowledge through the interaction with customers can be at a causal level (rather than only declarative or procedural). Therefore, providing explicit knowledge about issues can facilitate the generation of new tacit and causal knowledge, derived from the interpretation of experiences through these motivations.

7.5.4. The evolution of knowledge performance

The implementation of the configuration of levers in the different stages of development fostered an improvement of performances of the knowledge processes. Beyond the improvement of the learning behaviours, with specific reference to some of them, people and process performances also improved. In terms of people performances\(^\text{11}\), three dimensions have been fostered by the implementation of the portal. Salespeople have increased their self-esteem through more successful interaction with the customer. As they own knowledge about competitors and products/solutions, they can provide the best solution to the customers and improve their visibility within the community. People also increase their satisfaction in working in a community in terms of the sense of belonging and the level of collaboration. Moreover, the level of satisfaction of people operating in the organisation has also improved. Despite the sales people being employed by TBP's, through interacting in the community in the third and fourth phases, they have developed a strong sense of belonging to Company K values, with a consequent reduction in turnover (50% to 17% in six months).

Positive effects have also been measured on process performances, specifically in terms of market share and customer loyalty. Managers of Company K noted that the market share has been maintained at 60%, despite an increase in competitors, and that customers were very satisfied with the acquired products in terms of meeting their required characteristics and the competences offered by salespeople.

Observing the evolution of performances typologies in the case, it seems that a virtuous cycle has been created. Initially, the main focus of the company was clearly on “fostering learning though the creation of a community”. This directly facilitated the salespeople in approaching and managing the customers. The success in carrying out their work, their

\(^{11}\) The survey submitted through the portal was aimed at assessing people performances. Results have been checked through telephone interviews.
desire to be “first in class”, and to increase their self-esteem, were a stronger incentive than any formal mechanism.

7.5.5. The alignment with the innovation strategy

Company K managers, at the beginning of the process, perceived the creation of the community of salespeople as a commercial tool focused on selling activities. However, in the third stage of evolution, the managers discovered that the contributions by members of the community were essential in making their decisions. Top managers of Company K, through their intervention in the community, have realised the potential value of knowledge coming from the community, especially concerning the customer (in terms of requirements, trends, feedbacks about the use of the product). Ideas coming from the community have been discussed by the marketing unit and also by the R&D unit. In 2001, the knowledge management system received the prize for best marketing tool in Italy. From the research point of view, these results show how the implementation of a new knowledge management system enhances the refocusing of an innovation strategy. In particular, the creation of the community of salespeople, and its integration with the marketing organisation, fosters the possibility of exploiting feedback coming from the market in the overall product innovation process (Bartezzaghi et al. 1998).

7.5.6 The barriers to configurational change and to its effectiveness

Company K has preliminarily identified and managed barriers to configurational change. In particular:

- **Familiarity with technology.** As noted for Company I, unfamiliarity with ICT can be a strong barrier to change, especially when change relates to introduction of new ICT functionalities. Such a barrier seems to be most relevant to the education and culture of the people involved in the change: salespeople are usually undergraduates who have traditionally based their work on managing relationships with their customer.

- **Slack, and combination with operational activities.** Slack, and the availability of time for knowledge processes have been identified as relevant enablers for learning (Gieskes, 2001). In the case of Company K, most of the access to the portal was between 1.00 a.m. and 4.00 a.m., and not during working hours. This is a very important result for two reasons: firstly, it shows that salespeople perceived participation in the community as extremely important and useful for their working and professional growth. It means that Company K and Z have been extremely successful in identifying the really important value of salespeople, which is common to most people: to be “first in class”. From the research point of view, it shows that slack in operational activities is not a necessary condition to enhance knowledge processes. The lack of slack in operational activities is a barrier to knowledge processes, but it can be overcome through designing the functionalities of levers in the configuration so as to manage the knowledge that is useful to people acting in the knowledge processes in order to realise their professional and personal goals.

- **Competitions among members.** The members of the community are employed by TBPs, and operate in competition with each other. This could be a very strong barrier to configurational change, as it hinders salespeople in sharing their knowledge with others. The organisational mechanisms adopted made the community independent from hierarchical levels and from organisational institutional belonging. In the first two
stages of development, the interaction was created between members of the community and Company Z, without directly involving the managers of Company K. The members did not perceive any formal relationship with Company K, they only saw the possibility of getting “useful knowledge” from participating in the community. Similarly, the competition among members has been managed through *managerial systems*. Participating in the community is considered a “game”: with contests and prizes that can be won, for example through solving each other’s problems or for the “best holidays” spent by members. The competition through the portal is played on a neutral field. This allowed the building of *mutual trust* in the community through discovering common interests, joint problem solving and the exchange of experiences, and through offline discussion opportunities.

- **Lack of commitment and sponsorship.** A lack of commitment has been identified as a critical barrier to knowledge processes (Gieskes, 2001). In the case of Company K, it is a very difficult issue to assess as, on the one hand, salespeople directly refer to TBP entrepreneurs, while the sponsor of the knowledge management system is Company K. Moreover, in building up the community, the hierarchical relationships could be critical. Company K decided to address this issue gradually: in the first two phases, the main goal was to create the community, and only in the following stages would top managers become involved in order to foster a sense of belonging, sponsor the initiative, and enhance the creation of causal knowledge.

Company K has successfully managed the described barriers. Further barriers have been recognised by Company K that require, in the fourth phase of development, a decision to be taken about the future of the community. The results therefore concern the existence of the barrier. In more detail:

- **Composition of the community.** Magnusson and Davidsson (2001), indicate how the composition (number of members and type) of a community is a critical dimension for its success. Firstly, in order to start the community activity, a critical mass is necessary in order to build the knowledge base and to make knowledge transfer effective. This barrier has been managed by Company K through the preliminary involvement of Company Z in the community. However, the huge number of people involved could then make interactions more complex. Notwithstanding, the real issue is the type of people involved in the community: at the beginning of the story, the community was addressed only to salespeople. The eventual involvement of TBP, or other functions of Company K, has been recognised by the company as a potential barrier, which could denature the community itself in terms of common interests, goals and language. The question is whether to allow these additional groups into the community and, if so, with what roles.

