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Managing the Development of Valuable Intellectual Capital

The Role of Management Control

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Julkaisun nimike Arvokkaan aineettoman pääoman johtaminen Johdon ohjauksen rooli		
Tiivistelmä <p>Vallitsevan käsityksen mukaan, yrityksen kestävä kilpailuetu perustuu pääasiassa sen aineettomaan pääomaan. Tässä väitöskirjassa keskitytään aineettoman pääoman teoreettisesti arvokkaimpaan osaan – organisaation tietämykseen ja kykyihin. Tässä tutkimuksessa selvennetään johtamisen roolia ja sen vaikutuksia organisaation kannalta arvokkaan tietämyksen ja kykyjen luomisessa.</p> <p>Empiiriset tutkimukset toteutettiin kolmessa suomalaisessa bioteknologian alalla toimivassa pienessä ja keskisuuressa yrityksessä. Tapaustutkimukset osoittavat, että organisaatietietämyksen rakentamiseen vaikuttavat olennaisesti toiminnanlaukaisijat, jotka tunnistetaan ja joihin reagoidaan johdon ohjausjärjestelmiä apuna käyttäen. Organisaation tietämyksen ja kykyjen johtaminen ei ole näkyvää, vaan pikemminkin implisiittistä toimintaa, jossa johdon huomio keskittyy pääasiassa tietämyskohteiden, inhimillisten toimijoiden ja kontekstin tiedostamiseen, jossa tietämystä luodaan sekä hyödynnetään. Implisiittisen johtamisen ja ilmenevien toiminnanlaukaisijoiden muodostama yhdistelmä luo pohjan yritystietämyksen ja kykyjen syntymiselle, mikä puolestaan lisää yrityksen kykyä saavuttaa kilpailuetuja.</p> <p>Tutkimuksessa kehitetään teoria implisiittisestä tietämyksen hallinnasta, jossa tietoluokkien puitteita ja tietovirtaa hahmotellaan yhdessä johdon asioihin puuttumista koskevien ehdotusten aikaansaamien vaikutusten avulla. Tutkimuksessa esitetään, että johdon ohjauksella on keskeinen tehtävä implisiittisessä tietämyksen hallinnassa. Johdon tehtävänä on yhdistää implisiittiset johtamismenetelmät, mukaan lukien johdon ohjausjärjestelmät, liiketoimintastrategian ja ympäristöolosuhteiden mukaan.</p>		
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Abstract It is widely suggested that intellectual capital is the primary source of sustained competitive advantage for a firm. This dissertation focuses on what is theoretically the most valuable part of intellectual capital – organizational knowledge and capabilities. The study clarifies the role of management and its effects on the creation of organizational knowledge and capabilities. The empirical study was conducted in three SMEs operating in the Finnish biotechnology sector. The case studies show that the path of building organizational knowledge and capabilities is largely affected by activation triggers which are recognized and acted upon with the help of management control procedures. Management of organizational knowledge and capabilities is not an explicit act, but is an implicit endeavor, during which managerial attention is primarily directed at knowledge objects, human actors and the context in which knowledge is created and exploited. By directing managerial attention to these elements different kinds of knowledge flows can be nurtured in the organization. The study develops a theory of implicit knowledge management in which the framework of knowledge categories and the knowledge flows are outlined along with propositions about the effects of managerial intervention. Management controls play an important role in implicit knowledge management. In particular, the use of outcome control enables management to influence the diversity of knowledge in the potential and realized capacities of the firm, whereas various decision-making and communication procedures shape the context of knowledge creation, enhancing the processes of organizational learning that build up these capacities.		
Keywords		
Intellectual capital, knowledge, capabilities, management control, resource-based view		

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List of Abbreviations

ANT	Actor Network Theory
IC	Intellectual Capital
IPR	Intellectual Property Rights
KM	Knowledge management
MA	Management Accounting
MC	Management Control
MCS	Management Control Systems
PC	Potential Capacity
R&D	Research and Development
RBV	Resource-based View
RC	Realized Capacity
SMEs	Small and Medium-sized Enterprises

1 INTRODUCTION

1.1 Identification of the research problem

The resource-based view of the firm (RBV) (Penrose, 1959; Rumelt, 1974; Wernerfelt, 1984; Dierickx & Cool, 1989; Barney, 1991; Amit & Schoemaker, 1993) along with the knowledge-based view (Conner & Prahalad, 1996; Grant, 1996b, 1996a), competence-based theory (Prahalad & Hamel, 1990) and the concept of dynamic capabilities (Teece, Pisano & Shuen, 1997) suggests that knowledge is the most important resource at the disposal of a firm pursuing competitive advantage. In the light of this, it is often suggested that managerial attention be directed at knowledge and knowledge-related resources. Scholars claim, however, that the literature of the RBV has not been able to provide satisfying suggestions for management (see e.g., Williamson, 1999; Priem & Butler, 2001). The knowledge-based and competence-based views have come with instructions to management that have been too wide and have not provided sufficient explanation to prompt managerial intervention (Williamson, 1999: 1093-1094). This has led Spender and Grant (1996: 9) to argue that the question of management has remained “a sort of black hole of strategic analysis”.

The field of intellectual capital (IC) has been trying to cast light into this “black hole” by suggesting numerous methods for identification, measurement and reporting of knowledge and knowledge-related resources, that is, the IC of the firm (e.g., Edvinsson & Malone, 1997; Roos & Roos, 1997; Sveiby, 1997; Sullivan, 1998; Lev, 2001). The aim of visualizing and reporting IC is to make knowledge amenable to managerial intervention (Mouritsen, Larsen & Bukh, 2001; Mouritsen & Larsen, 2005). In addition, the literature of knowledge management has provided a wide range of codifying, distributing and sharing technologies as means of knowledge management (Davenport & Prusak, 1998; Binney, 2001).

In spite of the numerous methods supporting knowledge and IC management, we still do not know how to manage the kind of knowledge and IC which is supposed to be a source of competitive advantage for the firm (Powell, 2001; Priem & Butler, 2001). Not all kinds of knowledge and IC are equally valuable for the

firm. Knowledge that is embedded in individual experiences (Polanyi, 1958) and organizational routines (Nelson & Winter, 1982) and capabilities (Prahalad & Hamel, 1990; Teece, Pisano & Shuen, 1997) is the most valuable, since it cannot be imitated and substituted by competitors (Barney, 1991). This makes such knowledge theoretically more interesting in pursuit of a competitive advantage.

The management problem is, however, that the theoretically most valuable knowledge is the “least identifiable and measurable” (Spender & Grant, 1996: 8). Much of this knowledge is inherently unobservable and bundled with various objects, processes and relationships in an organization (Latour, 1987; Mouritsen & Larsen, 2005: 373). Thus, on the one hand it is desirable to make the most valuable knowledge – organizationally embedded knowledge – amenable to managerial intervention, yet on the other hand, the inherently unobservable and bundled nature of such knowledge makes this almost impossible. This has resulted in a situation where the same reasons that make certain types of knowledge valuable for competitive advantage, constitute the biggest obstacle to managerial intervention (Spender & Grant, 1996).

Scholars have tried to tackle the problem by continuously working on the development of new classification and measurement methods for IC, as if a better measurement instrument were the solution to the problem. More than 30 classification and measurement methods of IC have been suggested to make knowledge and knowledge-related resources amenable to managerial intervention (Andriessen, 2004b). Nevertheless, these methods are incapable of operationalizing the most valuable parts of IC, since it is not possible to disentangle knowledge from the grip of other organizational resources (Chaharbaghi & Sandy, 2006). Neither are these methods of IC management acknowledged in practice (Marr, Gray & Neely, 2003; Lönnqvist, Kunansivu & Sillanpää, 2008). Thus, up to now there has been no method that is able to make organizationally embedded knowledge available to allow direct managerial intervention.

What about the possibility of indirect managerial intervention? Several scholars have outlined a role of management which does not rely on identifying and objectifying stocks of knowledge, but which instead creates an environment for IC growth via knowledge integration (e.g., Nonaka, 1994; Grant, 1996a; Nahapiet & Ghoshal, 1998) and communicative action (e.g., O'Donnell, O'Regan & Coates, 2000). Mouritsen and Larsen (2005) have argued, however, that a managerial role focused merely upon creating an environment does not allow for sufficient managerial intervention. It mainly induces knowledge integration and learning processes without having an effect on particular domains of knowledge

that are integrated and obtained by learning. It does not enable managers to intervene in the development of organizationally embedded knowledge in such a way that those categories of knowledge are nurtured which most benefit organizational strategies and the company's competitive position in the market. Hereby, the problem is that direct manipulation of organizationally embedded knowledge is problematic, whereas the existing approaches of indirect managerial intervention are not satisfactory.

At the same time, there are management practices in strategic management, management control, and many other fields, that successfully deal with various types of objects – people, material substances and relationships – that are closely related to knowledge. Knowledge is strongly interrelated with these objects, but there is only a limited understanding of how these managerial methods affect knowledge. The initial attention of these methods, as of management controls for instance, has not been placed on knowledge but the behavior of individuals. Knowledge is merely assumed to be one of the factors influencing the choice between these methods. For instance, Turner and Makhija (2006) suggest methods of management controls (behavioral, outcome and clan controls) are chosen according to the types of knowledge in the firm; nevertheless, it has not been explained how these controls affect knowledge. Thus, it is not clear whether and how these controls, which are originally directed at the people and material substance of an organization, do contribute to the knowledge and IC of the firm.

Scholars complain that direct methods of identifying and reporting IC have not been acknowledged in practice (e.g., Marr, Gray & Neely, 2003), but they have not directed attention to the methods that already work in practice (Kujansivu, 2008). The present study argues that instead of trying to directly affect knowledge by measurement and with the reporting tools of IC, it is necessary to consider the bundled nature of knowledge and investigate the effects of other managerial tools that work in practice but do not initially address knowledge. We do not know how management methods affect knowledge which is bundled with the same organizational objects and processes that these managerial methods were originally directed at. Clarifying this would widen our understanding of the options available to manage the most valuable part of IC, that is, knowledge that is embedded in organizational processes.

1.2 Purpose of the study

The purpose of the dissertation is to answer the question:

How can the creation and application of valuable intellectual capital be affected by managerial intervention?

The study investigates the opportunities to intervene in the creation and application of valuable IC. In defining valuable IC the study builds on the RBV (Penrose, 1959; Barney, 1991), knowledge-based view (Conner & Prahalad, 1996; Grant, 1996b, 1996a), competence-based theory (Prahalad & Hamel, 1990) and the concept of dynamic capabilities (Teece, Pisano & Shuen, 1997). Relying on these concepts, the present study uses the term *valuable intellectual capital* in referring to organizational level knowledge and capabilities, which are aligned with organizational strategies and environmental circumstances. In addressing the question of managerial intervention, the study reviews a wide variety of approaches and methods of knowledge and IC management. In addition to reviewing the knowledge and IC management literature, this study also takes a closer look at the field of management control which directs managerial attention to various organizational phenomena closely related to knowledge. For instance, several methods and procedures of management controls focus on organizational activities during which knowledge is applied, or on products and services through which the effect of knowledge is revealed. Thus, this dissertation investigates the forms of managerial intervention by exploring the literature of different research disciplines.

The empirical study of the dissertation is conducted to clarify how decision-making is guided in building IC valuable to the organization. Up to now, there are few studies on how knowledge is actually managed; which kinds of managerial procedures and control systems actually serve their purpose, and how they serve the creation and management of knowledge and knowledge-related resources in practice. Marr, Grey and Neely (2003: 441) have suggested focusing more on empirical research to test the existing theoretical models to “prove that the measurement of IC is really worthwhile”. In the present study, however, the aim is not to test the existing theoretical IC frameworks to prove their worthiness, but to study the existing management procedures that already work in practice. Management must be studied in its original settings to clarify the mechanisms of management methods (Burns & Kaplan, 1987). The rationale of practice has a potential to contribute to the conceptual grounds and improvement of theoretical concepts to make the existing theory align with the reality in practice.

1.3 Research method

The empirical study was conducted in three small and medium-sized enterprises operating in the Finnish biotechnology sector. The study aimed to identify the companies' managerial methods and procedures and the ways they affect the creation and application of organizationally embedded knowledge. The objective of the study requires its respondents to answer *what* as well as *how*-questions. Therefore, the study analyzes a rich selection of case data to explore, as well as to explain, the effects of managerial methods in practice. The field visits took place during the period from September 2005 to June 2006, and involved 53 interviews, several observations and analysis of numerous documents.

The research method of the present study is important to the existing literature, since there is a general lack of case studies about knowledge and IC management (Marr, Gray & Neely, 2003). There are some case studies of action research about knowledge and IC management, (e.g., Mettänen, 2005; Bornemann & Alwert, 2007; Lönnqvist & Kujansivu, 2007), a large number of purely theoretical studies (e.g., Grant, 1996a; Teece, Pisano & Shuen, 1997; O'Donnell, O'Regan & Coates, 2000; Andriessen, 2004a; Schultze & Stabell, 2004; Spender, 2006), but only a few studies that seek to interpret working practices in organizations (e.g., Kloot, 1997; Johanson, Mårtensson & Skoog, 2001; McNamara, Baxter & Chua, 2004). Therefore, the research method of the present study is relevant in the wider field of IC and knowledge management research.

Companies from the biotechnology sector have been chosen mainly because knowledge and IC are more critical to the success of these companies than they would be for many others. Biotechnology firms are similar to knowledge intensive firms (Starbuck, 1992; Ditillo, 2004), in the sense that knowledge constitutes a critical part of their resources. Biotechnology firms use knowledge as an input, transferring that knowledge into products and services. For a biotechnology firm, knowledge is also important as an output in the form of new innovative technologies (Gittelman & Kogut, 2003).

There are several studies on IC and knowledge management conducted in the biotechnology sector (e.g., Pisano, 1994; Cumby & Conrod, 2001; Palacios-Marqués & Fernando, 2003; Boekestein, 2006). The present study is, however, notably different. The existing studies involve statistical IC measurement techniques (e.g., Palacios-Marqués & Fernando, 2003) and the external reporting of non-financial data (e.g. Cumby & Conrod, 2001). The present study differs by not merely looking at biotech organizations but investigating the management

with a deeper look at the processes and internal dynamics of organizational knowledge and capabilities.

The purpose of the present study is not to describe the practice of biotechnology firms but to derive empirical implications for the general questions of knowledge management – to uncover the ways in which the creation of valuable IC can be affected managerially. The results of the case studies are acquired using the rhetoric of contextual generalization (Lukka & Kasanen, 1995). The results are generalizable to the theory (Yin, 2003) in terms of widening our understanding of the management of valuable IC of the firm.

1.4 Contribution of the study

The study makes the following contributions. First, the dissertation develops a theory of implicit knowledge management in which the framework of knowledge categories and knowledge flows are outlined with propositions about the effects of managerial intervention. By building on the RBV, the knowledge-based view, and the concept of IC and organizational learning, the theory of implicit knowledge management invites a new perspective on knowledge management. In the proposed theory, managerial attention is paid to knowledge objects, human actors and the context in which knowledge is created and applied. Directing managerial attention to these elements, it is possible to affect various flows of knowledge in building the valuable IC of the firm. Thus, the theory of implicit knowledge management sheds new light on the anatomy and development of organizational knowledge and capabilities, overcoming the practical problems in knowledge operationalization.

Second, the study contributes to the strategic management literature by overcoming the theoretical paradox¹ of the RBV. Briem and Butler (2001: 23-24) have claimed that existing research has cited Barney's (1991) RBV statements without providing new explanations of the work's constructs. The present research is different in the sense that it provides an explanation of how the most valuable resources can be managed without falling into the theoretical paradox of the RBV. The implicit means of managerial intervention allow managers to affect

¹ The practical problems are related to the difficulties in disentangling knowledge from other resources for the purpose of its objective observation and manipulation. The theoretical paradox relies in the RBV causality statements suggested by Barney (1991). The overview of the paradox is presented in Appendix 1 (see also Lado, Boyd, Wright & Kroll, 2006).

the creation and application of its most valuable resource – organizationally embedded knowledge – without jeopardizing its valuable characteristics.

Third, the study outlines the role of management control in implicit knowledge management. In existing literature there are many discussions about the relationships between knowledge and types of management controls. However, in discussing types of controls existing studies have mainly directed attention to the choice between the controls, whereas knowledge of the firm has tended to be considered merely as one factor influencing this choice (see e.g., Ouchi & Maguire, 1975; Ouchi, 1977; Eisenhardt, 1985; Snell, 1992; Merchant & Van der Stede, 2003; Turner & Makhija, 2006). For instance, Turner and Makhija (2006) suggest the methods of management control available to manage various types of knowledge. They suggest behavioral, outcome and clan control be chosen according to the types of knowledge in the firm; nevertheless, they do not explain whether these controls would have an effect on knowledge, or if they did, how. Similarly, several studies have suggested that the design of management accounting depends on the types of information in the organization (see e.g., Chenhall, 1986). Much less attention has been paid to the effects that the implementation of different types of controls may have on knowledge in the firm. The present study suggests management controls influence various flows of knowledge. Furthermore, the paper finds that outcome control has a considerable effect on the diversity of knowledge, providing the direction in which organizational capabilities evolve. At the same time the formal and informal structures of communication, information sharing and decision-making facilitate the processes of organizational learning through which organizational knowledge and capabilities – the valuable IC of the firm – is built.

Fourth, the paper shows that the path of building organizational capabilities is largely affected by activation triggers which are recognized and acted upon with the help of management control procedures. Activation triggers are events that encourage knowledge exploration, increasing knowledge and capabilities of the firm (Zahra & George, 2002). The present study shows how activation triggers shape the IC of the firm, encouraging processes of organizational learning and affecting organizational knowledge and capabilities. The desired organizational outcome determines the intensity of the trigger, whereas the intensity of the trigger determines the speed and organizational level at which the processes of organizational learning take place. In managing activation triggers management controls (a) help in discovering activation triggers in time, (b) provide supporting procedures in reacting to triggers, and (c) induce certain directions in developing the knowledge and capabilities of the firm. Consequently a combination of existing resources, a management control system and emerging activation triggers

allow the firm to build highly firm-specific, inimitable and non-substitutable IC (Barney, 1991; Teece, Pisano & Shuen, 1997).

1.5 Structure of the study

The dissertation is organized as follows (see Figure 1). The introduction chapter presents the background of the research and the motivation behind it, with an explanation of the research objective. It also provides a short overview about the research method and contribution of the study to the existing literature.

The second chapter starts with a short introduction to the concepts and theories applied in the dissertation. The chapter explains the value of organizational knowledge and capabilities with the assistance of Barney's (1991) resource attributes. Thereafter the framework for creating organizationally valuable IC is outlined. The three-dimensional framework of knowledge is built to illustrate the categories and flows of knowledge in a firm in building organizational knowledge and capabilities.

The third chapter explores the opportunities for managerial intervention. The literature of knowledge and IC management is explored in relation to the realist and non-realist epistemologies of knowledge. While the scope of the dissertation is somewhat broad, no attempt is made to investigate all possible methods of management. The selection is made from among the existing management methods to delineate the prevailing tendencies in existing management approaches. In addition to the knowledge and IC management methods, the role of management control is explored.

The fourth chapter introduces three case studies which interpret management methods in practice. Firstly, the chapter provides the description of the research method, and the overview of the processes and tools in data collection. This section also addresses the reliability and validity of the study. Secondly, the chapter provides the case descriptions. In case studies A and B the study shows how managerial attention is placed on knowledge objects, the behavior of human actors and the context in which knowledge is developed and exploited. Some actor-networks are briefly described to show how knowledge is implicitly affected by the management control procedures of the firm. The case studies outline the roles of management control and activation triggers in affecting the knowledge flows and building IC of the firm. After that, case C shows the circumstances which lead to a more explicit kind of knowledge and IC management. The case study also shows how difficult it is to direct the

managerial attention to potential capacities (i.e. knowledge), since people know more than can be expressed in written forms.