- **Integration with the organisation.** This barrier is very much related to the previous one, and is implicitly related with the concept of community. According to McDermott (1999), and Brown and Duguid (2000), the role of formal management in the community should be limited to sponsorship, since other formal hierarchical control mechanisms hinder the learning process within the community. However, if the objectives of the community are not aligned with the goals and strategies of the company, the potential of learning within the community is not exploited for the benefit of the organisation. Company K has enabled the creation of a community, and since it has recognised its potential as a knowledge management system for the overall organisation (beyond the
commercial unit), it is considering whether to integrate it with the other functional units. Several elements have to be considered at this stage: firstly, the relationship with the overall ICT structure of Company K, which is much more complex than the infrastructure supporting the community. Then, measuring of value is non-traditional. Wenger and Snyder (2000) highlight how it is very difficult to measure the performances of a community: sometimes the effects of their work are delayed, and moreover the results generally appear in the work of other business teams in the organisation and not necessarily within the community. Further, there is the difficulty in formally rewarding members of the community: this has to be aligned with the policies of Company K and of TBP's, and could also hinder the “game characteristic” of the community.

- **Integration with sales processes.** As far as the fourth phase is concerned, the community has been to an extent protected from the technological point of view (all the software resides on servers of Company Z and it is moderated and managed by Company Z), from the organisational point of view (as it is not integrated into either TBP’s or Company K’s organisations), and from the managerial point of view (as its priorities and incentives are related only to the community itself). At the same time, Company K would like to further improve the use of the tool but, so far, members are accessing the portal mainly during the night. Two possibilities are being considered by the company: firstly, to allow access to the portal through wireless applications, and secondly, to formalise the use of the community for also managing selling processes. This has been addressed as a very critical issue. Organisational and managerial levers that support formal group activities are different from those that support knowledge processes within the community.

### 7.6 Summary and conclusions

Through the application of action research in the case, certain conclusions can be drawn, and are summarised in figure 7.6. The first result relates to **the role of knowledge management** as the process of designing, implementing, maintaining and improving a system of Organisational mechanisms, Information and Communication technologies and Management systems (the levers). Through these an organisation fosters and focuses individuals’ and groups’ behaviours in terms of Assimilation and generation, Transfer and sharing, Capitalisation and reuse of knowledge, in both tacit and explicit form, that are useful to the organisation. From the action research case, **two levels of enablers have been identified:** the enablers that directly stimulate knowledge processes, and the enablers implemented to maintain, improve, and revise the previous set of levers in order to access knowledge management performances. The latter set of levers is also implemented by the organisation to overcome the initial barriers to change and its effectiveness. From the action research, **three principles** that drive the knowledge management process have emerged:

- **Identification of users’ requirements and priorities to design the configuration.** The correct identification of the priorities of people and groups operating in knowledge processes, allows the enablers to be aligned with them.
- **Flexibility in the configuration.** If users’ requirements are not perfectly known in advance, or if they change rapidly, flexibility of the system allows adaptation to new emerging priorities.

*Coherence with organisational goals.* A risk associated with the two previous principles is that of separation of the knowledge management system and the community (which has been fostered in this case) from the organisational goals. The knowledge management system in the action research case has demonstrated how the community priorities can be continuously combined with organisational priorities.

The second main result is the **refinement of the model.** It concerns the identification of relationships among variables, which provides the possibility to develop new research propositions for further research. Two main categories of relationships emerge: internal relationships and external relationships.

**Internal relationships**
- **The role of ICT.** Within the configuration, ICT is only a means through which the community is supported. Its main goal, which is consolidated over time, is to recreate the context missing in the case of dispersed workers, by relying on functionalities that become richer over time. The organisational mechanisms and managerial systems are continuously adapted to new emerging requirements (from both the community and company).
- **The relationship between the barriers and the enablers** implemented in the knowledge management system, as summarised in figure 8.7.
- **Other barriers have been identified** but not yet managed, so although the enablers and relative performances can be surmised from literature and previous research, they cannot be assessed as yet. These barriers are the number of members in the community, the diversity of the members, the integration of the community into the overall organisation, and the use of the knowledge management configuration to support both knowledge and business processes. The awareness of these barriers, and their relevance to the characteristics of the configuration, leads to some further research questions that could be addressed in later research (Chapter 8).
<table>
<thead>
<tr>
<th>Role of the knowledge management</th>
<th>Result</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Levers to stimulate knowledge processes</td>
<td>Levers to design, maintain, improve and revise the levers; stimulating knowledge processes</td>
<td>A set of levers is implemented in order to overcome barriers to change and to monitor the evolution of the levers supporting knowledge processes</td>
</tr>
<tr>
<td>Principles driving the knowledge management process</td>
<td>• Identification of users requirements and priorities to design the configuration • Flexibility in the configuration • Coherence with organisational goals</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Internal relationships</th>
<th>The role of ICT</th>
<th>In the decentralised approach, ICT recreates the context and does not stimulate the use of the KM system. The latter is the role of organisational mechanisms and managerial systems</th>
</tr>
</thead>
<tbody>
<tr>
<td>The relationship between the barriers, enablers and performances</td>
<td><strong>Barriers</strong></td>
<td><strong>Levers to overcome barriers</strong></td>
</tr>
<tr>
<td>Familiarity with technology</td>
<td>Levers to assess the level of unfamiliarity with ICT and training.</td>
<td>Performance: • Assimilation (B8) • Embedment into vehicles (B7) • Transfer within among processes (B4 and B5) • Use of business activities to develop knowledge (B2)</td>
</tr>
<tr>
<td>The potential competition among users</td>
<td>No hierarchical formal mechanism between the community and the company (organisational mechanisms). ICT and managerial mechanisms to create an alternative neutral field of competition.</td>
<td>• Transfer within and among processes (B4 and B5) • Embedment into vehicles (B7)</td>
</tr>
<tr>
<td>The lack of commitment and sponsorship</td>
<td>No formal control. Gradual involvement of roles at high levels of hierarchy.</td>
<td>• Alignment with strategic goals (B1) • Abstraction and generalization (B6)</td>
</tr>
<tr>
<td>Other barriers</td>
<td>• Number of members in the community • Diversity of members • Integration of the community in the overall organization • Use of the KM configuration for knowledge and business processes</td>
<td></td>
</tr>
<tr>
<td>Emphasis on performance measurement</td>
<td>Identify, measure and evaluate on the basis of knowledge processes performances is a strong lever</td>
<td></td>
</tr>
<tr>
<td>Acquisition of generalised knowledge, stored at a tacit level.</td>
<td>• Contacting experts who store generalized knowledge • Acquiring explicit knowledge about motivations and, thanks to it, generalizing knowledge based on experiences, even at a tacit level</td>
<td></td>
</tr>
</tbody>
</table>

**External relationships**
The adoption of a knowledge management configuration fosters the refocalsation of innovation strategies.

Figure 7.6: Summary of results concerning RQ3.
8. Implications of findings for theory and practice

8.1 Introduction

The goal of the research developed in this thesis has been to gain insights into how organisations enable knowledge processes in innovative environments. Results from theory and earlier research (CIMA project and Gieskes, 2001) have been confirmed, operationalised, refined, and extended.

Due to the goal of this booklet, the summary of results has been reported in the previous chapters, while the following sections reflect on the overall methodology (Section 9.2), on the contributions of the research to theory and practice (Section 9.3), and on possible evolutions of the research (Section 9.4). However in appendix 1 all the propositions coming from the research work will be listed.

8.2 Reflection on the methodology

Several methodological challenges have been encountered in this research work, and in the relationship with other research: the combination of the present research with other research works, the combination of different methodologies within this research work, and finally the combination of empirical and theoretical levels of analysis.

Combination with other research works

As described in Chapter 4, the research carried out in the thesis has been combined with previous research even from the methodological point of view, addressing the same research topic:

1. A preliminary explorative approach has been adopted during the CIMA project, primarily focused on learning in product innovation processes, in order to investigate all the possible levers to foster learning, the behaviours, performances and contingencies.

2. The refinement of the preliminary framework through quantitative statistical analysis developed in Gieskes (2001). Through the research, additional insights have been
developed on the relevant variables in the model, in terms of their impact on
behaviours and barriers.
3. The exploration phase in this thesis started from the levers obtained from Gieskes
(2001), and provided a confirmation of the earlier results, but at the same time, it
moved the focus from the analysis of each lever in terms of behaviours/performances,
to the analysis of the configuration of levers.
Considering the different research approaches, it is reasonable to conclude that a
triangulation of methodologies has been achieved (Kekälä, 2001), thus providing a
validation of the results. As the triangulation involved studies and analysis carried out in
several pieces of research, by different researchers, it could be referred to as external
triangulation.

Combination of different methodologies to operationalise and refine the model of
knowledge management
The main goal of this thesis has been to confirm, operationalise, refine and extend the
conceptual framework about knowledge management in innovative environments.

The confirmation of the model concerned the variables involved in the process, achieved
through the preliminary investigation of knowledge (management) processes in the
consultancy company industry. This analysis was also extremely useful in order to
operationalise the model: the variables have been classified into categories, which could be
assessed and measured. At this stage, a relevant assumption concerned the analysis of
successful companies in terms of business performances: if companies are successful, and
the knowledge process is their core activity, then knowledge processes must be managed
successfully. Therefore, an analysis on the levers implemented by such companies would
lead to the identification of successful configurations.

The refinement and extension of the model mainly concerned two issues: firstly, the existence
of successful configurations of levers and, secondly, the relationship between the variables
in the model (in terms of the association of configurations with innovation strategies, and
in terms of change in the variables over time).
Within the thesis, in order to achieve these goals, several methodologies have been
adopted: multiple case studies to operationalise the relevant variables in the model and to
identify configurations, longitudinal cases for a preliminary analysis of the relationships
among them, and action research to refine and extend the understanding of those
relationships.

Several observations can be made about the adoption of the different methodologies in
this research. Firstly, external triangulation, referred to work carried out in this thesis and
in previous research works, has concerned the adoption of quantitative and qualitative
methods to identify relevant variables. However, triangulation is also relevant in
addressing the issue of relationships among variables in this thesis. The longitudinal case
studies and action research both aim to investigate RQ3, concerning the analysis of
configurational change. As triangulation is addressed within the research work, it is
possible to refer to this as internal triangulation.
Moreover, one other reason driving the design of longitudinal case studies was to produce propositions for the action research. The availability of preliminary propositions at the beginning of the action research process allowed the approach to be focused on relevant variables in a context which otherwise would have been extremely difficult to manage: due to the number of roles involved, the scope of the project considered, and to the number of variables changing within the system.

At the same time, the potential of the action research approach, which differentiates it from longitudinal case studies, is the possibility of distinguishing the independent and dependent variables, through deliberately changing one of the variables in the system, and observing the effects on the others. This was not possible in the longitudinal case studies, where at each stage it was possible only to observe the overall change in a set of variables. A prerequisite for this task is the definition of preliminary propositions about variables, and hypotheses about the relationships among them (the output of the multiple and longitudinal case studies in the consulting and telecommunications industries). The intermediate theory developed at each stage of the action research allowed the preliminary propositions to be refined.

Another issue concerns the role of the researcher in the overall research: in the development of case studies, the researcher is mainly external to the system, and aims to interpret the system itself. The same role is played in the longitudinal case studies, where the observation moves to the evolution of the system over time. In the specific cases in this thesis, however, there was some involvement of the managers in the analysis, in order to get more detailed data about the company and to develop experience (on the research side) for carrying out the action research. During the action research, the researcher had to play a dual role: an interpretative role on what was happening in the case according to specific choices made and, at the same time, to act together with managers within the system, in order to understand all the effects on the variables in the system and refine the model.

A final reflection concerns the type of insights deriving from action research. Propositions developed through action research aim at gaining an understanding of the main characteristics of configurational change, its process, and its effects on performances. Within action research, several methodologies can be used: in this research, mostly qualitative methods and a short survey (addressing especially people performances) have been adopted. The propositions developed are a valid starting point for developing hypotheses to test through quantitative research.

**Combination of empirical and theoretical levels of analysis**

Another challenge concerned the combination of empirical and theoretical levels of analysis. As described in Chapter 4, the use of theory in this thesis is twofold: firstly, to develop preliminary theory to apply in an empirical setting; and then to explain and interpreting results, validating them and build new insights. It is important to note that empirical results have been:

- *Interpreted* through theory. This allowed the results to be explained, and then embedding in theory.
- *Validated in different research settings*. This is related to the generalisability of results.
8.3 Contributions of the research

The aim of this section is to highlight the main contributions of this thesis to the development of theory and practice and then to derive some guidelines for designing further research.

8.3.1 Contribution to theory

The research interest of this thesis is how knowledge processes can be supported in innovative and knowledge-intensive environments, with particular emphasis on the role of ICT. The research especially focuses on managerial activities and decisions that help companies in stimulating knowledge processes; on how those decisions are related, with specific focus on ICT; and how they relate with the innovation strategy of the companies. The research is clearly rooted in different streams of literature: organisational learning, innovation management, strategic management, knowledge management and ICT management literature. All of them provide their own interpretation of knowledge and of knowledge processes. Further, a research work with a specific focus on product innovation has been carried out. Reviewing theory and previous research according to the research interest, the starting point for this thesis can be summarised as follows:

- A multidimensional definition of knowledge, highlighting its peculiarities and challenges to be managed within an organisation (Nonaka, 1991; Teece et al., 1997).