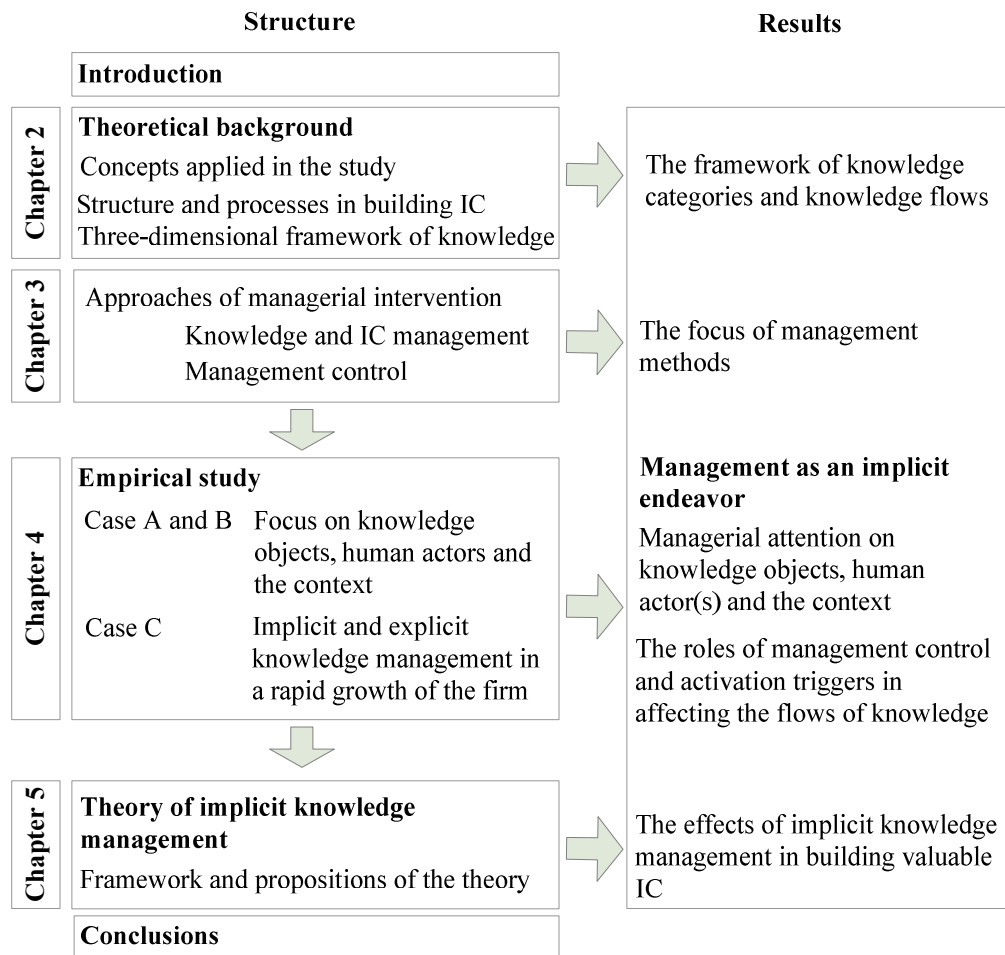


Figure 1. Structure of the study

The fifth chapter draws on the theory section and results of the case studies to develop a theory of implicit knowledge management. The chapter outlines the effects of three types of managerial intervention. It provides propositions of how the implicit kind of knowledge management has an effect on the development of organizational knowledge and capabilities. After outlining the main theoretical propositions, the chapter explains the value of the theory for research and practice. The final chapter offers the conclusions drawn from the study.

2 STRUCTURE AND PROCESSES IN BUILDING VALUABLE INTELLECTUAL CAPITAL

The present chapter investigates the theoretical foundations of building organizationally valuable IC. The chapter begins by introducing the concepts related to knowledge and IC to provide the terms and definitions for the coming discussion. Thereafter the creation of valuable IC is discussed and illustrated at individual and organizational levels. Finally, the three-dimensional framework of knowledge is developed while demonstrating how valuable IC – a source of sustainable competitive advantage – is built in the firm.

2.1 Concepts applied in the study

The concept of knowledge has been evolving since the era of classical Greek philosophy, whereas the discussions about organizational learning and knowledge as an organizational resource were initiated in strategic management literature only a few decades ago (Argyris, 1978; Daft & Weick, 1984; Barney, 1991; Nonaka, 1994; Conner & Prahalad, 1996; Grant, 1996a; Spender, 1996; Kim, 1998). In addition, the concept of IC started to evolve from a slightly distinct stream of literature in the early 1990s (Sveiby, 1989; Hudson, 1993; Brooking, 1996; Edvinsson & Malone, 1997; Stewart, 1997; Sveiby, 1997). Despite their slightly different origins, the concepts of organizational learning, knowledge management and IC are highly intertwined, sharing a common theoretical ground and often meeting the same scholarly purposes. The subsequent discussion starts with the theoretical explanation of the importance of knowledge as an organizational resource, and, from there, the concepts of knowledge management, organizational learning and IC will be introduced.

The basic concept of the present dissertation, the concept of knowledge, is rather vague, having different meanings for different people in different situations, as well as for different cultures (Andriessen & van den Boom, 2007). Plato's definition of knowledge as a "justified true belief" (by Plato in *Meno*, *Phaedo*, and *Theaetetus*) has been widely used (Nonaka & Takeuchi, 1995), as well as criticized from various perspectives discussing the conditions of truthfulness and justification (see e.g., Gettier, 1963). Grant (1996b: 110) has applied the definition according to which "knowledge is that which is known". Alvesson and Kärreman (2001: 998) have criticized these kinds of general definitions arguing that "researchers seem to have difficulties in saying something distinct about the specific content of knowledge that presumably is so central in their work".

Despite the criticism, this dissertation follows Grant's (1996b: 110) definition for two reasons. Firstly, the present study is not geared to enter the debate on Plato's definition of knowledge (Gettier, 1963; Thalberg, 1969). Secondly, Grant's (1996b: 110) definition of knowledge is open to various types of knowledge that are relevant to the firm. This definition is indeed vague, but corresponds to the general nature of knowledge – knowledge is not definable *per se*, since it does not exist *per se*, but is related to things and relationships in an organization (Mouritsen, Larsen & Bukh, 2001: 738-739).

The reasons for the large scholarly interest in knowledge as an organizational resource can be found in statements of the resource-based view (RBV) (Penrose, 1959; Rubin, 1973; Rumelt, 1974; Wernerfelt, 1984; Dierickx & Cool, 1989; Barney, 1991; Amit & Schoemaker, 1993). The basic standpoint of the RBV suggests that organizational resources are the source of a firm's competitive heterogeneity (Penrose, 1959). It is an "inside-out perspective" (Rouse & Daellenbach, 2002), perceiving the source of competitive advantage rather differently from the approach of competitive forces (Porter, 1980). According to the competitive forces approach, or the market-based perspective, a firm chooses its strategy and acquires the necessary resources from the market. According to the RBV, however, a firm is largely defined through its existing resources (Teece, Pisano & Shuen, 1997). Differences in firms' existing resources allow them to gain advantages in the market.

The definitions of resources in the RBV have covered all kinds of sources. Wernerfelt (1984) defines resource as "anything, which could be thought of as a strength or weakness of a given firm". Examples of resources cited include skilled personnel, brand names, machinery, trade contracts, efficient procedures (Wernerfelt, 1984), assets, capabilities, organizational processes, company attributes, information (Barney, 1991) and knowledge (Wernerfelt, 1984; Barney, 1991; Amit & Schoemaker, 1993; Grant, 1996b, 1996a).

Not all kinds of resources are equally relevant to the achievement of competitive advantage, however. Knowledge has been considered far more important to competitive advantage than other resources of the firm. More specifically, the most important resource theoretically, is considered to be the kind of knowledge that is organizationally embedded. The large amount of interest in such knowledge has mainly been sparked by the causality statements made by Barney (1991; 1995; 2001). Barney (1991) states that a resource can be, or may become, a source of sustainable competitive advantages if it is:

- valuable,
- rare,

- inimitable,
- non-substitutable.

Being valuable to the firm means that a resource or set of resources “exploit opportunities or neutralize threats in a firm’s environment” (Barney, 1991: 106). A resource is rare if it is not simultaneously implemented by many other firms. Inimitable means that a resource must be “imperfectly imitable” in order to be a source of sustainable competitive advantage (Barney, 1991: 107). Finally, being non-substitutable means that there are no equivalent substitutes for that resource in the market. In addition to these characteristics, scholars have also suggested the characteristics of a resource termed appropriability and durability (Dierickx & Cool, 1989; Prahalad & Hamel, 1990; Amit & Schoemaker, 1993).

Since tacit knowledge (Polanyi, 1958) and knowledge that is highly embedded in organizational routines (Nelson & Winter, 1982; Amit & Schoemaker, 1993; Teece, Pisano & Shuen, 1997) fall most probably into the category of resources that are valuable, rare, inimitable and non-substitutable, the interest of strategic management literature has clearly been drawn to these types of knowledge. The knowledge-based view (Grant, 1996b), competence-based theory (Prahalad & Hamel, 1990; Conner & Prahalad, 1996) and dynamic capabilities (Teece, Pisano & Shuen, 1997), being complementary to the RBV, have all investigated the ways that organizationally embedded knowledge is a source of competitive advantage for the firm.

Many scholars have also outlined challenges to and contradictions found within the RBV (e.g., Rouse & Daellenbach, 1999; Powell, 2001; Priem & Butler, 2001; Rouse & Daellenbach, 2002; Hoopes, Madsen & Walker, 2003; Lado et al., 2006). For instance, Hoopes et al. (2003) have identified other sources of competitive heterogeneity, such as industry structure, that are not covered by the RBV rationale. Priem and Butler (2001) and Lado et al. (2006) have argued that some of the propositions of RBV scholars have been conflicting. In addition, Powell (2001) and Hoopes, Madsen and Walker (2003) suggest that due to the analytical propositions of Barney’s (Barney, 1991) RBV framework, the falsification of the causality statements is not possible. Despite the criticism, the RBV has been very popular in a wide variety of management studies, increasing dialogue between different research areas (Mahoney & Pandian, 1992), and providing the basic standpoint from which to perceive organizationally valuable resources, such as knowledge (Marr & Roos, 2005).

Since the RBV and knowledge-based view posited the importance of organizationally embedded knowledge, various concepts have investigated the creation and application of such knowledge. Figure 2 provides a simplified

illustration of how the RBV and concepts of knowledge management, organizational learning and IC can be positioned in the process of attaining competitive advantage and superior organizational performance.

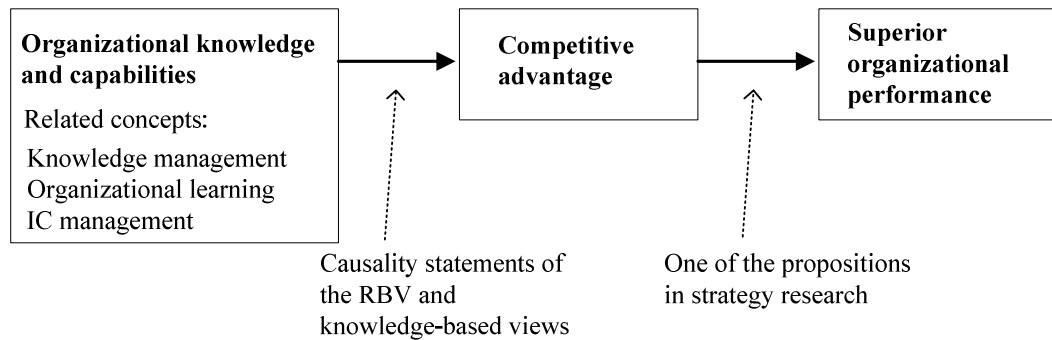


Figure 2. General relationships between the concepts

As noted earlier, the RBV and knowledge-based view explain the causality between organizationally embedded knowledge and competitive advantage. The causality between organizational performance and sustainable competitive advantage² is suggested in strategic management research (Grant, 2002). The concepts of knowledge management, organizational learning and IC do not explain the causality between organizational knowledge and competitive advantage, but concentrate on the opportunities for management to intervene in the development of organizational knowledge and capabilities. For the definitions of the concepts see also Appendix 2.

The literature of these concepts is fragmented, however, and has a high level of diffusion in its interpretation of and approaches to them (see Shrivastava, 1983; Scarbrough & Swan, 2001; Kaufmann & Schneider, 2004). To sketch out some basic parameters: the literature of knowledge management focuses on the types and flows of knowledge suggesting numerous loosely coupled methods to support managerial intervention (Styhre, 2003). Much of the attention is placed on tacit and explicit, and individual and organizational levels of knowledge in suggesting codifying, restoring, distributing and sharing mechanisms to make individual

² The philosophical and logical foundations of the causality hypotheses between competitive advantage and superior organizational performance have also been criticized (see e.g., Powell, 2001).

knowledge available to an organization (Davenport & Prusak, 1998). Many studies of knowledge management literature also have a significant orientation towards the field of information systems (Wilson, 2002).

The concept of organizational learning has been introduced to explain how new knowledge and learning is developed in an organization (Argyris, 1978; Daft & Weick, 1984; Cohen & Levinthal, 1990; Kim, 1998). The concept has been applied in terms of information processing (Huber, 1991), cognitive limitations (Levinthal & March, 1993), and the processes that build the absorptive capacity of the firm in which data is acquired and turned into organizational knowledge and actions (Daft & Weick, 1984; Cohen & Levinthal, 1990; 1998; Zahra & George, 2002).

Several scholars perceive IC as an end product of knowledge management and organizational learning (e.g., Lennon & Wollin, 2001), consisting of the knowledge stocks and knowledge-related assets of an organization (Brooking, 1996; Edvinsson & Sullivan, 1996; Edvinsson & Malone, 1997; Roos, Roos, Dragonetti & Edvinsson, 1997; Stewart, 1997). One definition frequently referenced is that suggested by Stewart (1997: 101) according to which IC is “knowledge, information, intellectual property, experience – that can be put to use to create wealth. It is collective brainpower or packaged useful knowledge”. The economist Galbraith used the term *intellectual capital* as early as 1969 (Hudson, 1993: 15), whereas the active discussions about its meaning, content and the options for managerial intervention started about two decades later. Some scholars prefer the term *intellectual assets* (e.g., Sveiby, 1989; Sveiby, 1997; Caddy, 2000), while others started to use the term *intellectual capital* (e.g., Brooking, 1996; Edvinsson & Sullivan, 1996; Edvinsson & Malone, 1997; Roos et al., 1997; Stewart, 1997; Petty & Guthrie, 2000). Often the terms *intellectual capital* and *intangibles* are used interchangeably to refer to the same phenomenon (e.g., Harrison & Sullivan, 2000; Joia, 2000; Johanson, Mårtensson & Skoog, 2001). Other scholars draw a distinction between these terms perceiving *intangibles* as a limited financial accounting term (e.g., Caddy, 2000). In this paper, the term *intellectual capital* (IC) is used throughout the study to refer to the collection of knowledge and knowledge-based resources and the ability to use those resources. Thus, IC includes individual as well as organizational level knowledge and capabilities bundled together with other organizational resources.

The components of IC cover a span reaching from single human skills to complex knowledge bundles, such as brand names, patents and customer relationships. In literature it is very popular to speak about IC in terms of the categories of human capital, structural capital and relational capital (Edvinsson & Malone, 1997; Roos

et al., 1997; Stewart, 1997; Sullivan, 1998). Several categories of IC are also presented in Appendix 3. The categorization of IC is not, however, relevant in the present study, since the aim is not to disentangle the parts of IC. The dimensions of human, structural and relational capital are considered only as metaphors (Mouritsen & Larsen, 2005) in discussing some parts of case studies (in chapter 4).

Some scholars consider IC to include only organizational level knowledge (Nahapiet & Ghoshal, 1998: 245) defining it as “a valuable resource and a capability for action based in knowledge and knowing”. Other scholars include individual as well as organizational level knowledge and assets related to knowledge (e.g., Edvinsson & Sullivan, 1996; Edvinsson & Malone, 1997; Roos et al., 1997; Stewart, 1997). Drawing on the RBV and knowledge-based views the present study applies the term *valuable intellectual capital* in referring to the theoretically most valuable knowledge and knowledge-related resources – organizational level knowledge and capabilities, which are aligned with organizational strategies and environmental circumstances.

The development of the IC concept has been slightly distinct from the concepts of organizational learning and knowledge management, since the IC concept has its own origins. Initiated by the interests of consultancy, the early progress of the IC concept was similar to certain fashions in management (Abrahamson, 1996) in outracing the traditional views of organizational assets. The original views of IC were rather static, perceiving IC as consisting of various types of knowledge as assets that are available for the firm (e.g. Brooking, 1996; Edvinsson & Sullivan, 1996; Edvinsson & Malone, 1997; Roos et al., 1997; Stewart, 1997). Lately, however, in parallel with the static view the dynamic dimensions of IC in generating organizational knowledge and capabilities have been discussed (see e.g., Lennon & Wollin, 2001; Habersam & Piber, 2003; Rastogi, 2003; Kianto, 2007). Consequently, the development of the IC concept has been moving closer to the ideas of knowledge management and organizational learning.

The RBV and concepts of knowledge management, IC and organizational learning share an interest in organizational knowledge and capabilities. These concepts overlap in terms of their interest in organizationally embedded knowledge, improving our understanding of the mechanisms operating beneath the surface of organizational action and competitive advantage. Better understanding of these mechanisms should lead to opportunities for managerial intervention – to influence the development of organizational knowledge and capabilities according to the firm’s strategies and environmental conditions.

The common interest of these concepts in organizationally embedded knowledge has also led to the common problems of managerial intervention. Management has not been an easy task, since the highly ambiguous and idiosyncratic nature of knowledge makes it difficult to capture. Before addressing the question of management in the present study, however, it is necessary to understand the general structure and mechanisms with which a valuable IC – consisting of organizational knowledge and capabilities – is built. Thus, the discussion in the subsequent sections outlines the structures and processes relevant to create valuable IC.

2.2 The creation of inimitable and non-substitutable intellectual capital

2.2.1 *Creation and existence of knowledge*

There are many views about the ways organizationally valuable knowledge is created. The common standpoint is that the creation of organizational knowledge always starts with individual knowledge (Argyris, 1978; Grant, 1996b; Sanchez, 2001a: 8–9). The creation of individual knowledge can be explained by the help of Grant's (1996b: 110) simple definition, according to which "knowledge is that which is known". This definition indicates that there is a thing which is known and somebody who knows of it. Thus, the subsequent discussion does not attempt to specify the general meaning of knowledge, but outlines the elements that give rise to the creation and existence of various kinds of knowledge.

In general, there are three elements that are necessary for the creation of knowledge (see also Figure 3) being:

- a human actor
- a knowledge object
- a context.

A human actor is a central part of the triangle, representing the entity that knows about some thing. An individual freely makes choices, acting according to an interpretation of situations faced. Different people learn different things in an organization and use their knowledge differently (Spender, 1996).

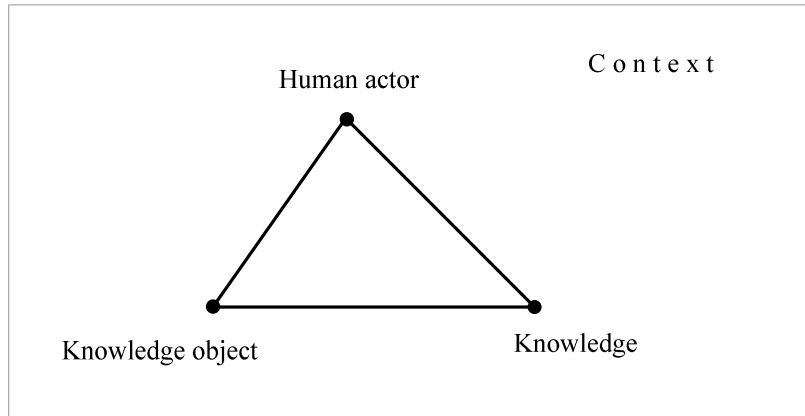


Figure 3. The triangle of knowledge

A knowledge object represents a focal object that knowledge is about. Individual knowledge is a person's understanding of an object, procedural or declarative knowledge about the object or the ways in which the object can be used (Polanyi, 1958: 174-175). An individual can gain some knowledge, or learn something, but the learning always takes place about some thing or phenomenon. We know about some object and we cannot separate our knowledge from that object. The object gives meaning and significance to knowledge. Knowledge is not independent of these objects. Knowledge does not exist and have value *per se*, but is connected to objects (Mouritsen, Larsen & Bukh, 2001). As Mouritsen, Bukh and Bang (2005: 32) state:

“Knowledge is not an entity by itself; it has to be connected with things, phenomena or relations. It is knowledge about something rather than knowledge *per se*.”

These objects are the things and artifacts of the real world. In an organization, these represent all the material substances, such as materials, products, suppliers, customers, as well as the processes and technologies of how to exploit the material substances.

One person can have different types of knowledge and skills, and they may relate to one object or many objects. To perform a particular task usually involves many objects. For instance, in order to polish a shoe one needs to know at least about the following objects: a shoe that needs to be polished, a brush, and a suitable polish. Firstly, the person has to be aware of these objects. Secondly, he or she has to know how to use these objects in theory. And finally, the person has to be able to apply the theory in practice. Not to mention the fact that there are a variety of shoe-polishing techniques and other options that will contribute to the end

result - well or poorly polished shoes. In principle, none of these types of knowledge would exist without these objects and the human actor.

The context represents other objects and people, existing organizational knowledge and processes, as well as situations and relationships that a human actor is engaged at different times. In an alternative context, knowledge objects can acquire novel meanings, opening up new ways of thinking and doing. The context includes a temporary element in the form of different situations in which individuals create and exploit knowledge, but it also includes formal and informal structures of an organization, which are generally more sustainable in nature. Organizational hierarchy and procedures of communication represent formal structures, whereas organizational culture and social ties build up informal structures that give rise to the creation and application of knowledge. In addition, tools for communication and information storage form an important part of the context.

All these elements, the human actor, the knowledge object and the context, play a relevant role in the creation and existence of knowledge. Knowledge can never be created if any of these entities are missing. Different situations, objects and human actors sustain various kinds of knowledge, since “no one has ever observed a fact, a theory, or a machine that could survive outside of the networks that gave birth to them” (Latour, 1987: 248).

In perceiving the role of these elements, some philosophical questions can be raised. The question of the relationship between the subject (human actor) and the object especially, has been debated over the centuries. It has been repeatedly asked, what forms knowledge, is it the human actor or the fundamental nature of the object (Arbnor & Bjerke, 1997; Venzin, Krogh & Roos, 1998). This question is addressed and debated from several epistemological standpoints (see Appendix 4). In order to simplify the discussion, the existing views have often been reduced to two epistemologies (see e.g., McNamara, Baxter & Chua, 2004: 54):

1. A realist epistemology of knowledge,
2. A non-realist epistemology of knowledge.

The realist epistemology of knowledge, also referred to as objectivism, has a highly positivist belief that the world is objective and consists of stable rules and means-and-ends relationships. This view corresponds with cognitive psychology, later developed as cognitivism theory, which considers the mind as an information-processing system of objective reality. Here it is also termed cognitive epistemology of knowledge (Venzin, Krogh & Roos, 1998). The realist epistemology has a dualist view in which knowledge objects and knowledge are perceived as independent from the knower (McNamara, Baxter & Chua, 2004).

Since reality is “out there”, knowledge is gained through the methods of scientific discovery. The content of knowledge is determined by the fundamental nature of the knowledge object.

In non-realist epistemology, also termed the subjectivist or relativist view, the mind of a human actor is central to knowledge creation. Kant suggested a constructivist view in which the discovery is mediated by human beings making their knowledge always conditional and subjective, tentative and situated (McNamara, Baxter & Chua, 2004). Individuals are always interpreting everything around them and creating a context-sensitive meaning. Knowledge is not determined by the nature of knowledge objects, but is largely dependent on the cognitive structures of the human actor. Similarly, formal and informal structures of the context are dependent on the cognitive interpretations that the human actor gives to these structures.

In addition to the realist and non-realist epistemologies of knowledge, there are many other perspectives distinguished in the literature. For instance, Schultze and Stabell (2004) have discussed four discourses in perceiving knowledge: a neo-functional, a constructivist, a critical and a dialogic discourse (see Appendix 5). The neo-functional and critical discourses, can be seen as representing realist views of knowledge, perceiving knowledge as either an asset or a representation of power. The constructivist and dialogic discourses carry the ideas of non-realist perspectives. In particular, the constructivist discourse follows the Kantian critique, in which knowledge is created and shaped by self-interpretation and subjective impressions of the world, whereas dialogic discourse considers all knowledge as representations of discipline.

Scholars have argued that one study cannot take multiple epistemologies of knowledge but has to make a choice between the epistemologies (e.g., Schultze & Stabell, 2004: 568). Latour (1993; 1999), on the other hand, has a different opinion, criticizing the dualistic subject-object poles. He claims that in the realist pole the world of science is non-human, determined by things that exist *per se*. In the non-realist pole, the world of science is “entirely limited to humans, absolutely divorced from what things are in and for themselves” (Latour, 1999: 9). Earlier Latour (1993) suggests that it is necessary to consider a mixture of these poles in studying various phenomena. Several studies have agreed with this view by acknowledging the role of a human actor as well as that of knowledge objects and the context that gives rise to the existence of knowledge (see e.g., Mouritsen, Larsen & Bukh, 2001; Gherardi & Nicolini, 2003; Mouritsen, Bukh & Bang, 2005). The present study follows this stream of research by not only

acknowledging the role of human actors, but also recognizing the importance of objects and the context in the creation of knowledge.

2.2.2 *Structure of building intellectual capital*

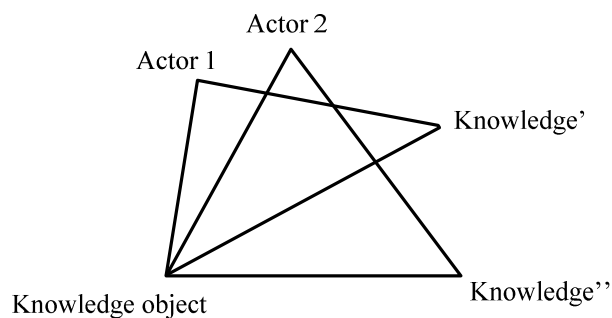
Knowledge may or may not have an effect on focal objects, artifacts, other people or relationships. Mouritsen et al. (2001) outline that in order for knowledge to be valuable it has to have an effect on something. Knowledge may stand as an awareness of some thing or be turned into actions. The philosopher, Ryle, provided the distinction between propositional knowledge and practical knowledge (Hyman, 1999: 434). Propositional (i.e. possessed) knowledge is being aware of some fact, whereas practical (i.e. practiced) knowledge means knowing how to perform an act. Further, the question is whether a person just knows how to perform an act or whether he/she is actually able to turn this knowledge into action. In the same vein, Cook and Brown (1999) talk about *possessed* and *practiced* knowledge (also called *knowing*).

Returning to the shoe-polishing analogy, a person has to know about many objects – the brush and the polish amongst others – to accomplish something with another object, an unpolished shoe. The knowledge can be either about the focal object or about the practical reasoning, experience and skills of the process of how to do something. Nevertheless, if the person does not apply that knowledge in action (does not polish a shoe, for instance), the knowledge does not have an effect. The shoe might stay unpolished due to a lack of motivation or a shortage of practical skills. If the person applies the knowledge (does polish the shoe), knowledge has an effect on the focal object (the shoe becomes polished and a newly-bought brush and polish become used). In the same way, knowledge that has an effect on something is more valuable for a firm.

Often knowledge is not identifiable as a simple awareness but recognizable only as an ability to do something (Spender, 1996; Hyman, 1999). In particular, tacit knowledge emerges only in action (Polanyi, 1958). The present study still acknowledges this distinction, since it is necessary to know something in order to be able to act, even though the creation and application of knowledge may often happen simultaneously. The existence of propositional knowledge does not automatically determine the fact that a person will take an action. For instance, Pfeffer and Sutton (1999; 2000) point to managerial knowledge that remains unapplied creating a gap between knowledge and doing.

Knowledge can remain at an individual level or be shared among several individuals or groups in organization (Nonaka, 1994; Nonaka & Takeuchi, 1995).

Many people may have knowledge about the same focal object, but it does not necessarily imply that they share their knowledge. In fact, their knowledge may differ significantly. For instance, an electronic and a mechanical engineer may work individually applying their expert knowledge of engineering on a particular machine (a knowledge object). Figure 4 shows the abstract picture of the different knowledge that two individuals have about a knowledge object.



Individual knowledge, either propositional or practiced, is theoretically not as interesting as knowledge that is shared, since individual knowledge cannot create a sustainable competitive advantage for the firm. The problem is that the knowledge of these individuals (for instance, the knowledge of the electronics and mechanical engineers in Figure 4) is imitable by competitors since it is considered as tradable factor in markets (Barney, 1991; Alvesson, 2000). “Individuals come and go, but organizations preserve knowledge, behaviors, mental maps, norms, and values over time” (Daft & Weick, 1984: 285). Thus, the expert knowledge of individuals cannot possibly create advantages that last for a longer period.

Knowledge that is shared represents a common understanding of individuals or groups of individuals about knowledge objects and nurtures common behavior amongst members of an organization. Figure 5 presents an abstract picture of knowledge that is shared by two individuals. The arrow in between the two individuals refers to their continuous interaction and communication (Nonaka, 1994) through which shared knowledge is built. Figure 5 illustrates the individuals’ common understanding of some knowledge object. However, organizational knowledge is not a sum of individual’s knowledge. In fact, an organization may know even less than its members (Argyris, 1978: 9). Only a part

of the knowledge that exists is shared between members of organization, since the processes of building organizational knowledge are quite complicated³. However, it does not necessarily mean that organizational knowledge includes only shared knowledge. It is rather a combination of individual and shared knowledge that nurtures common behavior and enables the firm to take coordinated actions.

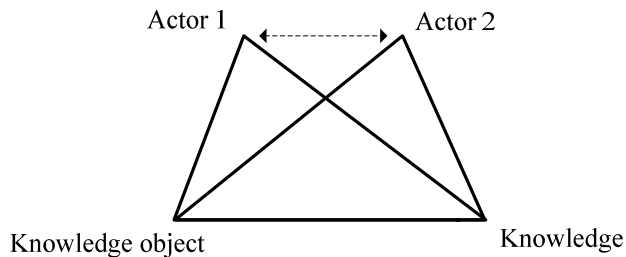


Figure 5. Shared knowledge

Zahra and Georg (2002) have suggested that organizational knowledge can also take the form of propositional knowledge and knowledge in practice, forming both a *potential* and a *realized capacity* for the firm. Knowledge that is not applied in actions remains a potential capacity of the firm. In Penrosian terms, knowledge of potential capacity stays as a mere resource of the firm without generating services that it can potentially render (Penrose, 1959: 25). Knowledge that is turned into action becomes a realized capacity of the firm (Zahra & George, 2002). Mouritsen and Koleva (2005) have studied patents and suggested the existence of packaged and unpackaged knowledge. Packaged knowledge represents the potential capacity of the firm and unpackaged knowledge stands for realized capacity, being applied in organizational processes and turned into actions. Unpacking knowledge enables it to turn into valuable activity and processes.

Relying on the above discussion, the following matrix can be drawn (see Figure 6) with the four categories of knowledge along the dimensions of individual and organizational knowledge, and potential and realized capacities. In reality, the dimensions of individual and organizational level knowledge exist in a continuum. For instance, several scholars have also considered a group level

³ These processes will be introduced in chapter 2.2.3.

knowledge (e.g., Nonaka, 1994; Nonaka & Takeuchi, 1995; Crossan, Lane & White, 1999).

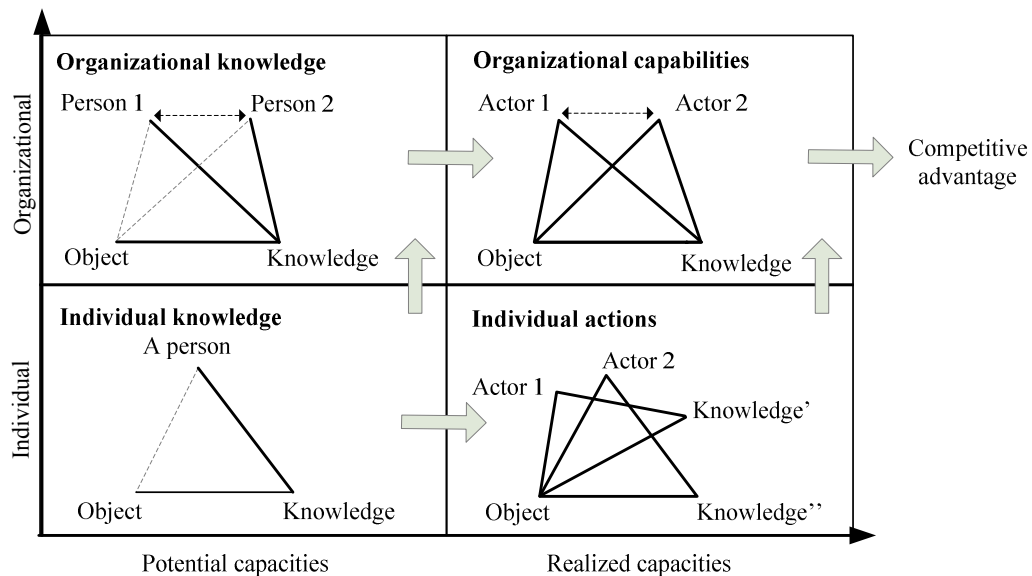


Figure 6. Categories of knowledge in the firm⁴

The basic level knowledge in that present matrix, **individual knowledge**, has already been discussed in a previous section. A person has knowledge about some object but the effect of knowledge does not emerge since the individual is not engaged in action. Nor is this knowledge shared.

The effect of individual knowledge would emerge in **individual actions**. Individual actions are shown by two knowledge triangles in the second quadrant of the matrix in which two individuals apply their individual knowledge. The knowledge of these individuals has an effect on the products, services or some other phenomena of an organization.

Organizational knowledge represents the potential capacity of the firm. It includes knowledge that is shared among the individuals⁵. The high path-

⁴ The concept of potential and realized capacity is applied (Zahra & George, 2002) to represent propositional knowledge and practical knowledge in action. The terms of potential and realized capacities are going to be used alongside the terms of organizational knowledge and capabilities through the remainder of the dissertation.

⁵ In Figure 6 the number of two individuals is chosen to simplify the triangles. In reality, it takes more than two people to build organizational knowledge and capabilities.

dependency and complexity of the processes of developing organizational knowledge make such knowledge more difficult for competitors to imitate (Cohen & Levinthal, 1990; Teece, Pisano & Shuen, 1997), but organizational knowledge as propositional knowledge does not directly lead to competitive advantage but provides the basis for actions by the organization. It also provides organizational flexibility to quickly react to environmental changes (Zahra & George, 2002). Learning and new ideas that are not turned into productive activities can serve as a source of future competitive advantage.

Organizational knowledge and the ability to act, build **organizational capabilities** in which knowledge held by individuals and by the organization is integrated into and applied as part of the processes of the organization (Prahalad and Hamel, 1990; Amit and Schoemaker, 1993; Teece, Pisano and Shuen, 1997; Kasunoki, Nonaka and Nagata, 1998). Capabilities consist of organizational routines (Nelson and Winter, 1982) in which an organization's embedded knowledge is turned into action. The explanation of the difference between knowledge and capabilities can be drawn from the distinction of resources and capabilities suggested by Amit and Schoemaker (1993: 35):

“Capabilities, [...] refer to a firm's capacity to deploy Resources, usually in combination, using organizational processes, to affect a desired end. They are information-based, tangible or intangible processes that are firm-specific and are developed over time through complex interactions among the firm's Resources.”

Given this, some knowledge may remain as a potential capacity of the firm, not being turned into actions. Alternatively, individual and organizational level knowledge and other resources may be exploited in repeatable patterns of actions, so building organizational capabilities⁶, that is, the realized capacities of the firm.

The arrows presented in Figure 6 between the dimensions of knowledge are drawn to suggest the general causality in which each dimension and process of knowledge creation precedes other dimensions and processes in creating the basis of competitive advantage. These dimensions of knowledge do not exist independently but build on each other (Zahra and George, 2002). As for instance,

⁶ There are two types of capabilities in the firm: functional capabilities and integrative capabilities (Verona, 1999). Functional capabilities include various technological capabilities, such as R&D, production and marketing, whereas integrative capabilities enable the building of these capabilities via external and internal knowledge absorption that is supported by managerial processes and structures. The present discussion is rather about the creation of functional capabilities.

the existence of individual knowledge facilitates individual actions and is also a basis for the creation of organizational knowledge. Similarly, organization-level knowledge as potential capacity is the basis for the creation of organizational capabilities. Weaknesses in potential capacities constrain the latter realized capacities. As we cannot do more than we know, we cannot create realized capacities without the existence of potential capacities of the firm.

In addition, knowledge is being transformed as it flows between the dimensions of the matrix. There is interplay between potential and realized capacities, as well as between individual and organization-level knowledge, during which new types of knowledge and abilities emerge. As Cook and Brown (1999) argue, there is a “generative dance” between knowledge and knowing that is an important source of new knowledge and organizational innovation. Potential capacities are not merely turned into realized capacities, but new meanings and skills can be created.

In reality, there are numerous relationships that are not represented by the arrows in Figure 6. For instance, organizational level knowledge has an effect on individual and group level understanding due to the feedback mechanisms of learning (Crossan, Lane & White, 1999). Individuals or groups of individuals create a shared understanding that becomes institutionalized at an organizational level, where they start to feed the same context in which they were originally created. In this way organizational knowledge and capabilities become a part of the context in which individual knowledge is created. Thus, knowledge does not only flow from the individual to supplement organizational level knowledge but organizational level knowledge becomes a part of the context in which individual level knowledge and actions occur.

The dimensions of knowledge presented in the matrix are not always identifiable, since much knowledge cannot possibly be determined before its application in action. For instance, the existence of tacit knowledge would emerge only in realized capacities, because a person may not be aware of his or her knowledge before its actualization in a particular situation. It is not expressible without the action (Polanyi, 1958). Therefore, the creation of potential and realized capacities often takes place simultaneously (Zahra & George, 2002). Spender (1996) suggests four types of knowledge: conscious, automatic, objectified and collective (see Table 1). Implicit knowledge emerges only in “doing” i.e. the effect of knowledge is visible only in actual activity or as a result of the activity (as a nicely polished shoe, for instance). Thus, potential capacities that are largely based on implicit knowledge are usually not observable. In this case only the final effects of knowledge indicate the existence of such knowledge. In other words,

without actions neither the existence nor the effects of such knowledge would emerge.

Table 1. Different types of organizational knowledge

	Individual	Social
Explicit knowledge	Conscious	Objectified
Implicit knowledge	Automatic	Collective

Adapted from Spender (1996: 52)

This, however, makes some types of knowledge highly important contributors to the firm's competitive advantage. Capabilities consist of various types of knowledge of which a large part are implicit. They are theoretically most interesting as a source of potential advantages in the market, since these capabilities are most likely inimitable, non-substitutable and rare. Barney (1991: 107-108) has argued that inimitability of a resource is achieved in one of or a combination of the following ways:

- a resource is obtained along a unique historical path of the firm;
- the link between a resource and competitive advantage is “causally ambiguous”;
- a resource is “socially complex”.

The creation of capabilities is generally considered as a highly path-dependent and complex process (Cohen & Levinthal, 1990; Teece, Pisano & Shuen, 1997), dependent on the historical conditions and development of a firm. The automatic and collective knowledge embedded in capabilities make them complex and causally ambiguous. Collective knowledge, in particular, is by nature a socially complex phenomenon (Spender, 1996). These types of knowledge, among other more identifiable patterns of knowing, create synergies in a capability, making capabilities impossible to objectively observe or transfer to another organization (Teece, Pisano & Shuen, 1997; Kasunoki, Nonaka & Nagata, 1998; Makadok, 2001). In particular those capabilities which largely include collective knowledge are highly inimitable since the existence of such knowledge emerges only in collective actions; it is not tradable in the market and it is difficult to transfer to other organizations (Spender, 1996).