- A model of the knowledge process based on its phases: acquisition, capitalisation and reuse, transfer and sharing of knowledge. Each phase is characterised by the participation of actors who can be internal and external to the organisation. The individuals and groups operating in the various phases show behaviours whose frequency reflects the extent to which they are involved in knowledge processes (Huber, 1991).

- The classification of types of knowledge according to the level of explicitness of knowledge (Polanyi, 1966; Nonaka and Takeuchi, 1995), the knowledge object (in terms of know what, know how and know why) (Quinn et al. 1996, b), and the level of abstraction and generalisation (knowledge can be contingent and generalised) (Bartezzaghi et al. 1997).

- The identification of all the possible levers (under different headings) fostering knowledge processes. These enablers have been systematised, and the effectiveness of each of them on knowledge processes has been assessed (Gieskes, 2001).

- A categorisation of levers of learning, in terms of ICT, management systems and organisational mechanisms (Zack, 1999a).

- The identification of critical issues for enhancing knowledge processes in innovative contexts: abstraction and generalisation, double loop learning, experimentation, and unlearning (Hedberg, 1981; Argyris and Schon, 1978).

- Innovation strategies can be classified according to the degree of innovation (exploitation vs. exploration strategies) and to the main source of innovation (only internal vs. internal plus external) (Zack, 1998).

- Barriers of learning are not the inverse of levers (Gieskes, 2001).
The contribution of this thesis is focused on understanding how knowledge processes take place in innovative organisations, and how managers can stimulate them. Although rooted in the streams of literature highlighted, such a contribution can be referred to the knowledge management topic.

The contribution of this research can be referred to as three groups of results: the first group (how organisations foster knowledge processes) addresses the types of approaches and their effects on performances. The other two groups refine the previous one in terms of the relationships among variables: the second group concerns the relationships among internal variables, while the third group concerns the relationship with external variables.

**How organisations foster knowledge processes**

- **Three configurations of levers** emerge from the analysis and are embedded in theory: the centralised, oligarchic and decentralised approaches. These are successful in their effects on knowledge processes, and they reflect characteristics emerging from theory concerning organisational design. In particular the three configurations are characterised by:
  - **Different functionalities of ICT, managerial systems and organisational mechanisms implemented to foster knowledge processes.** The levers can be operationalised according to their functionalities towards knowledge processes, and they can be shaped in different forms or solutions to realise the same functionality. Technological solutions realise ICT functionalities, managerial tools and methodologies realise managerial systems functionalities, and organisational structures and roles realise organisational mechanisms functionalities. Most if ICT management literature (Ruggles, 1997; Bradshaw et al. 1997) addressed the ICT functionalities (often focused on specific tools), without considering the management systems and organisational mechanisms that, implemented in the same KM configuration, foster their effectiveness on knowledge processes.
  - **Different performances** measured in terms of: frequency of learning behaviours of people and groups operating in knowledge processes, people performances, in terms of satisfaction of people in performing their work, and business performances. Few and only recent contributions in literature address the issue of performance of knowledge management (Germain et al. 2001), due to the difficulty in measuring the effects of the implemented enablers: it is topic of increasing interest.
  - **Different types of knowledge.** Each configuration supports different types of knowledge when considering the three classifications: according to the object, according to explicitness of knowledge, and according to the level of abstraction and generalisation of knowledge (Nonaka and Takeuchi, 1995). Although literature provides several frameworks for knowledge classifications (Quinn et al. 1996), most of them are theoretical and not based on empirical evidence. The approach adopted is in line with research works carried out at University of Twente (Wijnhoven, 2002) which aim at deriving consequences for knowledge transfer systems according to different types of knowledge.

- **In the decentralised approach,** functionalities of levers are implemented in order to:
  - stimulate knowledge processes;
overcome barriers to change and to monitor, improve and revise the levers implemented to stimulate knowledge processes. These levers pursue three principles: identification and monitoring of users’ priorities, enable flexibility, and create coherence with organisational goals.

This result is important in terms of understanding how the levers implemented in a decentralised approach work in order to reach good performances. This result is coherent with the “personalisation strategy” provided by Hansen et al. (1999).

According to the scope of the knowledge management configuration (overall company/functional unit), the organisational structure, the technology, the management system, and the values at a company level become contingent variables that influence the design of the configuration implemented, and its effects on performances.

Internal relationship among variables
In order to understand how organisations foster knowledge processes, this group of results is focused on the identification of the relationships among the variables within a configuration:

- **If ICT functionalities change within the configuration, then the other levers also change in order to support the overall characteristics of the configuration and to achieve successful performances.** As already highlighted, ICT management literature (Stein and Zwass, 1995) is primarily focused on one single lever, without considering the relationship with other variables. Moreover, most contributions address knowledge management with a case study approach, and only few of them consider configurational change (Orlikowski and Hofman, 1997).

- **The role of ICT.** In a decentralised approach, ICT recreates the context of interaction among workers (Linger et al., 1999), but does not stimulate the use of the KM system. The latter is the role of organisational mechanisms and managerial systems. This is in line with the socio-technical approach to knowledge management (Carayannis, 1998).

- **Transfer of knowledge stored in tacit form.** In the decentralised approach, the acquisition of generalised (causal) tacit knowledge, stored at a tacit level, is fostered either through contacting experts who store generalised knowledge. This in line with the contribution of Hansen et al. (1999). In the research, however, it emerged that the acquisition of tacit knowledge, stored at a tacit level, can be stimulated also by acquiring explicit knowledge about motivations and, from this, generalising knowledge based on experiences, even at a tacit level.

- **Barriers to configurational change** are not the inverse of levers. Barriers concern the level of familiarity of the users with ICT, the lack of slack for knowledge processes, the competition among users, and the lack of commitment and sponsorship. An appropriate configuration can help the organisation to overcome these barriers. The configuration can implement specific functionalities of levers in order to overcome these barriers and enhance the effectiveness of the overall configuration. The specific effects of those barriers have been identified. This approach is complementary to the one provided by Kim (1993): according to this perspective barriers were related to incomplete learning loops. However, the mechanisms determining these incomplete loops were not analysed.

- **The configurational change effects on different performances over time**, depending on the functionalities of levers implemented. The effects on business performances, and the
awareness of the relationship between the performances and the use of the knowledge management configuration, become stronger levers. Performance measurement is therefore important to monitor the results achieved by the knowledge management system (Daft, 2001), but at the same time, it is also a real enabler of knowledge processes.