Barney (1991) has also suggested the characteristics of rareness and value of a resource. The rareness of a resource does not depend only on types of knowledge and the historical path of a firm's development. The question of rareness is rather ambiguous. Rareness can have two dimensions, depending on the combination of physical rareness in the factor market or the supposed value that results from the firm's particular resource combination (Black & Boal, 1994). Therefore one cannot actually know how rare the resource has to be in order to be a source of competitive advantage, since rareness depends not only on firm-specific intrinsic characteristics of the capability but its uniqueness in the market. However, the unique patterns of a firm in developing its capabilities increase the probability that the strategies derived from these capabilities are relatively rare in the market. Similarly, the characteristic of value does not only depend on the nature of a resource. A resource should correspond to environmental circumstances in order to be valuable (Teece, Pisano & Shuen, 1997). Thus, the matrix introduced above (Figure 6) does not reflect the value of a resource, since the value of a resource does not depend so much on its intrinsic structure but the position of the resource in the market. The question of value will be further discussed in chapter 2.3.

2.2.3 *Processes of building intellectual capital*

In creating organizational knowledge and capabilities it is not only important to capture the structure of knowledge categories, but more importantly, the processes in which they are created and formed. Knowledge is not only interesting and important because of what it is, but also in terms of "how knowledge of various kinds can be acquired" (Hyman, 1999: 434). There are various processes of organizational learning (Argyris, 1978) that continuously generate flows of knowledge from the external environment to the firm, and between the knowledge dimensions inside the firm. From the external environment, new information and knowledge is acquired to build potential capacities. At the same time there are many dynamic flows of knowledge inside the firm: from ideas to actions, from individual know-how to shared meanings, from shared knowledge to organizational actions etc. The flow of knowledge constantly takes place at various unconscious and conscious levels within organizational members, finally revealing itself in products and services, and customer behaviors.

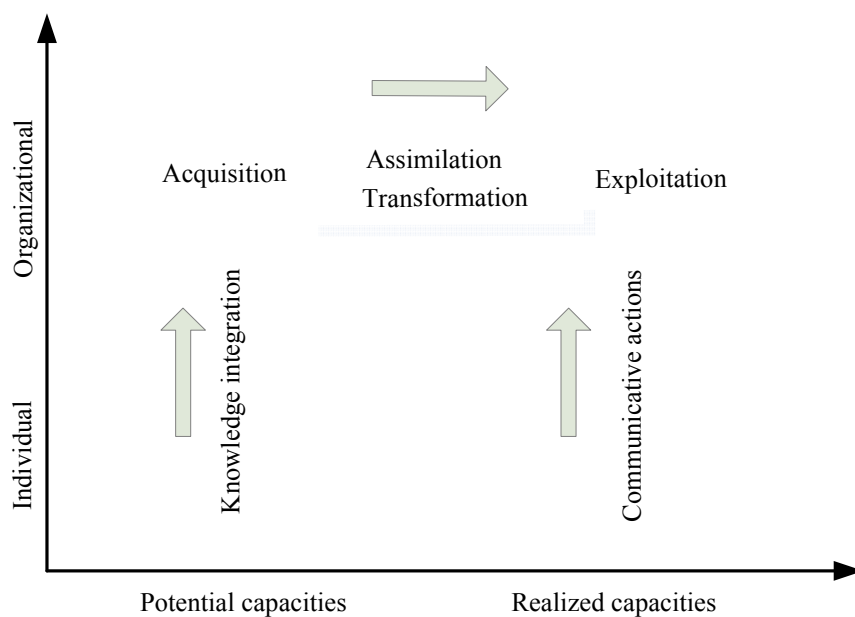


Figure 7. Processes of organizational learning

There are several processes of organizational learning that build organizational knowledge and capabilities⁷ (e.g., Daft & Weick, 1984; Cohen & Levinthal, 1990; Grant, 1996a; Zahra & George, 2002). Figure 7 represents the directions along which processes of organizational learning generate flows of knowledge from the external environment to potential capacities, between potential and realized capacities, and individual and organizational levels of knowledge.

Literature suggests organizational learning is highly rooted in individual learning but requires more than inquiry from individuals. “Individual learning is a necessary but insufficient condition for organizational learning” (Argyris, 1978: 20). Organizational learning starts as individual level learning with recognizing and intuiting relevant information (Cohen & Levinthal, 1990; Crossan, Lane & White, 1999). After the step of recognition and intuition of new and relevant information, the following processes of organizational learning build potential and realized capacities of the firm (Cohen & Levinthal, 1990; Zahra & George, 2002):

- acquisition,

⁷ Many scholars also consider organizational learning itself as a specific organizational capability (e.g., Verona, 1999; Zahra & George, 2002).

- assimilation,
- transformation, and
- exploitation.

These processes are often perceived and termed differently. For instance, March (1991) uses the concepts of knowledge exploration and exploitation. Processes of exploration increase potential capacities, whereas exploitation builds realized capacities of the firm. March (1991: 71) describes these processes in the following way,

“Exploration includes things captured by terms such as search, variation, risk taking, experimentation, play, flexibility, discovery, innovation. Exploitation includes such things as refinement, choice, production, efficiency, selection, implementation, execution.”

Kloot (1997) distinguishes processes of knowledge acquisition, information distribution, information interpretation and organizational memory in which the creation of organizational memory means storing and institutionalizing new knowledge. The present study applies the terminology suggested by Cohen and Levinthal (1990) and Zahra and George (2002). Thus, the terms of knowledge acquisition, assimilation, transformation and exploitation are applied.

Knowledge acquisition starts at the individual level, where new information is obtained. Scholars have also used the term scanning of the external environment in referring to knowledge acquisition (e.g., Daft & Weick, 1984: 285). Assimilation processes comprise a firm’s routines of analyzing and sharing information. The process of assimilation is also termed as interpretation in which new information is interpreted through existing cognitive maps of the organization (Daft & Weick, 1984). It is suggested that organizational learning via acquisition and assimilation of external information increases the potential capacity of the firm and its ability to react to changes in the external environment (Birchall & Tovstiga, 2005). The alternative process to assimilation is transformation of knowledge (Todorova & Durisin, 2007).

The assimilation or transformation of knowledge is conducted at either an individual or a collective level. To create organizational knowledge, the collective interpretation and understanding of objects and artifacts of an organization is necessary. Integration of knowledge can be considered as inducing the creation of organizational knowledge from individual capacities, as well as contributing to knowledge assimilation, transformation and exploitation processes (Grant, 1996a, 1996b). The process of knowledge integration is influenced by the structural, cognitive and relational dimensions of social interactions (Nahapiet & Ghoshal,

1998), taking place via combinations of tacit and explicit knowledge that span individual, group and organizational level conversions (Nonaka & Takeuchi, 1995). Grant (1996b; 1996a) suggests that integration and application of knowledge is the essence of organizational capabilities, it is “knowledge integration rather than knowledge itself” that matters in this process. Knowledge integration does not only allow communication of existing meanings to the higher levels of an organization, but the generation of new meanings and ideas. Consequently, organizational level potential capacities become significantly richer than a mere sum of the individual knowledge would have been.

The last process, exploitation of knowledge, represents the process in which knowledge is applied in organizational actions. According to Argyris and Schön (1978) and Daft and Weick (1984: 286) organizational learning happens when interpreted knowledge is turned into action. Thus, a mere increase in potential capacities without turning new capacities into actions does not represent organizational learning. Organizational learning means repeated exploitation of new capacities in which new organizational routines emerge (Nelson & Winter, 1982).

In reality, there is a mixture of processes that flow along a diagonal of the matrix from individual knowledge to capabilities. The processes start with intuiting something at the individual level, then involve interpretation processes at the individual and group level, and end with the process of institutionalization in building organizational capabilities (Crossan, Lane & White, 1999). These four processes are not distinct but intertwined with knowledge integration. In practice, it is impossible to objectively observe and distinguish each of the processes. The processes of knowledge acquisition, assimilation, transformation and exploitation can occur simultaneously and a time lag between the processes does not necessarily exist (Zahra & George, 2002). For instance, organizational capabilities can also be built by learning-by-doing and mechanisms of communicative action (Habermas, 1987; O'Donnell, O'Regan & Coates, 2000). Individuals learn simultaneously from the actions they take (Argyris, 1978). Figure 7 represents the processes of learning in a simplified manner, whereas the more elaborate processes can be seen in Appendix 6.

Knowledge that is largely tacit, such as automatic knowledge (Spender, 1996: 52), can be integrated via communicative actions (see Figure 7). O'Donnell (2004) suggests that the key to building organizationally valuable intellectual capital, unobservable and bundled organizational knowledge and capabilities, lies in ongoing interactions of activities in which individuals build shared knowledge. In such a way feelings, communications, thoughts and activities become

intertwined into a set of processes in which collective knowledge emerges in organizational actions.

Due to the stickiness and path-dependency of the processes of organizational learning (Dierickx & Cool, 1989; Cohen & Levinthal, 1990), it is rather difficult for the firm to extend its capabilities in any extreme way or build new capabilities in other fields of business. Penrose (1959) has suggested that resources can be created quickly, but to convert them into productive services takes time. Similarly Teece, Pisano and Shuen (1997: 528) suggest,

“Because of imperfect factor markets, or more precisely the non-tradability of ‘soft’ assets like values, culture, and organizational experience, distinctive competences and capabilities generally cannot be acquired; they must be built. This sometimes takes years – possibly decades.”

The cumulateness of absorptive capacity (Cohen and Levinthal, 1990) also implies that the processes of extending a certain technological domain of capabilities in one period will give rise to more efficient processes in the next period, meaning that the effectiveness of the processes of knowledge acquisition, assimilation, transformation and exploitation in one period will positively affect the same processes in the next period (Zahra & George, 2002). The negative side of this accumulation is, however, the creation of high path-dependency (Levinthal & March, 1993).

There are numerous individual and organizational factors that affect the processes of organizational learning. For instance, acquisition and assimilation of knowledge are limited by the cognitive limitations of individuals. Research in cognitive psychology shows that people are generally unable to process more than nine items of information simultaneously (Miller, 1956; Baddeley, 1994). Therefore, individual limitations affect the absorptive capacity of an organization (Cohen & Levinthal, 1990), influencing the creation of organizational capabilities. The processes of organizational learning are also inhibited by different and conflicting views and the way that people tend to withhold information (Argyris, 1978). The firm’s ability to acquire new knowledge and integrate it into existing capabilities is also largely dependent on the structure and availability of external sources, and firm’s internal communication structures (Cohen & Levinthal, 1990; Kim, 1998; Zahra & George, 2002). A more thorough picture of the factors influencing organizational learning is presented in Appendix 7.

2.3 The framework of building valuable intellectual capital

The amounts of organizational knowledge and capabilities do not determine their usefulness, since not all kinds of organizational level knowledge and capabilities are equally beneficial to the firm. Alvesson and Karreman (2001: 999) argue that “Knowledge is not necessary functional, useful, and a generally good thing”. Even learning might not be valuable, since “there is no reason to assume that new knowledge will be useful [...]” (Penrose, 1959: 114). For the firm it is not enough to have intellectual capital which is inimitable and non-substitutable by competitors but is not valuable in the market. Firms are forced to keep up with changes in the market – globalization, new technologies and customer demands. Inimitability and non-substitutability of organizational knowledge and capabilities do not guarantee that the products and services of the firm will meet customers’ needs. Resources have to supply valuable outcomes to the marketplace. Barney (1991: 106) explains that being valuable to the firm means that a resource or set of resources should “exploit opportunities or neutralize threats in a firm’s environment”. Therefore, in addition to inimitability and non-substitutability, organizational knowledge and capabilities should have the potential to generate an outcome, which is congruent with environmental circumstances.

Strategic management literature addresses the link between a firm’s strategies and its environmental circumstances (Porter, 1980; Mintzberg & Waters, 1985; Grant, 2002). The need for a fit between environmental circumstances and organizational characteristics, such as organizational values, structure, and processes, has been introduced in congruence theory (Nightingale & Toulouse, 1977). The theory seeks to find a fit between various organizational components in order to achieve more effective organizational behavior⁸. Among many possible fits, literature has outlined the importance of the following alignments:

- the alignment of an organizational strategy with environmental conditions;
- the alignment of organizational behavior with the chosen strategy.

Since emergent types of strategies⁹ are flexible and adaptive to changes in the environment (Mintzberg & Waters, 1985) they can be considered as generally

⁸ The term *organizational behavior* is explained by Argyris (1978: 13) as decisions and actions of individuals, which are governed by collective rules of an organization.

⁹ According to Mintzberg (1978) there are *intended* and *emerged* strategies. Intended strategies are formed by explicit and purposeful planning as a priori guidelines for action. The strategy that is finally realized may be significantly different, since strategy gradually evolves and new strategies emerge due to the managerial decisions in reacting to environmental changes.

more aligned with environmental circumstances. However, in conceptualizing the emergent types of strategies Mintzberg and Waters (1985) consider the alignment of a strategy with environmental circumstances, but not the alignment of organizational resources and behaviors with the strategies chosen initially.

Regarding the formulation of a firm's strategy, there are significant differences in views of the RBV (Penrose, 1959; Wernerfelt, 1984) and competitive forces (Porter, 1980). Teece, Pisano and Shuen (1997) explain the main differences between these approaches. According to the competitive forces approach, a firm can freely choose its strategy based on industry structures, and acquiring the necessary resources from the market. According to the RBV, however, a firm is largely defined through its existing resources. Teece, Pisano and Shuen (1997: 514) argue,

“Resource endowments are ‘sticky’: at least in the short run, firms are to some degree stuck with what they have and may have to live with what they lack.”

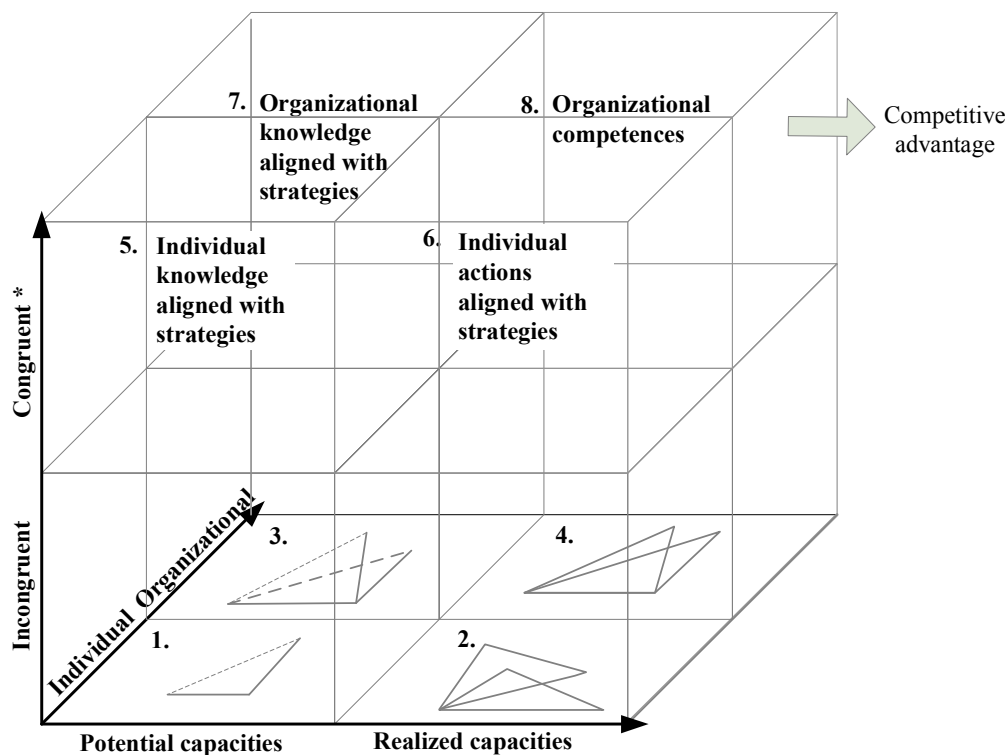
Thus, according to the RBV a new strategy of the firm is rather a renewed version of previous strategies, not a fresh move toward the market, since this strategy is largely formulated by relying on existing resource endowments. Since the RBV sees strategies as largely dependent on existing resources, it means that a significant part of a firm's knowledge and capabilities are always aligned with its chosen strategies.

Nevertheless, the existing knowledge and capabilities of the firm cannot be entirely aligned with organizational strategies for at least three reasons. First, individuals share only partially congruent goals with an organization (Ouchi, 1979). The ways in which they learn and act may not be aligned with organizational strategies. Second, increasing competition forces companies to strive for a competitive position in the market and choose the business strategies that challenge existing resources. Formulating seemingly impossible goals are a form of “resource leverage” to overcome the constraints that existing resources represent for the firm (Prahalad & Hamel, 1990). Hence, firms tend to function on the edge of their constraints constantly aiming a little higher than the existing knowledge and capabilities allow. And third, rapid changes in the environment force the firm to change its strategies, but the path-dependency of organizational knowledge and capabilities (Dierickx & Cool, 1989; Cohen & Levinthal, 1990; Levinthal & March, 1993) creates a gap between the necessary strategies and the firm's ability to act. As a result, the strategic plans of the firm may change faster than the firm's capabilities can be extended. Thus, there are many circumstances

in which the knowledge and capabilities of the firm may not be aligned with its current strategies.

Figure 8 shows a three-dimensional framework built to consider the congruence of knowledge and functional capabilities with organizational strategies. The two dimensions of the matrix presented earlier represent the bottom of the cube, whereas the dimension of congruence is shown on the vertical axes. The value of the following framework lies in highlighting eight categories of knowledge from which different effects on organizational performance may occur. The figure combines static and dynamic views of knowledge in building the basis for sustainable competitive advantage of the firm. The framework relies on the following assumptions:

- managers choose strategies according to their perception of a firm’s existing resources and environmental circumstances;
- the definition of a strategy is constantly adapted to environmental circumstances, but changes in organizational knowledge and capabilities take more time.



* Congruence – alignment with organizational strategies

Figure 8. Three-dimensional model of creating competitive advantage

The following eight categories of knowledge exist and are continuously created in an organization:

1. **Individual knowledge, incongruent with organizational strategies.** In this situation a person has knowledge that is not beneficial (being either neutral or negative) to organizational strategies and environmental circumstances. This category can also be determined as a lack of knowledge – insufficient or missing knowledge for the necessary actions of the firm. The firm is interested in expert knowledge that is aligned with organizational interests as much as possible. The firm would probably not hire a person without the necessary knowledge of the field or of the profession. Nevertheless, the question is not just a field of professional knowledge but also the correspondence of individual knowledge and willingness with the current strategies of the firm. This category of knowledge does not have to be entirely disadvantageous for the firm, however. Taken from a more positive angle, this category of knowledge may include some new ideas, albeit either not aligned with current organizational strategies or not communicated to other organizational members.
2. **Individual actions, incongruent with organizational strategies.** More critical than incongruent knowledge are incongruent actions. Negative actions represent harmful behavior of individuals and a waste of the firm's resources. The effects of these actions can be harmful to current strategies and organizational performance. Reasons for these kinds of actions may lie in a lack of knowledge or a lack of motivation amongst individuals.
3. **Shared knowledge, incongruent with organizational strategies.** The existence of such knowledge can have either negative or positive effects on an organization. On the one hand, such knowledge may exist in the form of negative attitudes towards higher-level managers and organizational goals, and have a negative effect on organizational performance and constrain the achievement of organizational objectives. On the other hand, as a result of knowledge integration mechanisms, various new ideas may emerge for new products or services or about unique ways of doing things. These ideas may not be aligned with the current strategies of an organization, but may initiate new strategies and be beneficial for the future organizational performance. Thus, this kind of knowledge can be a source of organizational innovation. Weiping (2006) has suggested that having knowledge in areas other than are covered by current strategies makes an organization flexible, whereas having too much knowledge in areas outside organizational strategy (without turning it into beneficial strategy) may harm the prosecution of the organization's current strategies.

This category of knowledge can also consist of contacts and partnerships that were beneficial during the implementation of the firm's past strategies. These contacts may become relevant again in the future.

4. **Organizational capabilities, incongruent with organizational strategies.** Organizational culture and belief systems may sometimes be harmful, causing institutional routines and actions that do not benefit organizational goals. These may be a result of poor strategic communication or inconsistency of managerial systems with organizational strategies. These kinds of routines may cause failure in implementing organizational strategies, resulting in poor organizational performance. These capabilities can also be things and behaviors that an organization has not been able to unlearn (Huber, 1991: 104-105) after a change in strategy.

Viewed from a slightly more positive angle, some of these actions can be a source of experience and learning which may become useful in the future.

5. **Individual knowledge aligned with organizational strategies.** The recruitment of people with expert knowledge required by the organization would fall into this category. It provides a basis for necessary actions. This knowledge must be turned into productive actions in order for the organization to benefit from its employees.
6. **Individual actions aligned with organizational strategies.** The actions of experts aligned with the organization's interests are unique and valuable; nevertheless, competitive advantage cannot be sustainable, because individuals are not inimitable resources of the firm (Daft & Weick, 1984; Barney, 1991).
7. **Organizational knowledge aligned with organizational strategies.** These include shared knowledge that is aligned with organizational strategies. This category of knowledge may include packaged knowledge (Mouritsen & Koleva, 2005), contacts and networks with partners that are not applied but may become beneficial in the near future. Recognized but unrealized opportunities to implement new actions can also fall into this category.
8. **Organizational competences** consist of a set of organizational capabilities oriented towards organizational goals (Prahalad & Hamel, 1990; Teece, Pisano & Shuen, 1997; Sanchez, 2004). Organizational competences can only be built by adjusting organizational knowledge and capabilities to the opportunities and threats of the environment. In a competence, the actions of individuals and groups of individuals are integrated into productive organizational processes and routines, moderated by the management systems of an organization. Competences exist in layers, where the lower level competences consist of basic manufacturing capabilities (operational skills and techniques) whereas the higher level competences are built on various coordinated capabilities for building up organizational functions and business units (Rumelt, 1994).

In order to build business strategies and organizational competences in congruence with environmental circumstances, managers need to recognize signs from the environment – the signs about emerging opportunities and threats. Any chance to gain advantage in the market is limited by the firm’s ability to recognize the opportunities and be able to respond to them (Penrose, 1959: 32). Ansoff (1980:133) calls these signs *strategic issues* and defines them as follows:

“a *strategic issue* is a forthcoming development, either inside or outside of the organization, which is likely to have an important impact on the ability of the enterprise to meet its objectives. An issue may be a welcome issue, an *opportunity* to be grasped in the environment, or internal *strength* which can be exploited to advantage. Or it can be an unwelcome external *threat*, or an internal *weakness*, which imperils continuing success, even the survival of the enterprise.”

An organization responds to these issues by adapting its present capacities to the new circumstances. When a necessary change of organizational behavior is possible based on existing potential capacities the processes of organizational learning constitute single-loop learning (Argyris, 1978). Sometimes, however, changes in an environment require a significant extension of potential capacities in order to attain new levels of organizational behavior. Argyris (1978) terms that double-loop learning.

	Opportunities	Threats
Internal	Internal successes and congruencies of existing capacities with current business strategy	Incongruence between existing organizational capacities and current business strategy
External	Favorable developments in the market that enable a firm to achieve advantages based on existing or adjusted organizational capacities	Incongruence between current business strategy and environmental circumstances

Figure 9. Emerging activation triggers

Zahra and George (2002) have termed the emerging strategic issues *activation triggers* and explained how an activation trigger induces a firm to increase its potential and realized capacities in order to adapt to new situations. Figure 9 summarizes the types of strategic issues, i.e. activation triggers, faced by a firm. Usually external opportunities and threats force changes in organizational knowledge and capabilities in order to implement new business strategies. Teece, Pisano and Shuen (1997: 524) argue that “a shift in the environment is a far more serious threat to the firm than is the loss of key individuals, as individuals can be replaced more readily than organizations can be transformed”.

Internal opportunities enable a company to improve existing organizational capacities, whereas an internal threat may show a critical misalignment of organizational capacities with the current business strategy. However, misalignment of individual knowledge (potential capacity) cannot easily be detected as a threat for an organization. Incongruent individual knowledge is also less harmful (sometimes even beneficial) than incongruent realized capacities. Knowledge from other fields of interest may potentially become beneficial in the future despite being incongruent with the current organizational strategies. New ideas generated by individuals or groups of employees (represented as knowledge category 1 and 3 in Figure 8) can potentially become an internal opportunity for the firm – a source of a new business strategy. On the other hand, individual actions and capacities realized at an organizational level that do not serve the current environmental circumstances and business strategy of the firm may promote an unreasonable allocation of resources and so have a detrimental effect on organizational performance. Thus, incongruent realized capacities may represent a serious internal threat to the firm.

It is not only the categories of knowledge that are important, but finding a suitable balance between them. In building organizational competence, the balance between potential and realized capacities should be aligned with environmental circumstances to reduce the risks to the firm in building competitive advantage. Weiping (2006) has outlined the importance of balancing knowledge exploration and exploitation strategies in different environmental circumstances. Since potential capacities give the firm the flexibility to react quickly to environmental changes (Cohen & Levinthal, 1990; Zahra & George, 2002), a firm must radically increase its potential capacity when facing a rapidly changing environment (Levinthal & March, 1993; Weiping, 2006). If the firm does not widen its potential capacity, new external opportunities will remain unrecognized and the firm will create a strong tendency to ignore the demands of the long run (Levinthal and March, 1993). On the other hand, excessive growth of potential capacities in a relatively stable environment leads the firm to experience a growth

of knowledge without an application of this knowledge in productive activities. The firm may find itself pushed “into traps of ceaseless exploration and suffer the costs of experimentation without gaining many of its benefits” (Weiping, 2006: 149). Consequently, the potential capacity will rapidly increase without any increase in realized capacity and the firm’s overall performance. Thus, in the light of a strategic development and change the tension between investing more in the processes of generating potential or realized capacities is critical for the firm (Crossan, Lane & White, 1999).

To summarize, the discussion of the present study started from the concept of individual knowledge as a part of the knowledge triangle. A matrix was developed and presented to illustrate the creation of organizational knowledge and capabilities, representing the inimitable and non-substitutable IC of the firm. Further, the processes of organizational learning were outlined in building organizational knowledge and capabilities. In this section, a third dimension has been added to discuss the eight categories of knowledge. The three-dimensional framework (a cube) was presented to illustrate the creation of inimitable, non-substitutable, and valuable IC.

In order to build valuable IC of the firm, two concerns should be pointed out: (1) the ability of the firm to recognize internal and external activation triggers; and (2) the willingness and ability to react to these activation triggers. The abilities to recognize and react to environmental changes set boundaries for the development of valuable IC, and thus, competitive advantage. The question of management becomes critical, since without managerial concern external and internal activation triggers may not be recognized or the firm might not be able to react to these triggers. Since individuals share only partially congruent goals (Ouchi, 1979), organizational knowledge and functional capabilities may not be built in the necessary domains of the firm. The desirable flows of knowledge across the dimensions of the cube would simply not emerge without the necessary managerial attention. Therefore, the next chapter explores the opportunities for managerial intervention in building organizationally valuable knowledge and capabilities.

3 MANAGERIAL INTERVENTION APPROACHES

This chapter explores the existing literature to clarify the ways in which companies can build valuable organizational knowledge and capabilities through managerial intervention. The first section provides a short overview of the purposes of knowledge management and management control. The second section provides a discussion of various managerial approaches, analyzing their effects on knowledge flows in relation to the three-dimensional framework of knowledge. The third section discusses the types of management controls as possible means of managerial intervention.

3.1 Relevant concepts and disciplines

Despite the fact that *ex ante* insights into the link between a firm's resources and competitive advantages are severely limited for any manager (Amit & Schoemaker, 1993: 33-34), studies of knowledge management suggest that managerial care is very necessary to develop knowledge and capabilities of the firm (see e.g., Barney & Spender, 1994; Nonaka & Takeuchi, 1995; Grant, 1996a; Teece, Pisano & Shuen, 1997; Davenport & Prusak, 1998). Similarly, the literature of IC outlines the importance of management nurturing the source of competitive advantage and reaching higher levels of organizational performance (e.g., Hudson, 1993; Edvinsson & Sullivan, 1996; Edvinsson & Malone, 1997; Roos & Roos, 1997; Stewart, 1997; Sveiby, 1997; Sullivan, 1998). There are many research disciplines that propose different means of managerial intervention. Figure 10 shows the example of the concepts and methods introduced in the literature. It presents a value chain of a firm in relation to different managerial concepts. The three-dimensional framework of knowledge presented at the end of the previous chapter falls mainly into the gray area in the figure.

Starting from the left side of Figure 10, input controls enable the firm to acquire the necessary combination of expertise and skills for the organization (Snell, 1992). Strategies of personnel selection and training enable the firm to acquire and develop individual level knowledge and experiences for the firm. Dewar and Dutton (1986) studied innovations in the footwear industry and found that an input control, in the form of investment in technical experts, plays an important role in facilitating process innovation. The problem is, however, that input controls mainly address ways of selecting and training individuals without leading to sufficient creation of organizational level knowledge. An input control helps to choose between available expert knowledge, but does not have much control over

what happens later and how organizational knowledge is created. Similarly, human resource management (Schuler & MacMillan, 1984) and human resource accounting (Flamholtz, 1974) do not have the means to intervene in the creation of organizational knowledge. Implementation of accounting and cost-based approaches to human resources has been problematic (Roslender & Dyson, 1992; Johanson, 1999). In addition, Johnson (2002) and Chaharbaghi and Sandy (2006) have argued that mere monetary-based decision-making in managing organizational knowledge and capabilities is not meaningful.

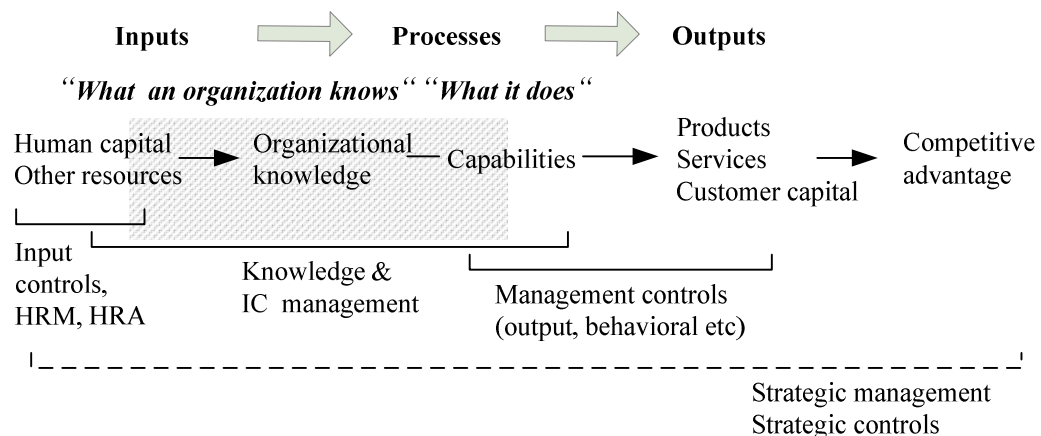


Figure 10. Relevant managerial concepts

The ultimate goals of knowledge management¹⁰ and management controls¹¹ are similar – to facilitate the achievement of competitive advantage and a higher performance level for the firm. The initial focus of these disciplines is different, however. The focus of management control is fundamentally on organizational action, whereas the field of knowledge management tries not only to influence the organizational action but also to affect the inputs of these actions, namely individual and organizational knowledge. To put it simply, the primary purpose of knowledge management has been to affect the individual and collective knowledge of organizational members – to primarily intervene in *what the*

¹⁰ To simplify the present discussion the perspectives of knowledge management and IC have been considered together as representing the discipline of knowledge management.

¹¹ The present study uses the term *management control* to refer a broad perspective of controls, not limited to accounting control but including the processes from direct surveillance and feedback systems to social controls (Simons, 1995: 5), and from formalized procedures (Simons, 1990) to informal practices and routines (Preston, 1986).

organization knows to further relate this knowledge to the organizational actions. The function of management control has generally been described as to affect the behavior of organizational members – to intervene in *what the organization does*. The definitions of management control outline its function as that of directing the behavior of actors towards the strategic objectives of an organization. For instance, Anthony (1988: 10) suggests that management control is “the process by which managers influence other members of the organization to implement the organization’s strategies”. Ouchi (1979) suggests that management control systems provide a means of obtaining cooperation among individuals and organizational units who may share only partially congruent objectives, directing their activities toward organizational goals. In a similar vein, Flamholtz, Das and Tsui (1985: 35) define management controls as “attempts by the organization to increase the probability that individuals will behave in ways that will lead to the attainment of organizational objectives”. Therefore, the primary object of management control is *what the organization does* – the individual and collective activity of organizational members that build up organizational behavior.

The field of strategic management covers all the above-mentioned functional areas of research, relating the inputs, processes and outputs of the firm more strongly to the pursuit of competitive advantage. In strategic management research the questions of *what the organization knows* and *what the organization does* have been considered in a wider environmental context. The RBV (Penrose, 1959; Rumelt, 1974; Wernerfelt, 1984; Dierickx & Cool, 1989; Barney, 1991), the knowledge-based view (Grant, 1996b), and competence-based theory (Prahalad & Hamel, 1990; Conner & Prahalad, 1996) have addressed the relationships between the inputs, processes and competitive advantage. The concept of dynamic capabilities in particular provides a strategic perspective explaining the firm-specific mechanisms through which organizational capabilities are adjusted to environmental circumstances (Teece, Pisano & Shuen, 1997).

The concept of strategic control, as a part of strategic management, aims to provide tools and methods to align organizational strategies and behavior with the external environment (Govindarajan & Gupta, 1985; Simons, 1987a; Bromwich, 1990; Dent, 1990; Simons, 1990; Kaplan & Norton, 1996). The primary question is whether the organizational objectives and the consequent behaviors are congruent with environmental circumstances. The strategic controls provide a lens through which an organization recognizes the signals from the environment, (the external activation triggers) to make the necessary adaptations to its organizational strategies and behavior (Atkinson et al., 1997). It has been suggested that the link between controls on environmental screening and

competitor analysis is especially strong in new-economy firms, probably to cope with rapidly changing environments (Granlund & Taipaleenmäki, 2005). Taking strategic and management controls together, its mechanisms aim to facilitate the development and implementation of business strategies. However, the focus of managerial intervention is primarily directed on the question of *what the organization does*, and less on individual and organizational knowledge that might be necessary for these actions.

Since organizational actions require the necessary knowledge and ability to act, the field of management control has lately made several steps closer to the field of knowledge management by drawing attention to organizational learning. For instance, Kloot (1997) has investigated the effects of management control on organizational learning. Henri (2006) has studied the suitability of controls in nurturing various types of organizational capabilities. Ditillo (2004) explains the role of management control in processes of knowledge integration. In addition, various managerial frameworks have been proposed to introduce a knowledge-based perspective into management control systems (e.g. Hartmann & Vaassen, 2003; Leitner & Warden, 2004).

It is not always meaningful, however, to distinguish management accounting and control mechanisms from the methods suggested by other management disciplines. Today's management accounting and controls cover a wide variety of activities and processes, making it difficult to define management accounting and control systems *per se* (Bjornenak & Olson, 1999; Ittner & Larcker, 2001). For instance, Grant (1996b) discusses knowledge management and suggests several managerial mechanisms similar to management control without mentioning the term *management control*. In addition, non-financial measurement systems that are known in management accounting and control literature are suggested to be very similar to the IC management methods (Bontis, Dragonetti, Jacobsen & Roos, 1999; Petty & Guthrie, 2000). Despite of the similarities they are not the same, however (Mouritsen, Larsen & Bukh, 2005). Therefore, the present study explores their views of managerial intervention in different sections, distinguishing these disciplines based on a source of the studies and terminology applied.

The following sections will explore the approaches of knowledge and IC management and the types of management controls related to organizational knowledge and capabilities. It should be noted, however, that the following theoretical discussion of the means of managerial intervention does not provide a fixed framework for empirical testing, but merely provides the basis for the analysis of the case studies detailed later.

3.2 Approaches in knowledge management and intellectual capital literature

3.2.1 *Different approaches to knowledge management*

The views and methods found in both knowledge and IC management literature are highly diffused. Methods of knowledge management have covered the issues from a wide variety of areas from individual awareness to organizational action. For instance, several studies have considered knowledge management as encouraging the processes that integrate individual knowledge and actions into organizational learning (Nonaka, 1994; Grant, 1996a; O'Donnell, O'Regan & Coates, 2000), increasing the absorptive capacity of the firm (Cohen & Levinthal, 1990), or building procedures through which organizational capabilities can be adjusted to environmental circumstances (Cohen & Levinthal, 1990; Teece, Pisano & Shuen, 1997; Eisenhardt & Martin, 2000; Weiping, 2006). At the same time, the literature of IC has proposed numerous methods for measuring and reporting IC (see e.g., Edvinsson & Sullivan, 1996; Edvinsson & Malone, 1997; Roos et al., 1997; Sveiby, 1997; Sullivan, 1998; Bontis, Keow & Richardson, 2000; Lev, 2001; Viedma, 2001).

Despite the plethora of views and methods in the literature there are recognizable tendencies that allow the existing approaches to be distinguished from one another. These tendencies proceed from the underlying assumptions about the creation and existence of knowledge (Venzin, Krogh & Roos, 1998: 63; McNamara, Baxter & Chua, 2004; Schultze & Stabell, 2004; Spender, 2006). Styhre (2003: 45) has suggested that “knowledge can be a wide variety of things, depending on what perspective we have on knowledge”. Depending on the perspective that is chosen in each study, knowledge and IC management can also be a wide variety of things.

Most of the IC and knowledge management studies can be considered as having either realist or non-realist views that affect their perceptions of management¹². Studies that adopt the realist epistemology of knowledge consider knowledge as an object that can be directly affected either in quantitative or qualitative terms (see Table 2). Its size and value are seen to be of importance to the firm, enhancing the total value of the firm and gaining superior performance. The metaphor for knowledge is “asset”. In studies of non-realist epistemology, on the

¹² The realist and non-realist epistemologies were briefly introduced in chapter 2.2.1.

other hand, the importance of the mind as a creator of knowledge is acknowledged. The metaphor for knowledge is “mind”. (Schultze & Stabell, 2004: 556)

Table 2. Two perspectives on knowledge management¹³

	Realist perspective	Non-realist perspective
Metaphor of knowledge	Asset	Mind
View of human actor, knowledge object, knowledge and context	Dualism: these entities can be independently observed and manipulated	These entities are highly entangled and construct each other
The focus of management	Identification, measuring and reporting stocks of knowledge Codification, storing, distributing knowledge Instructing the behavior of individuals	Encouraging flows of knowledge by influencing formal and informal structures of communication and interaction Encouraging certain types of behaviors in an organization

In the literature of knowledge and IC management the assumptions of realist and non-realist epistemologies have directed the managerial focus on stocks of knowledge, human behavior or the context in which knowledge is created and applied (see Figure 11). For instance, many studies have taken the realist approach, being concerned with the identification of knowledge stocks to make them accessible to managerial intervention (e.g., Edvinsson & Sullivan, 1996; Sveiby, 1997; Sullivan, 1998; Bontis, Keow & Richardson, 2000; Lev, 2001; Viedma, 2001). In addition, several scholars see knowledge management as information processing, focusing on mechanisms and tools for codifying, storing and distributing knowledge (Wilson, 2002).

Alternatively, studies of the non-realist perspective do not objectify knowledge (e.g., Grant, 1996a; O’Donnell, O’Regan & Coates, 2000). Instead of trying to make knowledge accessible they perceive the managerial role as influencing the context – to encourage the processes and mechanisms of organizational learning

¹³ In this table the metaphors of knowledge are adopted from Schultze & Stabell (2004: 556).

in which human actors build organizational knowledge and capabilities. Several studies also focus on training and development or the behavior of human actors as a part of knowledge and IC management systems (e.g., Edvinsson & Malone, 1997; Mouritsen, Larsen & Bukh, 2001; Stovel & Bontis, 2002). A few studies also pay attention to knowledge objects and their role in the creation and application of knowledge (e.g., Mouritsen, Larsen & Bukh, 2001; Gherardi & Nicolini, 2003).