- **The creation of a community.** Few contributions have developed a theory about the process of creating a community, and most take it for granted that the main issue for managers is to capture knowledge from communities that already exist (Wenger and Snyder, 2000). The research has identified a new task for managers: to create the awareness of being part of a community.

### External relationships among variables

The innovation strategy pursued at a company or functional level influences the design of the configuration implemented and its effect on performances. Literature in the area of innovation and knowledge management highlighted how innovation influences the levers adopted by companies to foster knowledge processes (Bartezzaghi et al. 1997; McKee, 1992). Moreover, they have stated that knowledge management in innovative environments is a real challenging task (Hedberg, 1981). This research explains the relationship between innovation strategies and knowledge management configurations in two directions: firstly, how innovation strategy influences the choice of a knowledge management configuration in line with the approach followed by Zack (1999b). In particular, if the focus of the company is on reusing solutions, and it adopts an exploitation strategy, it is successful. Moreover, if the knowledge management configuration supports the generalisation of solutions, then the source of knowledge is mainly internal. If it does not generalise solutions, a process model of consultation is followed, and the real support provided consists of knowledge about methodologies and motivations. Secondly, the adoption of a specific knowledge management configuration can foster the organisation in pursuing a new innovation strategy: the adoption of a decentralised approach can involve new actors in the innovation process, and therefore change the innovation strategy of a company.

### 8.3.2 Contribution to practice

This thesis does not contain guidelines for managers, but its main findings contribute in supporting the decision process of managers.

Two main contributions are addressed in this thesis: first of all the adoption of a methodology that allows the viewpoint of managers to be included, and, then the development of results that are useful for managers.

- **Methodology:** the methodology adopted in this thesis is strongly based on the contributions of managers. Especially in the action research phase, discussions with managers were carried out in order to check the variables in the model, the meanings given by the researcher, and the relationships derived from previous stages of the research. This provided the opportunity to refine the model in order to developed “actionable” knowledge: knowledge that could be also used by managers when carrying out KM projects.

- **Results,** four main results have been seen as relevant by managers:
  - The **reference knowledge management configurations.** The companies in this study initially started by implementing an ICT tool, without considering the relationship with
other variables (within the configuration, and externally with the innovation strategy) and this resulted in poor performances. Once they also adopted organisational mechanisms and managerial systems, their performances improved. The option of having reference configurations is very useful for managers since it enables them to start their projects with a preliminary reference model.

- **The barriers.** From the cases, it was seen that a lack of identification and management of barriers leads to unsuccessful knowledge management configurations. Barriers were either related to change (i.e. to inertia and to low familiarity with ICT tools), or related to the effectiveness of levers on performances (i.e. potential competition and lack of slack). From the study, it emerged that, in the companies that did not recognise such barriers, behaviours were not frequent. The awareness of barriers, and of possible levers to overcome them, can help managers in creating a monitoring system.

- **The process.** This issue is a relevant topic for new research. The development of knowledge management systems has traditionally been assimilated as a part of a management task (Davenport et al., 1998; Quinn et al. 1996). However, from the action research case, it would seem that one of the keys to success is the flexibility of the system in terms of its ability to perceive users’ new requirements and to adapt the system accordingly.

- **The performances.** The issue of performances was extremely important in the action research: in investigating the evolution of variables in the system according to preliminary hypotheses. From a managerial point of view, they are a useful tool for monitoring the implementation process and eventually refining the actions taken.

### 8.4 Notes for further research

From the results, several propositions have been made which are important in the design of further research. In particular they can be further refined or they could lead to further hypotheses to test.

The present research aimed to confirm, operationalise, refine, and extend a preliminary conceptual model on knowledge (processes) in innovative environments. The analysis of variables, and their relationships, has been carried out primarily using qualitative methods (multiple cases and longitudinal cases). The action research also relied mostly on qualitative methods. New research questions emerged, triggered by two issues:

1. From the type of insights derived from the methodology adopted in this thesis. Multiple cases allowed knowledge to be developed that has been explained through theory. Action research aimed to gain an understanding of the relationships among the variables, generating preliminary theory that could be tested at each stage of the investigation.
2. From the results from action research that could not be further investigated due to the context of the specific case and the time limitations of the research. The results relate to the decentralised approach, and further research could investigate the same processes in centralised and oligarchic approaches.

The research questions which seem to be the most prominent, considering the results and the newness of the topic, are:
How can the process of implementing a new knowledge management configuration be organised and managed? Very few contributions in the literature address the issue of implementing a new knowledge management system in an empirical setting (Davenport et al. 1998), and the few that do mainly address it according to a “change management approach”. Answering this new research question could benefit of the understanding of the variables that determine the success of the knowledge (management) processes, and the classification of the configurations, which are a result of this thesis. In the current research, several principles driving the success of the implementation of a decentralised approach have been described, but insights have not been developed with regard to centralised and oligarchic approaches. The proposed research question could be addressed through an explorative analysis, investigating, using a retrospective approach, companies where KM configurations have been implemented. The analysis could concern the process (in terms of goals, roles, phases, and possible evolutions) according to the type of configuration adopted, and taking into account the success of the implementation process. The question aims at classifying the types of implementation processes that could be adopted in the case of different configurations.

How does the knowledge management configuration evolve over time? Which are the triggers of this evolution? Are there maturity levels in this evolution and which functionalities of levers characterise them? The case studies developed in the consultancy companies concerned successful configurations in an industry where KM practices were already consolidated, and there was a high level of awareness of the importance of KM. The action research case, however, involved a company addressing KM issues for the first time. In considering the community involved, it is clear that barriers to including it within the knowledge processes of the organisation are now emerging. The proposed research question addresses how a knowledge management system evolves over time, considering the particular situation of a community. The research question is relevant for two reasons: firstly, because answering it means to identify the key decisions that could be taken to improve the system and its performances over time, contributing to develop a form of improvement model for the development of knowledge management configurations. Further, in this research work it has been shown that a decentralised approach supports the creation of a community; if also the new research question was focused on a decentralised approach, then more insights could be provided about the evolution of communities within the organisations, which is a really unexplored and challenging topic. This research question could be addressed through two action research projects, possibly starting with the implementation of two different configurations, and extended over a longer time than the research reported here. One could analyse how the configurations change according to external variables, how they trigger other changes within the considered functional units and in the organisation (in terms of new goals and priorities), and reflecting new knowledge processes priorities due to a higher level of maturity of the KM configuration.