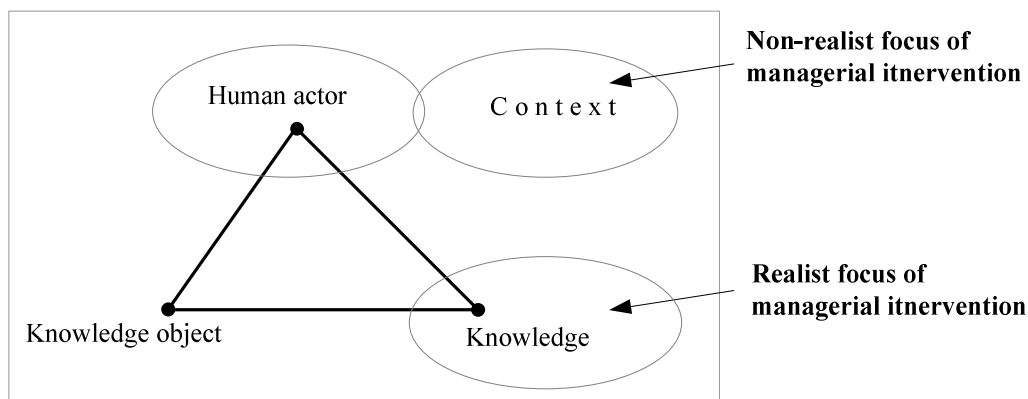


Figure 11. Central focus of knowledge and IC literature

In addition to realist and non-realist perspectives on knowledge and IC management, there are many other perspectives distinguished in the literature. For instance, Mouritsen (2006) has discussed the ostensive and performative theories of IC. Chaharbaghi and Sandy (2006) have described the rational and non-rational perspectives on knowledge management. The explanation behind the rational versus non-rational is slightly different from the realist and non-realist distinction. The rational perspective has been seen as a normalizing, disciplinary approach, grounded in logic, restricting individual actions and variety of thought, whereas the non-rational perspective encourages the free flow of individual capabilities and potential.

The interest of the present study is in exploring the existing managerial approaches. The existing views of management are focused on different parts of the knowledge triangle, having different effects on the processes of organizational learning. The following sections explore the effects of the existing management approaches in developing valuable IC of the firm. The discussion draws some parallels with the three-dimensional framework introduced in chapter 2.3.

3.2.2 *Managerial focus on knowledge*

In the realist epistemology of knowledge the managerial focus is directly placed on knowledge. Schultze and Stabell (2004) call this perspective the explicit management of knowledge, since it requires identification and disentanglement of knowledge from other organizational phenomena. Scholars have suggested objectification of knowledge to serve two managerial purposes:

1. To build institutional memory and make knowledge available across the organization;
2. To make knowledge manageable as an asset similar to tangible resources.

The first is well known in the literature of knowledge management. Studies of knowledge management have suggested various methods for codifying and distributing knowledge to build organizational memory and make it available across the organization (Nonaka & Takeuchi, 1995; Davenport & Prusak, 1998). Wilson (2002) claims, however, that studies of knowledge management inform about information or data management, not about knowledge management. Considering the entities of the knowledge triangle, by codifying knowledge one leaves the context and/or human actor out of the knowledge triangle. In doing so, knowledge is reduced to information, a structured data, which it is possible to save in and retrieve from an information system. Information that is codified can later be used for various purposes, independently from its original creators (Hansen, Nohria & Tierney, 1999).

Firms that have standardized products and services can gain from knowledge codification strategies, since knowledge codification enables them to build individual and organizational actions on an existing knowledge base, creating an economy of reuse (Hansen, Nohria & Tierney, 1999). In this way, knowledge codification favors knowledge flows along one of the horizontal axes in the cube (see chapter 2.3, Figure 8) – from potential capacities into realized capacities. Alvesson and Karreman (2001: 1007) claim that the purpose of codification is to standardize and simplify things, enabling organizations to “gain leverage from relatively unskilled – and cheaper – workers”.

Since one of the purposes of codification strategy is to make codified knowledge available across the organization, it also supports knowledge flows from individual to organizational level capacities. However, codification tends to omit proper description of the context, and because of that, human judgment is always necessary to reapply this information elsewhere (Morris & Empson, 1998). Pfeffer and Sutton (1999) have suggested that there is much more knowledge in stories and gossip than in mere information found in data systems. Thus, codified knowledge (i.e. information) does not necessarily serve the same activities and

processes in different parts of an organization. This information is impersonal and needs a human actor for it to be turned into knowledge. Information that is stored does not replace knowledge. Therefore, without any other managerial mechanisms involved in addition to codification, new organizational knowledge and capabilities may not be created.

The second purpose of knowledge objectification has been introduced as being to make the stocks of organizational knowledge amenable to managerial intervention. Knowledge is perceived as an asset in order to make it manageable. Numerous studies of IC assume management to have a direct effect on the size of knowledge without considering the mechanisms in which knowledge is created and applied (e.g., Edvinsson & Sullivan, 1996; Roos & Roos, 1997; Stewart, 1997; Bontis, Keow & Richardson, 2000). This view also forms the basis of the RBV (Barney, 1991; Conner & Prahalad, 1996). Barney's framework of the RBV (Barney, 1986, 1991, 1995, 2001) is one of the examples of the realist view of knowledge, since its main statements about the management of resources do not consider the difference between knowledge and other assets of the firm. The framework suggests identifying valuable, rare, inimitable, and non-substitutable resources, and reducing all production inputs, including knowledge, to elements comparable to tangible resources.

To make organizational knowledge and capabilities manageable, the IC literature has made great efforts to identify stocks of knowledge. As a result, a plethora of IC taxonomies have been suggested (see also Appendix 3). The most widely used taxonomy suggests IC consists of human, structural and relational (i.e. customer) capital (Edvinsson & Malone, 1997; Roos et al., 1997; Stewart, 1997; Sullivan, 1998). In some studies two components of intellectual capital, such as human capital and structural capital, have been distinguished, whereas some customer and relational aspects are enclosed within structural capital (e.g., Sveiby, 1989; Edvinsson & Malone, 1997; Roos et al., 1997). Some authors have distinguished a fourth component of structural capital, outlining the importance of innovation capital (Bounfour, 2003b), technology (Mouritsen, Bukh, Larsen & Johansen, 2002) or intellectual property (Brooking, 1996). What is common in these taxonomies is that these categories try to classify IC according to the focal objects, the people and relationships that the knowledge is about or related to – the entities that signify organizational knowledge. In doing so, it makes knowledge more visible, since the entities around which knowledge bundles are created can be more easily identified.

Most of the management methods suggested in the IC literature have taken the realist approach to knowledge. Management is largely seen as consisting of IC

measurement and reporting (e.g., Edvinsson & Sullivan, 1996; Edvinsson & Malone, 1997; Roos & Roos, 1997; Roos et al., 1997; Sveiby, 1997; Sullivan, 1998; Bontis, Keow & Richardson, 2000; Lev, 2001; Viedma, 2001; Andriessen, 2004b). Scholars have suggested more than 30 methods for the classification, measurement and reporting of IC (Andriessen, 2004b, 2004a). In general, realist methods of IC management represent three streams of research:

1. The first stream focuses on IC measurement and reporting as an internal management tool for IC (e.g., Edvinsson & Sullivan, 1996; Roos & Roos, 1997; Sveiby, 1997; Andriessen & Tissen, 2000; Bontis, Keow & Richardson, 2000; M'Pherson & Pike, 2001).
2. The second stream of research takes an external view of IC, attempting to evaluate and benchmark firms based on the size of their IC (e.g., Roos et al., 1997; Stewart, 1997; Sullivan, 1998; Lev, 2001; Viedma, 2001). These methods try to estimate knowledge and knowledge-related resources in monetary terms as intangible assets of the firm; calculate the difference between a company's market capitalization and its stockholders' equity as the value of IC; or compare the relative ROAs¹⁴ of different firms and industries as an indicator for IC. The ideas of these models are somewhat similar to those of human resource accounting (Flamholtz, 1971).
3. The third research stream covers external reporting issues, and discusses the information deficiencies that arise from the shortcomings of the traditional accounting systems, trying to report IC in accounting terms (e.g., Lev, 2001; Maines et al., 2002; Seetharaman, Sooria & Saravanan, 2002; Wyatt, 2002). Many models implicitly address both aspects, internal and external reporting.

The realist methods have gained in popularity due to the simplicity of their statements, as well as to their practical orientation. Suggestions for management are mainly normative, generating a large number of methods with little theoretical explanation (Andriessen, 2004a; Kaufmann & Schneider, 2004). Despite the seeming simplicity, these methods are popular mainly in academic literature and consultancy, gaining little acceptance in practice (Marr, Gray & Neely, 2003).

One of the critical problems is that these models encourage management to focus only on identifying and quantifying organizational knowledge without considering the application of knowledge – thus the focus is placed mainly on the existing potential capacities of the firm. Most methods of IC management focus primarily on the *what*-question, without considering the processes in which organizational knowledge and capabilities are created and applied (Leitner &

¹⁴ Return on Assets.

Warden, 2004). Many methods of IC management have focused on stocks of knowledge in different categories of IC. However, the categories of IC are relevant only when they are considered in the sense of their usefulness for organizational actions (Mouritsen, Larsen & Bukh, 2001: 747). Enhancing the growth of IC as a stock of organizational knowledge does not necessarily lead to superior action and the improved performance of the firm.

Some studies, however, do relate the measurement and reporting of knowledge stocks to their value and usefulness for organizational strategy (e.g., Marr, Schiuma & Neely, 2004; Mouritsen, Bukh & Marr, 2004; Marr & Roos, 2005), and doing so, encourage the recognition of the knowledge-related resources and capabilities that benefit organizational performance and success. Thus, in relating potential and realized capacities to organizational strategies, these methods consider the flows of knowledge along the vertical axes in the prior model of this study (chapter 2.3, Figure 8), increasing the congruence of potential and realized capacities with the strategies of the firm.

The most critical problem of IC measurement and reporting models is that the realist methods of IC management sacrifice the characteristics of knowledge, such as heterogeneity, dynamics and tacitness, for the simplicity of management method, ignoring the fact that these characteristics of knowledge give rise to its high value compared to other resources. Knowledge is located in the system of ongoing practices; being relational and mediated by artifacts; rooted in a context of interaction; and is dynamic and provisional (Gherardi & Nicolini, 2003). The value lies especially in tacit knowledge (Polanyi, 1958) that is embedded in organizational knowledge and capabilities (Prahalad & Hamel, 1990; Teece, Pisano & Shuen, 1997), since it makes the IC of the firm very difficult for competitors to imitate (Barney, 1991). The parts of IC, which are usually classified and measured in these oversimplified models, have lost their most valuable characteristics, since the role of human actor(s) and context is often overlooked in these models. Consequently, the management of IC is largely turned into a non-human concept (Mouritsen & Flagstad, 2005).

The realist methods of IC face an insuperable challenge of identifying something that is basically unidentifiable and immeasurable. The present study agrees with Priem and Butler (2001: 32), who argued that since organizational knowledge and capabilities consist largely of unobservable knowledge, such as tacit knowledge, "it is likely to be quite difficult for practitioners to effectively manipulate that which is inherently unknowable". The problem is, however, not only common in IC research but in research on human science in general (Dreyfus, 1986). It is common for scholars of human sciences to take a realist view and to try to follow

natural sciences. They attempt to reach theoretical explanations that would predict the behavior of their phenomena as in the physical sciences. In doing so, they face a similar conflict as in IC models - not being able to attain the objective theoretical explanations about the phenomenon that include the human being. The problem of identifying and objectifying something that can hardly be objectified is, thus, somewhat intrinsic to the realist approaches.

In addition to the practical problems, there is also a theoretical paradox according to which any attempt to manage organizationally embedded knowledge¹⁵ would undermine sustainable competitive advantage of the firm (see Appendix 1) (Schultze & Stabell, 2004: 562). The problem is that the causality condition of the RBV suggests that a resource is a source of sustainable competitive advantage for as long as it has not been identified (Barney, 1991; Powell, 2001). As Powell (Powell, 2001: 884) states:

“... competitive advantage propositions not only contain unobservables, but have the specially ironic feature that their entities and phenomena only function properly so long as no one observes or understands them”.

Turning knowledge into some explicit form will decrease the firm's ability to generate sustainable competitive advantage. Thus ironically, in order to uphold the value of organizationally embedded knowledge, the firm should not attempt to manage it (Schultze & Stabell, 2004: 562).

3.2.3 *Managerial focus on context and actors*

Many non-realist studies argue that managerial focus should be placed on the context in which knowledge is created and applied. According to Nelson and Winter (1982) the role of the firm is to provide the context for the organizational members to act within. Since processes of organizational learning are not readily visible and often occur simultaneously with knowledge application (Grant, 1996b), it is only possible to affect the environment in which these processes take place. Wiklund and Shepherd (2003) have stated that the way in which a firm is organized, enhances the positive relationship between the knowledge-based resources and firm performance. Similarly, several scholars suggest nurturing knowledge integration and communicative actions by use of a suitable working

¹⁵ Schultze & Stabell, (2004: 562, 569-570) have highlighted the paradox in relation to tacit knowledge. The present study suggests that the paradox is related to organizational knowledge that includes tacit knowledge, since only tacit knowledge does not serve as the basis for sustainable competitive advantage due to its inimitability.

environment (e.g., Nonaka & Takeuchi, 1995; Grant, 1996a; Nahapiet & Ghoshal, 1998; O'Donnell, O'Regan & Coates, 2000). In focusing management attention on nurturing the context, human actors are empowered (Armistead & Meakins, 2002) and have a large degree of autonomy in their communications and activities.

Encouraging a social environment facilitates knowledge integration, increasing the knowledge and capabilities of the firm. By encouraging social integration the firm can lower the barriers to information sharing, increasing the absorptive capacity of the firm (Cohen & Levinthal, 1990) and, thus, enhancing the efficiency of organizational learning. Tracey, Tannenbaum and Kavanagh (1995) studied the post-training behaviors of employees and found that the working environment plays an important role in transferring knowledge into actions. Thus, by affecting the working environment managers can also enhance the transfer of knowledge into actions, facilitating the development of organizational capabilities. In this way, the possible gaps between potential and realized capacities can be reduced (Zahra & George, 2002).

In addition, by facilitating particular structures of the context, for instance the system of gatekeepers, it is possible to enhance particular processes of organizational learning (Cohen & Levinthal, 1990; Zahra & George, 2002). The gatekeepers constitute the function of interface, being key people who acquire certain types of knowledge from the external environment or act as the interface between subunits of the firm. These people are able to translate vital external information to other groups of individuals. Cohen and Levinthal (1990) argue that external gatekeepers play a large role in the acquisition of knowledge, whereas internal gatekeepers can be important in the assimilation of knowledge, allowing better internal distribution of expertise.

To a certain extent it may also be possible to construct information storing and communication procedures to affect the ways in which human actors store and distribute knowledge (Armistead & Meakins, 2002). In this way, managerial focus is placed on behavior of human actors. Scholars argue, however, that behavioral instructions for building organizational knowledge and capabilities are hardly meaningful (see e.g., Alvesson & Kärreman, 2001). Thus, it is rather an encouraging environment and enabling environmental structures (i.e. the context of knowledge triangle) that facilitate the processes of knowledge assimilation and integration, enhancing the creation of potential capacity of the firm. Suitable working environment conditions would further assist these capacities to be turned into actions.

Mouritsen and Larsen (2005) argue, however, that focusing merely on context does not allow for sufficient managerial intervention. It is not possible to affect the types of knowledge that are created and applied in the firm. It does not allow managers to affect knowledge creation and application in the way that only those categories of knowledge would be created and applied that are congruent with organizational strategies. To allow greater managerial intervention, studies have suggested focusing on the development and training of human actors to strengthen the basis of the IC (see e.g., Edvinsson & Malone, 1997; Mouritsen, Larsen & Bukh, 2001; Stovel & Bontis, 2002). Focusing on training and the development of individual skills – an input to the actor’s knowledge – enables management to build the basis for new potential capacities that should go on to build the realized capacities of the firm.

Alternatively, literature has also directed managerial attention to the processes and activities during which knowledge has an effect in an organization. In so doing, the management focus is also placed on actors’ behavior and organizational processes. For instance, measuring the activities in which knowledge is exploited puts greater emphasis on activities as opposed to the stocks of knowledge (Johanson, Mårtensson & Skoog, 2001: 719-720). Similarly, Johnson (2002) takes the pluralist view of IC and suggests that firms identify some visible IC elements and manage the remaining, tacit and unobservable knowledge, as “knowledge work”. In doing so, management’s attention is directed towards individual level actions and organizational capabilities in which knowledge is exploited.

In the same vein, several scholars have suggested that managers focus on the firm as being capable of doing something – the activities in which IC is translated to the effects on the objects and processes of an organization (see e.g., Larsen, Bukh & Mouritsen, 1999; Mouritsen, Larsen & Bukh, 2001). In focusing on individuals and their collective actions, the IC report may combine a wide array of organizational knowledge into a narrative that makes the relationships between the elements, that initially give rise to organizational knowledge and capabilities, stronger (Mouritsen, Larsen & Bukh, 2001).

In summary, many non-realist studies have portrayed managerial focus as creating a good organizational context, and encouraging knowledge flows between individual and organizational levels of knowledge. Managerial focus directed only at the context, however, fails to affect the types and disciplines of organizational knowledge created and applied in an organization. It encourages the creation of new potential and realized capacities, but lacks the option to align these capacities with organizational strategies. In directing managerial focus onto

the activities of actors in which knowledge is exploited, it is possible to influence the congruence of individual and collective knowledge to organizational strategies.

3.2.4 *Managerial focus on knowledge objects*

One of the opportunities, which has attracted little attention in the literature, is to place managerial focus on knowledge objects. Several scholars see knowledge management through a post-structuralist lens, a view in which the central role of human construction in knowledge creation is complemented by a plurality of objects and artifacts (Mouritsen, Larsen & Bukh, 2001; Gherardi & Nicolini, 2003). This view is based on actor-network theory (ANT) (Latour, 1987). According to actor-network theory, a knowledge object does not have to be a passive entity but may induce human actors to act (Latour, 2005). An object may engage various other objects, actants and their knowledge in building the entire actor-network around itself. For instance, the shoe as an object that needs to be polished engages a person and other objects (brush and polish) in an actor-network. Without the existence of the unpolished shoe, the shoe brush and polish remain unnecessary. The existence of the unpolished shoe, thus, generates the need for the other objects and the need for an action.

Individual, group or organizational level knowledge that is related to similar objects or outcomes makes up knowledge bundles (skills of handling production materials, for instance). Knowledge bundles exist and are shaped by human actors, knowledge objects and the context in which knowledge is created and applied. In the RBV these are known as resource bundles (Penrose, 1959; Lippman & Rumelt, 1982; Dierickx & Cool, 1989); nevertheless, the RBV never details these bundles but only mentions their existence. Various knowledge bundles build organizational knowledge and capabilities. Knowledge objects of an organization (products, materials, technologies) remain in the center of these capabilities. Henderson and Clark (1990) argue that technical knowledge in an organization tends to be organized around the components from which the product is composed. In a similar vein, Sanchez (2001b) suggests that a firm's products and processes determine the structure of knowledge and create the *knowledge architectures* of the firm. These architectures are largely defined by the structure within which knowledge objects are organized in the firm.

In realist studies of IC much of the effort has been directed towards distinguishing these knowledge bundles into categories related to employees; processes and structures; and to partners and customers, generally called human, structural and relational capital respectively (e.g., Stewart, 1997; Sveiby, 1997). Nevertheless,

mere categorization of the firm's IC according to the types of knowledge objects is not very useful in instructing management on organizationally embedded knowledge (Mouritsen & Larsen, 2005). Alternatively, knowledge objects can be brought to the forefront of managerial attention by looking at the products or the customer behaviors on which organizational knowledge has a final effect. For instance, Mouritsen, Larsen and Bukh (2001) direct managerial attention towards knowledge objects by relating the IC of the firm to the things and relationships that knowledge affects.

Spender (1996) has touched on the management of knowledge objects from a slightly different angle. He has suggested that management should be interested in the situations where knowledge is absent, since an absence of knowledge is discernible and admittedly more critical for managers. The suggestion is that management focuses its attention on possible knowledge gaps that should be filled, encouraging information searches and knowledge acquisition in the necessary disciplines. Usually, a lack of knowledge is identifiable as an incomplete knowledge about some thing or process – about some knowledge object or a lack of ability to perform some task. Consequently, information searches and learning would be particularly directed to the areas related to some object or activity, increasing the potential capacity of the firm in the required disciplines.

To sum up, there are only a few studies that consider knowledge objects in discussing knowledge and IC management. The existing literature recognizes the role of knowledge objects in creation and existence of knowledge, but there is very little understanding of how knowledge objects may become relevant for management purposes. The ways in which a managerial focus on things and artifacts of an organization may affect the flows of knowledge are far from clear.

3.3 Mechanisms of intervention in management control literature

3.3.1 *The indirect effects of management controls*

The initial focus of management control has not been on organizational knowledge. For instance, strategic planning and budgeting consist of mechanisms that function as a filter, detecting and selecting information about activation triggers from the external environment. These are functions that provide relevant information to managers to ensure that organizational objectives and resources,

mainly tangible resources and employees' behaviors, are aligned with environmental circumstances – to ensure that *what the organization does* is congruent with its external environment. To some extent it is also concerned with *what the organization knows* in terms of organizational awareness of environmental circumstances.

The primary focus of managerial and operational control has been on the actions of organizational members during which knowledge is exploited, and perhaps new knowledge implicitly created, but managerial attention has rarely been on organizational knowledge per se. Taking strategic, management and operational control together, they include “processes for planning, budgeting, cost control, environmental scanning, competitor analysis, performance evaluation, resource allocation, and employee rewards” (Simons, 1991: 49). Knowledge has usually been considered as an implicit part of the inputs, content and output of these processes, but rarely split into its constituent parts for managerial consideration. Knowledge has simply not been countable¹⁶.

Management control deals mainly with the manipulation of visible and tangible elements in an organization. Much of the performance information is produced by management accounting methods, collecting numerical and financial data from various parts of an organization and summarizing it for higher levels of management (Emmanuel, Otley & Merchant, 1990: 97). The main tools of management control contribute to planning and performance measurement along with feedback and reward mechanisms (Flamholtz, Das & Tsui, 1985). The focus of planning and performance measurement has mainly been on the effective and efficient employment of tangible resources and making employees' behavior congruent with organizational objectives. It is generally realized capacities that are subject to performance evaluation – measuring the activities and the outcomes of these activities – but not knowledge as an input to these activities. Thus, management control addresses the realized capacities of the firm, having less effect on the potential capacities of the firm.

The only detectable knowledge, a relevant part of potential capacities, which can be considered to be created by management control, is the collective knowledge about the organizational objectives. This can be considered as a major type of organizational knowledge to which management control can contribute. By communicating information about the goals and strategies of the organization to its members, management encourages a common understanding of the things that

¹⁶ There are few exceptions (e.g., Ratnatunga, Gray & Balachandran, 2004).

are important to the success of the organization. Thus, an awareness of the organization's objectives is the kind of knowledge that management controls can affect. It is not so clear, however, how management control can affect other types of knowledge (i.e. potential capacities), which would facilitate turning the awareness of the organization's goals into productive activities. Capabilities are built from complex bundles of knowledge of which awareness of organizational goals forms only a part of the potential capacities.

In recent decades, however, the popularization of non-financial measurement systems has directed scholarly attention to potential capacities within firms. The non-financial measurement methods emerged in the management accounting and control literature of the mid-1980s, almost at the same time as the rise of IC and knowledge management literature (Kaplan & Norton, 1992). The initial idea of these methods was to enhance decision-making with a wide variety of internal and outward-looking performance measures. The benefits of non-financial measurement systems have been suggested to be a greater degree of management satisfaction in using non-financial accounting information in their decision-making (Ittner, Larcker & Randall, 2003) and the consequent positive effect on organizational performance (Baines & Langfield-Smith, 2003; Ittner, Larcker & Randall, 2003).

Several scholars have argued that the scorecard methods of measurement are similar to the methods of IC management and help manage knowledge and IC in the firm (Bontis et al., 1999; Petty & Guthrie, 2000). By measuring intangibles as well as their corresponding activities (Johanson, Mårtensson & Skoog, 2001) non-financial measurement systems encompass elements from both potential and realized capacities of the firm. To be more precise, however, methods of non-financial measurement address only a portion of the potential capacities, since tacit and organizationally embedded knowledge is not available for identification and measurement. There are also several conceptual differences between the approaches of balanced scorecard and IC systems. Mouritsen, Larsen and Bukh (2005: 10) suggest:

“they [IC and balance scorecard methods] differ in terms of strategy (competitive strategy versus competency strategy), of organisation (vertical versus lateral relations), of management (detailing versus visualising objectives), and of indicators (related causally versus bundled complementarily). Available balanced scorecards present a story about the firm's budget, while available intellectual capital statements narrate the firm's resources.”

Thus, balanced scorecard type methods do not serve knowledge and IC management well. They do not allow sufficient managerial intervention in organizational knowledge and capabilities.

Apart from the attempts at non-financial reporting, a majority of management accounting and control methods do not intend to directly affect knowledge. The effects of management controls on organizational knowledge (other than awareness of organizational goals) can be considered as *side effects* of these controls, rather than as their primary agenda. Due to the indirect nature of such effects, explanations of the mechanisms of and relationships between management controls and various kinds of organizational knowledge have been rather ambiguous. The processes of organizational learning and management controls are highly intertwined. Management controls affect and are affected by organizational learning (Gray, 1990; Kloot, 1997). For instance, there is a two-sided relationship between management control and common knowledge. On the one hand, common knowledge increases the probability that the individuals act according to the expectations of the organization, enhancing the congruency of activities and strengthening the control of the organization (Sunder, 2002). On the other hand, management control is generally considered to enhance communication structures (Simons, 1995). The appropriate structures of internal communication make individuals aware of other capabilities of an organization (Cohen and Levinthal, 1990) increasing the likelihood of creating more common knowledge in the organization. Overlapping knowledge and an expectation of behavior also form the basis for organizational culture (Sunder, 2002). Further organizational culture and common knowledge facilitate knowledge integration and support knowledge assimilation and transformation processes (Grant, 1996a).

Despite the complexity and the indirect nature of the effects that management control may bring to knowledge, recently several studies have shed more light on the role of management control in affecting both potential and realized capacities. Kloot (1997) has studied the relationships between organizational learning and management control in two municipalities in Australia. The case studies show that differences in management control systems influence organizational learning and the success of an organization in implementing organizational change. Kloot (1997: 69) explains the role of management control as follows:

“Management control systems affect the perception of the environment, and generative learning is a response to perceived changes in the environment. Management control systems affect the understanding of what those changes mean, how and what solutions might be generated, and a perception of whether the time has come to uncouple the organization from old structures and operating paradigms to move to new structures and

paradigms. In addition, as the organization learns and changes, it may change its structures and its control systems to accommodate the changes.”

Management control characteristics also determine whether single loop or double loop learning is encouraged in an organization. Kloot (1997: 69) suggests that double loop learning is supported by freely and frequently available accounting information about internal and external activation triggers; participative decision-making; shared visions; training and development of employees; and performance measurement systems that allow more horizontal control rather than vertical hierarchies of control.

In addition, knowledge codification tools as a part of management control systems make knowledge appropriable and store past experiences to inform future actions (Morris & Empson, 1998; Chang & Birkett, 2004; Leitner & Warden, 2004). Management control systems produce various kinds of information, not only to provide a basis for managerial decision-making but in the form of instructions available across the organization, policies and relevant information on technologies stored in databases. As already mentioned in chapter 3.2.2 scholars have different opinions on whether codification would enhance organizational learning. Levitt and March (1988) suggest that this kind of information supports organizational learning. Others claim, however, that codification strategies tend to shape only the present capacities of the firm, hampering the mechanisms of learning (Alvesson & Karreman, 2001: 1007).

Scholars have also studied the effects of diagnostic and interactive use of management controls (Simons, 1990; 1991; 1995) on organizational learning (e.g., Henri, 2006). The diagnostic use of management controls involves performance measures that are monitored through management-by-exception, correcting the deviations emerging from the performance measures as mistakes in actors' behavior. An interactive use of management control, on the other hand, increases variations in behavior and nurtures learning throughout the organization. Through the involvement of top management, an interactive dialogue is stimulated throughout the organization integrating different levels of managers and specialists into a collective communication and decision-making process.

In terms of the knowledge triangle, the interactive use of management controls places an emphasis on the context in which individuals learn and behave. It affects the structure of communication processes, encouraging knowledge integration in two ways. Firstly, communication between different managerial levels induces common understandings and interpretations across the organizational hierarchy. Secondly, improved communication enhances the

awareness of the capabilities of other employees and departments of the firm, further improving knowledge integration mechanisms (Cohen & Levinthal, 1990). At the same time, the common understandings of organizational goals ensure that new potential capacities are congruent with organizational strategies. Empirical studies have also shown the positive effect of interactive control systems on organizational capabilities by encouraging dialogue and directing organizational attention onto strategically important domains (see e.g., Henri, 2006). Thus, interactive use of management controls can increase and widen organizational level potential capacities by encouraging mechanisms of knowledge integration and the creativity of organizational members. By encouraging innovation, interactive use of management controls also supports the creation of new strategies of the firm (see e.g., Simons, 1991).

To sum up, management control has an effect primarily on realized capacities, indirectly affecting the creation of potential capacities. Therefore, the mechanisms of management controls in affecting organizational knowledge and capabilities are quite ambiguous. Lately, however, studies have also shown several roles of management controls in affecting the processes of organizational learning. Nevertheless, more investigation is necessary to clarify the role of management control in intervening in the creation of organizational knowledge and capabilities.

3.3.2 *The effects of behavioral, outcome and clan controls*

Methods of management control encompass a large spectrum of mechanisms primarily addressing the manipulation of physical resources and organizational activities. In order to better understand the indirect effects that management controls may have on knowledge, the following discussion relates particular types of controls to the knowledge triangle. From the array of existing methods, the present study discusses behavioral, outcome and clan controls.

Behavioral, outcome and clan controls have gained lots of scholarly attention in regarding the types of knowledge in the firm (see e.g., Ouchi & Maguire, 1975; Ouchi, 1977; Eisenhardt, 1985; Snell, 1992; Cardinal, 2001; Merchant & Van der Stede, 2003; Turner & Makhija, 2006). Similarly, studies have suggested that the design of management accounting depends on the types of information in an organization (see e.g., Chenhall, 1986). Firms are advised to choose between these types of controls based on their awareness of cause-and-effect relationships in the firm's processes. Nevertheless, the effects of these controls have rarely been discussed because information and knowledge is considered merely as a factor influencing this choice, not as a result of implementing these controls. It

has not been explained in enough detail, whether and how these controls may affect knowledge. The following discussion elaborates on the possible roles of clan, behavioral and outcome controls in the creation of organizational knowledge and capabilities.

In management control systems an actor's behavior is either directly affected by bureaucratic instructions or motivating leadership mechanisms. These approaches have rather different effects on knowledge flows. Adler and Borys (1996) distinguish coercive and enabling bureaucracy. A coercive bureaucracy sets formalized task descriptions to directly affect actors' behavior (see also Figure 12). An enabling bureaucracy represents a management influence of the context in which the human actor behaves. Behavioral controls can be largely paralleled with coercive bureaucracy. It specifies the tasks that individuals are accountable for and controls these tasks through personal surveillance or restrictions of actions (Ouchi & Maguire, 1975; Merchant & Van der Stede, 2003). Behavioral controls are usually suggested for use in cases where there are clear relationships between means and ends; between actions and desired results (see e.g., Ouchi, 1977; Eisenhardt, 1985; Snell, 1992; Merchant & Van der Stede, 2003; Turner & Makhija, 2006). They are also applicable in processes of low task uncertainty where the causes and effects of individual actions are clear (Hirst, 1981).

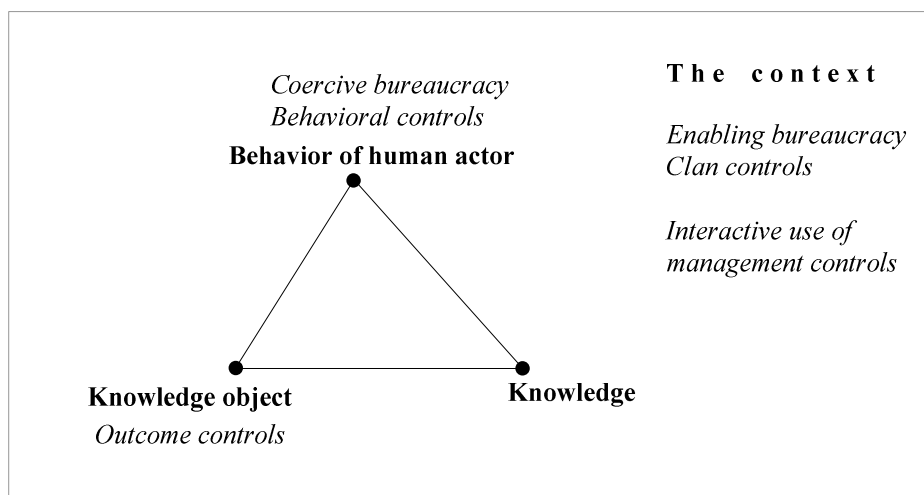


Figure 12. The focus of different types of management controls

In terms of the processes that build organizational capabilities, behavioral controls are primarily directed at the activities in which individuals and groups

exploit knowledge. These activities are usually replicable in a similar manner limiting the space of creativity. Grant (1996a) suggests a managerial mechanism for knowledge management – a *direction*, which basically overlaps the concept of behavioral control. He suggests the direction to be suitable, for instance, in cases of fast food preparation, nutrition, hygiene or aircraft maintenance operations. Any learning that may take place during these activities probably serves the need of the same actions. Therefore, this type of control primarily has an effect on actions that turn existing potential capacities into realized capacities.

Clan controls are largely related to enabling bureaucracy and empowerment. In directing the managerial focus onto the context in which human actors behave, the opportunities for knowledge creation and application are wider. Actors have greater autonomy and self-determination in decision-making. Clan controls are said to increase the goal-congruency of individuals (Ouchi, 1979; Eisenhardt, 1989a). Ouchi (1979) suggests that clans are based on a comprehensive socialization process which reduces goal incongruence between organizational members, so affecting knowledge integration and the congruence of organizational knowledge with the firm's strategies.

With the increase in uncertainty, cause-and-effect knowledge becomes more incomplete and, thus, behavioral controls are not applicable and clan controls are insufficient. For instance, in research and development organizations, where the number of exceptions is high, behavioral controls are not suitable (Abernethy & Brownell, 1997). In these situations, outcome controls are suggested. The outcome controls provide an explicit definition of results, usually in the form of output measures, that are required from the employees (Ouchi & Maguire, 1975; Eisenhardt, 1985; Merchant & Van der Stede, 2003). The outcome controls define the desired result with some knowledge object but not an actor's behavior or activities that lead to the desired results. Therefore, they are suitable in tasks where knowledge about the results is determined but the means to the end are difficult to specify (Eisenhardt, 1985; Snell, 1992). Turner and Makhija (2006) suggest using outcome control in cases where the process-related knowledge is tacit, incomplete and diverse and the outcome-related knowledge is explicit, complete, and non-diverse.

In general, outcome control provides greater creativity (Cardinal, 2001). Individuals can choose their actions and opportunity-seeking and learning is encouraged. On the other hand, the results may be defined in the short-term, which minimizes opportunity-seeking and creativity. This places the emphasis on the exploitation of existing knowledge. For instance, Hoskisson, Hitt and Hill (1993) found that an over-emphasis on short-term results of the managers

decreases the intensity of R&D investments. Thus, the possible effects of outcome controls on organizational knowledge and capabilities depend on the ways the outcome controls are applied in organizations. However, any sound conclusions cannot be made on the effects of outcome controls, since its influence on organizational knowledge and capabilities have not received much attention in the literature.

To sum up the entire third chapter, there are different means available to support managerial intervention depending on the perspective of knowledge and research areas adopted. Many studies in the fields of IC and knowledge management have tried to disentangle knowledge from other assets, or codify and restore knowledge to make it available across the organization. Alternatively, scholars have also suggested intervening in actors' behavior or the context in which knowledge is created and applied. Such methods of managerial intervention have rather different effects on knowledge flows. In addition, management control systems may also have various indirect effects on organizational knowledge.

In order to clarify the effects of these types of managerial intervention an empirical study is necessary. The following case studies provide more thorough picture of the mechanisms in which the IC of the firm is managed. In IC literature it has been suggested that researchers focus on empirical research to test the existing theoretical assumptions or to "prove that the measurement of IC is really worthwhile" (Marr, Gray & Neely, 2003). The present study argues, however, that it is instead necessary to study the existing management procedures in practice and the ways in which the existing management methods allow managers to intervene in the creation of valuable knowledge and capabilities. Therefore, the next chapter seeks to clarify which kinds of procedures and decisions can be considered to embody knowledge and IC management in practice; where managerial attention is directed in terms of the knowledge triangle; and how the applied managerial practices affect knowledge flows in building valuable IC of the firm.

4 CASE STUDIES

This chapter presents the empirical part of the research. Firstly, the design and method of the empirical study are described. Since the methods and processes of conducting case studies vary, the processes of interviewing and data analysis are carefully introduced. Secondly, case studies A and B are described to illustrate the patterns in which organizational knowledge and capabilities are built. After that the paper discusses the case studies, outlining the general focus of management, the significant effects of activation triggers in shaping the IC of the firm, and the role of management controls in directing the development of IC. Thirdly, the study introduces case C with a discussion of how the overload of potential capacities of the firm leads to changes in a managerial intervention.

4.1 Design of the empirical study

4.1.1 *Selection of case studies*

The case studies utilize the experiences of three biotechnology companies in Finland to interpret knowledge and IC management in practice. The case firms were chosen from the biotechnology sector for two reasons; the first reason was the similarity of biotech firms to knowledge-intensive firms; the other reason, however, was the difference between these firms. First, biotechnology firms are similar to knowledge intensive firms, in the sense that knowledge constitutes a critical element of their resources. The usual examples given of knowledge-intensive firms are accounting, law and consultancy firms, computer engineering firms, advertising agencies and research centres (Ditillo, 2004: 401). Knowledge is a central resource of these firms (Starbuck, 1992; Ditillo, 2004). Therefore, knowledge and knowledge management issues are expected to be important in these firms. Second, the differences between biotech and knowledge-intensive firms lie in the input-output role of knowledge in these firms. Knowledge-intensive firms are usually seen as using knowledge as an input, as well as an output, since they produce intangible solutions for the customers (Ditillo, 2004). In contrast, the ultimate goal of many biotechnology firms is not only to produce knowledge from knowledge but transfer knowledge into a tangible output. Knowledge represents an important input that is transformed into tangible effects in food, health-care, agriculture and other industries (Bergeron & Chan, 2004).

From the 140 firms in the Finnish biotechnology sector, 24 firms were contacted with a view to finding three case firms for the study. The selection was made

based on the size (number of personnel), business activities (excluding firms that did not have actual activities in biotechnology) and the firms' willingness to participate in research. With regard to the size of the firms, the case studies were selected from among small and medium-sized enterprises (SMEs) similar in terms of business activities. The case firms operate in the fields of pharmaceuticals, medicine and biomaterials (see Table 3).