What configurations are implemented in different contingent situations and what are their effects on performances? Starting from the propositions about the configurations12, and from the refined list of contingencies, a quantitative analysis can be developed, involving a

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12 All the propositions addressing RQ1
sample of companies and mapping their configurations, their contingent situation, and their performances. Additional insights can be developed on effectiveness of configurations, and more normative knowledge can be derived. This research question would add value for the propositions concerning the configurations that have been embedded in theory.

### 8.5 A final comment

The word “management” derives from the Latin “Manus” (Hand). It is a very concrete concept related to how a task or a phenomenon can be modified and forced in order to reach the desired results. Knowledge management is a really complex issue; how to manage something that is like air: ubiquitous, invisible, and taken for granted. It firstly requires to understand of what knowledge is, and then to determine how it can be fostered. This is the perspective taken by “organisational learning literature” which can be considered as the fundamental basis for every research work on knowledge management.

Starting from this point, this thesis has addressed the issue by relying on an inductive approach: reasoning from specific experiences to general truths (Kekälä, 2001). Beyond all the specific results already pointed out in the thesis, several issues emerged:

- **There is not one only way to manage knowledge.** Starting from the concept of knowledge, does not explain why companies adopt different approaches to how it can be managed, all of which can be very successful. The approaches are related to the innovation strategy adopted, and more generally to the contingent situation in which the company operates. These approaches are described in terms of “levers” (the “manus”) - the decisions that influence the system and its performances. All the approaches (three emerged from the investigations) reflect a set of functionalities (of ICT, managerial systems, and organisational mechanisms) which are consistent in the sense that if they are all present, the performances are successful, if one of them changes, all the others change in order to influence performances.

- **Knowledge management is a process of designing, monitoring and revising the “levers”.** As the system evolves over time, there is a double level of “management” control: the levers that stimulate knowledge and knowledge processes, and the levers that monitor and revise this system of levers. From the analysis carried out on a specific configuration, it emerged that the fundamental prerequisites are an adherence with users’ requirements, flexibility, and coherence with organisational goals. However, other prerequisites could easily emerge for other configurations. The essential issue to enhance “control” is the assessment of performances at the knowledge process, people and business level. Moreover, the second level of “control” is also responsible for the identification of possible barriers: barriers to knowledge processes are not the inverse of levers (Gieskes, 2001), and they have to be identified and overcome in order to allow the levers on performances to be effective.

- **The configuration used by an organisation to stimulate knowledge processes, also influences the innovation strategies.** The contingency theory does not completely fit with the issue of knowledge management. The innovation strategy influences the performances of knowledge management configurations, but at the same time, the potentialities, in terms of knowledge processes enhanced by the KM configurations, influence the map of possible sources of innovation within and among companies. The design of a
knowledge management system should therefore consider the roles of employees in the innovation processes.

Addressing the topic of knowledge management through an inductive approach requires keeping two issues in mind: the scope of the investigation, and the type of variables that have to be assessed and measured. Limiting the investigation to ICT implementation is extremely reductive: from this research it has emerged that many variables, also related to managerial choices and strategies, are influenced by the KM approach. Moreover, addressing this topic involves having to deal with intangible variables such as “culture”, “behaviours”, and “attitudes” which are extremely difficult to operationalise and especially hard to manage. This raises the issue of the choice of methodology: the development of a quantitative methodology should benefit from a preliminary understanding of relevant variables.

A final note: although focused on “management”, the results of the research are not only for managers. They are first of all for researchers, in order to provide more insights into an issue that is widely recognised as relevant but rarely investigated in “managerial” terms. They are indeed also for managers, to provide a greater understanding of the scope and variables to be considered when a knowledge management configuration is being developed. Finally, they are for knowledge-intensive workers, to provide evidence that “knowledge is an asset” and that many organisations are nowadays trying to develop knowledge management approaches that will also improve the quality of their working life.
Appendix 1: Propositions

P1.1 If a specialist unit for knowledge management is allocated within the organisation, then coordination of knowledge management efforts is formalised through standardisation of KM practices (i.e. procedures). The application of these practices is supported by specific knowledge management roles in the organisation, and by ICT that stores and transfers solutions and methodologies in an explicit and generalised form. (Centralised approach)

P1.2 If knowledge management is mainly a management task, a restricted group of people (managers) have joint roles as PM and knowledge owners. Managers constitute a “virtual community” where ICT support both synchronous and asynchronous communication and collaboration among them. ICT and managerial tools are used to capture knowledge from workers. The knowledge base is accessible to workers only through the manager (Oligarchic approach).

P1.3 If knowledge management is a diffuse responsibility; every worker has a dual role of performing process and knowledge management activities. Explicit managerial methodologies are implemented to foster and assess learning throughout the organisation. ICT mainly supports synchronous collaboration among teams (Decentralised approach).

13 The propositions indicated with the (g) are the ones generalised through the analysis of Companies I and L. The cases concerns only centralised and decentralised approaches. However, it could be assumed that the propositions concerning the oligarchic approach are also valid in professional knowledge-intensive environments.
P1.3 (g) In professional knowledge-intensive organisations, if knowledge management is a diffuse responsibility, every worker has a dual role of performing process and knowledge management activities. Explicit managerial methodologies are implemented to foster and assess learning throughout the organisation. ICT mainly supports synchronous collaboration among teams (decentralised approach).

P1.4 In the consultancy industry, the external factors which mostly influence the design of knowledge management processes are the degree of dispersion of activities, the level of complexity of the solution and of the project (and vertical integration), and labour churn.

P1.5 If a company adopts a centralised approach, then it is successful in terms of time to market, efficiency (business performances), high sense of belonging and use of time (people performances).

P1.5 (g) In professional knowledge-intensive organisations, if a company adopts a centralised approach, then it is successful in terms of time to market, efficiency (business performances), high sense of belonging and use of time (people performances).

P1.6 If a company adopts an oligarchic approach, then it will be successful in terms of customisation and customer satisfaction, innovation of the solution, time to market (business performances), use of time, sense of belonging and work satisfaction (people performances).

P1.7 If a company adopts a decentralised approach, then it will be successful in terms of customisation and customer satisfaction, innovation of the solution (business performances), work satisfaction, sense of belonging, self esteem and reduction of labour turnover (people performance).

P1.7 (g) In professional knowledge-intensive organisations, if a company adopts a decentralised approach, then it is successful in terms of customisation and customer satisfaction, innovation of the solution (business performances), work satisfaction, sense of belonging, self esteem and reduction of labour turnover (people performance).

P1.8 If a company adopts a centralised approach, then knowledge is strongly embedded in technological vehicles.

P1.8 (g) In professional knowledge-intensive organisations, if a company adopts a centralised approach, then knowledge is strongly embedded in technological vehicles.

P1.9 If a company adopts a decentralised approach, knowledge workers (consultants) are very much involved in seeing their activities as opportunities to develop knowledge and using their spare time to generate knowledge.

P1.9 (g) In professional knowledge-intensive organisations, if a company adopts a decentralised approach, knowledge workers are very much involved in seeing their activities as opportunities to develop knowledge, and to use their spare time to generate knowledge.
P1.10 If a company adopts a centralised or oligarchic approach, knowledge is abstracted and generalised by a restricted group of people (managers or specialised unit).

P1.11 If an organisation adopts a centralised approach to manage knowledge, it is described in terms of low horizontal decentralisation (specialised units for KM), medium vertical specialisation, with coordination mechanisms based on standardisation of work processes and output, and the use of primarily technical vehicles for knowledge transfer and focus in managing explicit and generalised solutions and methodologies.

P1.12 If an organisation adopts an oligarchic approach, it is described in terms of medium horizontal decentralisation, low vertical decentralisation, with coordination mechanisms based on direct supervision and work processes standardisation, and the use of mixed technical and relational vehicles, and a focus on managing solutions and methodologies in both tacit and explicit forms.

P1.13 If an organisation adopts a decentralised approach, it is described in terms of high horizontal decentralisation, high vertical decentralisation (cooperative), with coordination mechanisms based on mutual adjustment and skill standardisation, and the use of primarily relational vehicles, and a focus on managing solutions, methodologies and issues in both tacit and explicit forms and both contingent and generalised forms.

P1.14 If the scope of the knowledge management system is a functional unit, then the values and culture of the company, influence the choice of the configuration and its effects on performances.

P1.15 In a professional knowledge-intensive organisation, the use of the same levers to support both business and knowledge processes is a constraint to knowledge activities in terms of time pressure and available slack.

P1.16 If a professional knowledge-intensive organisation which uses the same levers to support both business and knowledge processes, implements a decentralised approach and formalises knowledge processes, in terms of definition of knowledge processes goals (explicit or implicit) and knowledge processes performances control, then it is successful in terms involvement of knowledge workers in seeing their activities as opportunities to develop knowledge (B2) and in the use of spare time to generate knowledge (B3).

P2.1 If a consultancy company pursues an exploitation strategy, and implements knowledge management configurations that support the capitalisation and reuse of existing generalised solutions and methodologies, then it is successful in terms of efficiency and revenues.

P2.1.1 If a company adopts an innovation strategy based on the exploitation of solutions/methodologies and internal sources of innovation, and the centralised approach supports acquisition, capitalisation/reuse, transfer/sharing of knowledge; it is successful in terms of efficiency and revenues.
P2.2 If a consultancy company pursues an exploration strategy and implements knowledge management configurations supporting the acquisition, capitalisation and reuse, transfer and sharing of new solutions and methodologies; it is successful in terms of innovativeness, customisation of solutions, and margins.

P2.3 If a consultancy company adopts a strategy based on internal sources of innovation (playing an expert role with the customer) and implements knowledge management configurations supporting the generalisation of knowledge about solutions; it is successful in terms of innovativeness, customisation of solutions and methodologies and margins.

P2.3.1 If a company adopts an exploration strategy (in terms of solutions/methodologies) and internal sources of innovation, and the oligarchic approach supports acquisition, capitalisation/reuse, transfer/sharing of knowledge; it is successful in terms of customisation, customer satisfaction, innovativeness of the solution, people performances (use of time, sense of belonging and work satisfaction) and knowledge performances (abstraction and generalisation-B6-transfer of knowledge –B4 and B5).

P2.3.2 If a company adopts an innovation strategy based on exploration of solutions/methodologies and internal sources of innovation, and the decentralised approach supports acquisition, capitalisation/reuse, transfer/sharing of knowledge and generalisation of knowledge; it is successful in terms of customisation, customer satisfaction, innovativeness of the solution, people performances (sense of belonging, work satisfaction, self esteem and reduction of labour turnover) and knowledge performances (use of spare time to generate knowledge-B3-use of business activities as opportunities to generate knowledge-B2).

P2.4 If a consultancy company adopts a strategy based on external sources of innovation (playing an expert role with the customer) and implements knowledge management configurations which do not support the generalisation of knowledge about solutions but do support the development of knowledge about methodologies and motivations (even in a contingent form); it is successful in terms of innovativeness, customisation of solutions and methodologies, margins and self esteem.

P2.4.1 If a company adopts an innovation strategy based on exploration of solutions/methodologies and strong involvement of the customers, and the decentralised approach supports acquisition, capitalisation/reuse, transfer/sharing of knowledge, but not generalisation of knowledge; it is successful in terms of innovativeness, customisation of solutions and methodologies, people performances (sense of belonging, work satisfaction, self esteem and reduction of labour turnover) and knowledge performances (use of spare time to generate knowledge-B3-use of business activities as opportunities to generate knowledge-B2).

P2.5 If a company adopts a conservative strategy (exploitation of solutions/methodologies and internal sources of innovation), and the centralised approach supports capitalisation and reuse of knowledge, then it will be successful (in terms of effectiveness of retrieval and efficiency).

P2.6 If a company adopts an exploration strategy (in terms of exploration of solutions/methodologies), then the decentralised approach supporting acquisition, transfer and sharing of knowledge will be successful (in terms of acquisition, transfer and
sharing of knowledge, quality of working life and customisation and innovativeness of solutions provided).

\textbf{P2.7} If a company pursues a strategy based on relevant involvement of external sources of innovation, then the decentralised approach will be effective in terms of generation of solutions, quality of working life and innovativeness of the product.

\textbf{P2.8} If a company implements a decentralised approach, then every role in the product innovation process is a potential source of innovation.

\textbf{P3.1} If ICT functionalities are changed within the configuration; the other levers also change in order to support the overall configuration.

\textbf{P3.2} If barriers to change such as culture, values, attitudes of people, and lack of familiarity with technology arise; the knowledge management configuration is not effective in terms of learning behaviours.

\textbf{P3.3} Consolidated practices in the company are a barrier to change. If the new functionalities of implemented levers require a change in consolidated practices, and no specific lever addresses this barrier, the configuration is not effective in terms of learning behaviours.

\textbf{P3.4} If the knowledge management configuration does not explicitly stimulate people to carry out knowledge processes, the stress on operational process goals and lack of available slack will reduce the effectiveness of the configuration on learning behaviours.

\textbf{P3.5} If the stress on operational process goals is very strong, and the knowledge management configuration uses the same levers to carry out both knowledge and operational processes, then the decentralised approach will be effective in terms of knowledge workers seeing their activities as opportunities to develop knowledge (B2) and in the use of spare time to generate knowledge (B3).

\textbf{P3.6} The adoption of a knowledge management configuration fosters a refocus of the innovation strategies.

\textbf{P3.7} If a decentralised approach adopts levers that address the priorities and values of the users, and that is focused only on the management of knowledge useful in carrying out their business activities, then it is successful in terms of involvement, in seeing activities as opportunities to develop knowledge (B2), and to encourage the use of spare time to generate knowledge (B3).

\textbf{P3.8} If ICT functionalities support synchronous communication and collaboration, and the adoption of specific incentives (aligned with people priorities) to stimulate people in sharing knowledge and solving other people’s problems, then the configuration is successful in terms of transfer and sharing of knowledge between and among processes (B4 and B5).
**P3.9** In a decentralized approach, if ICT is flexible (in terms of refining and adding new functionalities in order to meet new requirements from people acting in the knowledge processes), and also other levers can be adapted to suit, then the decentralized approach is successful in terms of the generation of knowledge (B2 and B3) and in terms of role recognition and work satisfaction.

**P3.10** The refinement of a knowledge management configuration to meet the requirements of a specific functional unit hinders the diffusion of the configuration throughout the company and its integration with consolidated practices.

**P3.11** The decentralized approach fosters the creation of a community

**P3.12** If the decentralized approach fosters the creation of a community, and it creates the awareness of the community itself in terms of interests, practices, routines and language; then the members of the community start to use business activities as opportunities to develop knowledge (B2), to transfer knowledge among different processes (B5), and embed knowledge into vehicles (B6). At the same time, they reduce the frequency of assimilating knowledge from external sources (B8).

**P3.13** If the decentralized approach fosters the creation of the community, and it builds integration mechanisms with the formal organisation, then the members start to use the organisation’s strategic goals and objectives to focus and prioritise their improvement and learning activities.

**P3.14** In a community, if ICT enhances the communication, and incentives and performance measurement systems foster the joint solutions of problems, and the involvement of roles and training support the understanding of motivations/issues; then the decentralized approach is effective in terms of abstraction and generalisation of knowledge (B6), and sharing of knowledge within the community (B4 and B5).

**P3.15** In a community, provided a decentralized approach supports the transfer of explicit knowledge about motivations, the configuration is effective in terms of generating new tacit and generalised (causal) knowledge.

**P3.16** If a decentralized approach supports the creation of a community, it will result in improved people performances in terms of higher self-esteem and greater satisfaction with working in a community.

**P3.17** If a decentralized approach supports the integration of the community in the company, it will result in improved people performances in terms of a greater sense of belonging and a lower staff turnover.

**P3.18** If a decentralized approach supports the development of the competencies of salespeople, and knowledge process performances and people performances also improve, then the effects on business performances will be improvements in terms of market share and improvement of customer loyalty.
P3.19 The awareness, measurement, and recognition of individual success (on business performances) due to participation in a decentralised approach, is an incentive to participate in the system.

P3.20 The adoption of a decentralised approach drives companies to refocus their innovation strategies in terms of exploration strategies and the involvement of external sources in the innovation process.

P3.21 If ICT functionalities are developed in order to build a decentralised approach, the barriers to change are: the level of unfamiliarity of the users, related to the education of people, their culture and type of job. 

P3.21.1 If new ICT functionalities are introduced in the knowledge management configuration, and if other levers are implemented in order to assess the level of unfamiliarity of the users with the new functionalities and to improve their technological skills, then the decentralised approach is effective in terms of: assimilation of knowledge from external sources (B8), involvement through seeing activities as opportunities to develop knowledge (B2); transfer of knowledge within and between processes (B4 and B5) and embedment of knowledge into vehicles (B7).

P3.22 The lack of slack for accessing knowledge processes is a barrier that hinders the effects of levers on performances.

P3.22.1 The decentralised approach in which ICT functionalities facilitate the better organisation of business activities and the creation of slack, and the organisational and managerial mechanisms facilitate the identification of the real priorities for users, stimulates them to dedicate their spare time to act in knowledge processes (B3), and using of business activities to develop knowledge (B2).

P3.23 The potential competition among users of the knowledge management configuration is a barrier that hinders the effects of levers on performances in terms of generation (B2, B3), transfer of knowledge among processes (B5) and embedment of knowledge into vehicles (B6).

P3.23.1 A decentralised approach where no hierarchical formal mechanism is created between the community and the company (organisational mechanisms) and where ICT and managerial mechanisms create a neutral field of competition through the portal and develop a sort of game, fosters the users to transfer within and among processes (B4 and B5), and to embed knowledge into vehicles (B7).

P3.24 A lack of commitment and sponsorship is a barrier that hinders the effects of levers on performances.

RQ3.24.1 The decentralised approach in which senior levels of the hierarchy do not have formal control, but support the development of competencies, and then become gradually involved in the knowledge processes, can overcome a lack of commitment and sponsorship.

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14 The propositions concerning the barriers are organised as follows: a first proposition indicating the barrier hindering the effects of levers on performances and a sub propositions indicating which levers facilitate overcoming the barriers and enhancing the effects of the configuration on performances.
RQ3.24.2 If senior levels of the hierarchy are involved in knowledge processes, then the knowledge management configuration is effective in terms of abstraction and generalisation of knowledge (B6) and alignment of the knowledge processes to corporate goals (B1).

P3.25 The number of members in a community is a barrier, as a minimum number of people need to participate in the knowledge management system in order to enhance the effects of levers on performances.

P3.26 The diversity of members in a community is a barrier: potentially they have to share the same interests, language and priorities, in order to enhance the effects of levers on performances.

P3.27 The integration of the community in the overall organisation is a strong barrier to the effectiveness of the levers on performances. If the priorities and the structure of the organisation, the ICT functionalities, the performance measurement, and the reward systems already available in the company and in the community are not consistent, then the decentralised approach to supporting the community is not effective in terms of transfer and sharing of knowledge (B4 and B5).

P3.28 The use of a knowledge management configuration to support both knowledge and business processes facilitates the capture knowledge embedded in business processes and creates more slack in business processes. At the same time, it hinders certain functionalities of the implemented levers: the creation of a neutral arena for competition/game playing, and working without a hierarchical component.
Appendix 2: References


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