Table 3. The three case firms in brief

	A	B	C
A broad definition of an industry	Pharmaceuticals	Medicine	Biomaterials
Size of the firm (no. of employees)	~25	~25	~100
Activities of the firm	R&D, no production, no sales	R&D, production, sales and marketing	R&D, production, sales and marketing
Object of sales	Drug concepts	Diagnostic rapid tests for fertility, allergies etc.	Biodegradable polymer devices for bone healing

From one point of view the case firms may be regarded as fairly homogenous, as they all are SMEs and belong to the biotechnology sector in Finland. The biotechnology sector has its special characteristics that define the nature of firms' environments and types of risks that they have to cope with. It gives rise to many similar features in the nature of knowledge processes and administrative structures of the firms. On the other hand, notwithstanding the common features that the biotechnology firms share, there are a number of differences and specific properties in their business models. Biotechnology has been claimed not to be an industrial sector, but a diverse field that comprises "a set of techniques for the manipulation of living organisms which comprises several disciplines which provide the scientific foundations for such techniques" (Saviotti, 1998: 19). In a broad interpretation, biotechnology can be categorized into six interdependent sectors: pharmaceuticals, medicine, agriculture, biomaterials, computing, and military applications (Bergeron & Chan, 2004). Therefore, the three cases represent a significant variety in terms of business models and the subsectors where they operate.

4.1.2 *Research method*

The case studies both explore and explain IC management in practice. The case studies can be considered as heuristic, describing and interpreting the emerging patterns in the field (Keating, 1995). The focus of interviews and case analysis was not merely on general constructs and replication but to become familiar with the rich context and unique patterns of each case (Eisenhardt, 1989b; Dyer & Wilkins, 1991).

Regarding the researcher's view of management control, the case studies focus on formal as well as informal management procedures. Scholars have considered management control as including formalized procedures, as well as informal practices and routines. Simons (1987a: 358) defines management control as "the formalized procedures and systems that use information to maintain or alter patterns in organizational activity", defining management control as containing only formalized procedures. Several authors provide a wider definition considering the formal as well as the informal processes of the organization. For instance, Scapens (1994) indicates management accounting systems that are constituted by stable rules and practices. Several scholars have argued that informal systems of management are highly valued in practice and formal processes may even be inappropriate in various situations (Preston, 1986). The following case studies focus on formal as well as informal management procedures. Nevertheless, the analysis does not go very deeply into the creation and institutionalization of informal types of controls, such as clan and cultural controls. Informal procedures of management control are investigated only at their general level, identifying the general routines in organizations without interpreting the deep social mechanisms and relationships that develop those routines.

The general ideas of actor-network theory (ANT) (Latour, 1987) are applied in interpreting the case data. The present study, is not a typical ANT study, however, where an actor is followed thorough the whole case study from beginning to end, so creating a story of the actor-network (Latour, 2005). In an ANT study something should circulate thorough the case description (Brown & Capdevila, 1999). The present study does not deconstruct actor-networks and follow the actors in the way suggested in ANT. It applies the notion of human and non-human entities on a rather general level in explaining the patterns of management. In that sense, the present study is similar to the studies of management accounting and control (e.g., McNamara, Baxter & Chua, 2004) which have been inspired by ANT but do not apply ANT in the way originally suggested by Latour (1986; 1987) and his collaborators (Callon, 1999; Law, 1999).

4.1.3 Data collection and analysis

The data were gathered from observations, interviews and internal documents of the firms during the period September 2005 to June 2006. The researcher was granted access to confidential data provided under confidentiality agreements. The data collection procedures involved interviews and observations as well as collecting the documents. The main source of data was interviews (see Table 4). Up to 53 interviews with 21 individuals were conducted. This amounted to more than 52 hours of discussions, of which more than 43 hours were fully recorded and transcribed. The interviews were conducted with managers and specialists at different levels of the organizations (see Appendix 8). Some of the field visits included a short observation, lunch with the managers or a plant tour during which additional insights were gained.

Table 4. The research activities in the field

	Case studies			Total
	A	B	C	
Number of interviews	12	15	26	53
Interviews total (h)	15,78	13,73	22,58	52,09
Tape-recorded interviews (h)	14,16	11,29	18,11	43,55
Observations (h)	0,58	2,33	3,42	6,33

Before each set of interviews the respondents had an idea of the themes to be explored because they had been sent a list of topics and questions in advance. Later, during the interviews the flow of topics remained flexible, varying according to the emergent issues in the field. The time break between the field visits allowed the researcher to seek the interpretation and meaning of the issues. The next field visit served to clarify the researcher's interpretations, update the progress made in the field dealing with the issues raised previously and to search out new angles of possible interpretation. These actions, taken as a whole, were intended to decrease potential observer bias and detect possible false interpretations.

In addition to the interviews, various sources of documentary material, such as company reports, internal memos and records, reporting instructions, e-mails and a history of electronic correspondence were gathered. The documents are listed in Appendix 9.

In each case company the researcher had an informant. Informants are highly relevant for the case research since they provide the general background and details about the company, interviewers and the events in the company that researcher would not have any access to otherwise (McKinnon, 1988: 50). The informants were very helpful in providing necessary information about the backgrounds of the respondents and their availability for interviews. They provided additional insights into the ongoing issues in the company, helped to find relevant people to address questions that emerged in the course of the study, and provided documents necessary to clarify the subject matter.

In each case study several respondents had held several different positions in the firm or had recently changed their position. In case A and B the functions and activities of respondents were significantly wider in scope than the original description of their position implied. In case C, several managers had recently changed, or were in the process of changing, their positions in the firm, by starting in a new business unit or at a higher level of management. Consequently, these respondents had a good overview of the ongoing issues in the firm and were able to sense the different working practices in different parts of the firm. This allowed the researcher to better understand various views and management practices across the different units of the organization.

During the ten months of the case studies, the researcher was able to repeatedly interview those respondents who possessed the information most relevant to the research. Especially in case C, which is a larger firm, the first round of interviews and several discussions with informants provided enough feedback to realize that reorganizing the mode of data collection would be necessary. To further improve data collection the range of interviewees was slightly changed. This allowed an improvement in the “representativeness of concepts, not of persons”, and enabled the study to better specify its phenomena from different angles and analyze the conditions that gave rise to them (Corbin & Strauss, 1990: 9).

Any study is always limited by the time period available for interviews and observations. Consequently, the researcher cannot observe the historical development of the management systems in the field, but relies on the respondents' descriptions. McKinnon (1988: 40) has suggested that “the longer the period of interaction, the larger will be the number of events that form the data set for analysis”, significantly affecting the validity of the study. The time frame of the present case studies gave a reasonably long period of contact that allowed the researcher to investigate the ongoing processes in the firms. The researcher had an opportunity to discuss several issues from their emergence through to their

solution. This allowed the collection of “fresher” data and discussion of the issues while they were still “hot”.

During the case studies several discussions were also held informally without the tape recorder running. The researcher had several lunches and casual talks with the members of the case firms, covering a range of topics from family and educational background of the respondents, through to areas of conflict in the firms, which shed light on the ways in which people work in these organizations. Also knowing the backgrounds, beliefs and concerns of the respondents increased the understanding of the way people work and communicate in the workplace. These discussions helped the researcher to better connect with respondents, facilitating openness, honesty and spontaneous reactions during the interviews. Hence, the issues raised in the interviews were more openly clarified for the researcher.

Data were organized and analyzed along the processes of interviewing. After each case visit the interviews were played back and transcribed then printed and organized chronologically into the case catalogues. The textual level analysis was conducted by coding the segments of chronologically ordered text. The texts in the three case catalogues were continuously analyzed in between the interviews to prepare for the next visits to the field. The coding was conducted by reading the printed text and designating meanings of sentences and paragraphs in relation to the theory. Codes were post-defined in the sense that codes were not predetermined but they emerged during the data collection and analysis (Miles & Huberman, 1994: 61-62). Corbin and Strauss (1990: 12) call it “open coding”. In other words, the researcher was open to what was received in the field, and constantly extending the coding system and redefining the codes as necessary.

Regarding the physical tools of data analysis, two phases of the study can be distinguished. The first four to five months of the analysis of the text included a high degree of effort invested into hand-written coding and integration of those codes. The codes were organized in hand-written maps and MS Excel, in parallel. By the end of the fifth month, there were up to 400 pages of text and hundreds of codes with memos and linkages between the codes. By this time, the researcher’s understanding of the theory and case evidence was significantly deeper. A review indicated the need for some changes in theoretical focus, as well as changes to the data analysis tools. Thus, in the second stage of the interviews, Atlas.ti software (Muhr, 2004) was applied in organizing and analyzing the case data. The change in interview focus required recoding and analyzing the data collected previously with the Atlas.ti software. Renewed codes were applied which were better suited for further analysis. The initial coding method of identifying the meaning of the

text by post-defined codes, however, remained the same. Coding was conducted by carefully reading and analyzing the meaning of the text. No automatic coding was applied. By the end of all case visits, more than 750 single-paragraph pages of transcribed text had been collected and coded. The case files encompassed 1875 quotations with 718 codes. The codes were organized into families and networks according to the development of the concepts.

In parallel to the Atlas.ti files of the text, the printed catalogues of case studies were still kept, since documents collected from the case studies were more convenient for analysis in a printed format. The documents gathered from the field were organized around the topics of the interviews, helping to better understand the issues discussed in the interviews, as well as to confirm the theoretical patterns found in case studies.

The ideas emerging through coding were captured with memos, which were linked to the codes and quotations of the text. Memos allowed the formulation and revision of the emerging theory over the entire course of the study (Corbin & Strauss, 1990: 10). The observational, methodological and theoretical notes were, however, clearly separated. This was to allow the original data to be “as uncontaminated by interpretation as possible” and to allow its reuse if necessary (McKinnon, 1988: 46). The hypertext analysis of Atlas.ti was used to organize the original transcripts around the emerging patterns of the study and support the story telling in writing-up procedures. It was also helpful in discovering some inconsistencies in the statements of the interviewees. The conceptual maps were drawn in Network Editor of Atlas.ti (Muhr, 2004) to analyze the patterns of themes and constructs of the study, integrating them into the theory.

4.1.4 Validity and reliability

The questions of validity and reliability are of central importance in evaluating the legitimacy of research. Validity is generally “concerned with the question of whether the researcher is studying the phenomenon she or he purports to be studying”, whereas reliability “is concerned with the question of whether the researcher is obtaining data on which she or he can rely” (McKinnon, 1988: 36). In the present research the issues of validity and reliability were addressed in the following ways.

To meet the test of external validity firms with similar characteristics were chosen. The choice of interviewees was based on the function of managers as well as their relevance to the constructs in the study. The case studies were analyzed based on a common theoretical base. To meet the test of construct validity, the

data collection principles suggested by Yin (2003) were followed. Multiple sources of evidence are used at each site. The data file generated about each company contains the interviews, notes of site visits, and copies of the documents gathered. Data triangulation was conducted to build stronger support for the constructs in the study (Eisenhardt, 1989b). Nevertheless, the constructs are highly dependent on the context and the researcher's interpretation of the evidence. Triangulation is highly dependent on the arguments, and the assessment of proper triangulation in a qualitative field study is problematic (Ahrens & Chapman, 2006).

To meet the test of reliability and demonstrate that the operations of the study can be repeated with the same results, the field visits and data collection were carefully prepared. Similar field procedures were used in each company. The interviews were tape-recorded and transcribed instantly after each visit. Interview data and the documents from each visit were summarized and analyzed in comparing the evidence of interviews with materials found in the documents. All data were organized in hard copy catalogues as well as in Atlas.ti software.

The reasonably long time period of the case studies helped to detect anomalies in the data. Sometimes "the subject may consciously seek to mislead or deceive the researcher, perhaps reporting events in a manner most flattering or acceptable to him/herself" (McKinnon, 1988: 38-39). In addition, people forget things and pay attention to the issues via their cognitive maps. These kinds of possible bias were diminished by asking probing questions, discussing the same issues from different angles, and discussing the same issues with different respondents. Any apparent contradictions were marked during the coding and considered in the interpretation of the data.

Since the exact flow of questions was often left open in the interviews, a significant portion of the questions was produced during the same interviews. Asking situation-specific questions increases the validity and reliability of the study (McKinnon, 1988; Yin, 2003). It diminishes the risks of filling the gaps in data with the researcher's own assumptions and false interpretations. In order to diminish the observer-caused bias, the emerging patterns in case studies were also repeatedly questioned from different angles.

The results of the case studies are derived using the rhetoric of contextual generalization (Lukka & Kasanen, 1995). The results are generalizable to the theory (Yin, 2003) whereas the generalizability is achieved through the process of abstraction. Corbin and Strauss (1990: 15) suggest that the more abstract the concepts, the more likely it is that the propositions of the theory are applicable to a wide range of situations. In the present dissertation the levels of abstraction and

identification of the conditions of the theoretical concepts are expected to enhance the generalizability of the study.

4.2 Case studies A and B

4.2.1 *Description of case A*

Overview of the firm

Case firm A is a small pharmaceutical company active in the biopharmaceutical sector, focusing on drug discovery and development. The company was founded in the mid-1990s and it can be categorized as a small company, having less than 25 employees. The strategy of the firm is to discover new candidate drugs and develop them up to clinical proof of concept with the aim to license them out for further clinical development and registration. At the time of interviewing, no sales and revenues exist. There is no production in the company, but eight development projects and several research activities. The projects contain R&D activities up to the stages of clinical trials of a candidate drug. Active commercialization activities of these projects are conducted simultaneously aiming to find an established pharmaceutical company interested in their candidate drugs.

In the field of bio-pharmaceuticals task uncertainty is extremely high. The business model of firm A comprises high-level risks and uncertain scenarios for success. In case of success, the risk-taker will be rewarded with significant returns. However, the road to success may be extremely long. The process of drug discovery and development can take from 2 to 20 years, or even more to complete (Bergeron & Chan, 2004). Many firms have failed to survive the long process of clinical trials. Furthermore, there is no guarantee that a candidate drug will even be allowed to enter clinical trials. The rate of regulatory approval to enter clinical trials has been only 0,1 percent of the applications (Bergeron & Chan, 2004). Nevertheless, a successful firm with a strong patent could potentially have exclusive rights to an entire class of drugs. Since an innovation of a single new molecule can mean billions of dollars in revenue for a multinational drug company, royalties for the patent holder of a successful drug (i.e. a biotechnology firm) can be significant.

The management of the firm is allocated across four functional departments: administration, business development, research, and development. Business development is mainly involved in the commercialization activities of the drug candidates. The research department encompasses drug discovery including the

groups of chemists and pharmacological testing. The development department manages eight development projects, where each project is coordinated by a project manager. The firm utilizes a strict planning and budgeting system based on the organizational structure. Each cost-center has its budget and targets that are regularly monitored. The formal management control system, comprising a highly structured performance measurement and meeting system, can be considered as relatively peculiar among other small new economy firms (Lukka & Granlund, 2003).

Managerial attention to knowledge objects

In order to make IC manageable several studies have identified stocks of knowledge bundles applying the taxonomy of human, structural and relational capital (e.g., Habersam & Piber, 2003; Lönnqvist & Kujansivu, 2007). During the first interviews the managers of the company contributed their perceptions of the important intangible resources, resulting in the table below (see Table 5). The structural view of the IC in case A, given in this table, perceives IC as a bunch of resources that are possible to acquire, store and exploit. These stocks of IC consist of various heterogeneous bundles of knowledge, some of them more tacit in nature, such as the ability to collect information from the substances and relationships with partners, some of them more explicit in nature, such as product concepts, patent families, trademarks etc.

Table 5. Managers' perception of valuable IC

Human capital	Structural capital	Relational capital
Trained, skilful, experienced and motivated employees Expertise and know-how of substances and abilities to collect information about the substances	15 patent families 8 product concepts Knowledge of technology platforms Project Management system Databases and activity-based data management system of R&D Trademarks Domain names	Relationships with international pharma and biotech companies Network of European, Nordic, Japanese and U.S. partners. Relationships with academic collaborator and contract researcher organizations. Expert panels and network of consultants Reputation in the field

What is interesting about this table is not its content or the way things are structured, but the fact that it has not much to do with the way things are organized in the company. It just looks nice and interesting for the managers visualizing some IC elements of the firm. Notwithstanding the nice look, such visualization does not proceed from the reality but stands alone, apart from the practice of decision-making and organizational actions. There is no measurement and reporting in terms of the categories shown in Table 5 in the firm. Nevertheless, the managers claim to be aware of the strengths and weaknesses of the organizational potential and realized capacities. Furthermore, they are confident that the IC has been constantly built upon and significantly improved over the years of the firm's existence. It is claimed that the IC, aligned with the firm's strategies, has been built albeit without deliberate focus and evaluation for that matter. Given this, the question can be raised, where is the main focus of management and how does it contribute to building and strengthening the IC of the firm?

In reality, the main managerial attention is not on these knowledge bundles presented above (see Table 5), but on eight knowledge objects and the activities related to them. In the center of activities there are specific substances – compounds (i.e. molecules). The elements of IC presented in the previous table are developed and exploited in relation to the specific substances. There are eight compounds at the center of the firm's activities, and the firm has specified various biological, technical and commercial milestones for each compound. People from the disciplines of molecular biology, computational drug design, medicinal and parallel chemistry are all working on the progress of these compounds. Every individual or group of experts (human capital)¹⁷ contributes with his/her skills and know-how of working with a compound. The networks of partners and colleagues in academia (relational capital) help to perform a specific task of purification of the cells, for instance, and acquire new knowledge about the possible application areas of the compound. The specific tools in the laboratory (physical assets) with the skills of combinatorial chemistry (human capital) are utilized to synthesize a number of compounds for further analysis in electronic tools and databases (structural capital).

In terms of actor-network theory (ANT) (Latour, 1987), the particular compound is an *actor* that attracts various people and partners to itself, building an actor-

¹⁷ The dimensions of human, structural and relational capital are used here as metaphors to better illustrate how the theoretically acknowledged elements of IC are actually organized around the focal objects of the firm.

network. The activities of people are directed to these compounds and they do things because of the pre-defined goals related to the compounds. Most of the things that happen in the firm are directly or indirectly related to the progress of these compounds. No part of the IC is developed for its own purpose, but because of the strategic objectives for the eight compounds.

There are three major areas in the firm through which the activities of each compound expand. These are: (1) research, (2) development, and (3) commercialization activities. In each of these areas, the firm has defined the annual goals for the compounds. Each compound attracts to itself a network of individuals, objects and artifacts along its journey through these three phases. The following case description tracks the progress of a specific compound through the above-mentioned three areas. It shows how a single molecule induces and engages the people to act and discuss the issues; how IC is created and employed in the actor-network; and how the outcome control plays its role in directing the actor-network of that molecule. Let us label it as *compound F1* while omitting any detailed description of its confidential properties¹⁸.

At the very beginning of the path, in the stage of research, there is not yet actually an F1 compound; neither is there a product concept nor a product, but various kinds of ideas, experiences and knowledge of the chemists, who make educated guesses about the experiments that could lead them to the desired molecule. There are people with previous experience and personal contacts in several therapeutic fields, such as neurotical and psychiatric diseases amongst others. More importantly, they have an idea about the molecule that they may be able to produce. The idea is to identify a lead compound – a clinical drug candidate. The outcome is defined as a set of properties that a molecule should have in order to potentially become the basis of a candidate drug for a given biological target. The definition of an outcome is not a desired quantity, because it does not matter how many molecules the laboratory is able to make – the result should be a master compound that meets certain criteria. It has to meet certain criteria in order to be valuable and acceptable for further development – it must have a desirable effect in laboratory conditions.

Despite the vague definition of the outcome, the scientists are highly motivated to work towards it and try to make a compound that meets certain kinds of requirements. The groups of chemists are asked to synthesize a compound and

¹⁸ The following case description does not, however, decompose the actor-network of the F1 in a way suggested in actor-network theory (Latour, 2005). While the research question of the present study is rather broad, the study looks for more general patterns in building the IC of the firm.

pharmacologists to set up a testing system to test their compounds. They apply their experience and skills with the aim of achieving the desired outcome. The effect of their knowledge emerges in various activities, in either conducting the skill of medicinal chemistry in the laboratory, or comparing the individual compounds in an electronic database. In addition to the physical treatment of the compound, discussions, e-mails or phone calls are made to drive the activities towards the outcome. Information searches from external databases and publications in the field are conducted to get new insights about the properties of a compound and its biological targets¹⁹.

A large uncertainty and the group-level definition of the desired outcome induces people to communicate with each other to make sense of each situation, interpret new information and choose the best possible actions to move towards the desired results. People search necessary information, discuss chemical and pharmacological matters, synthesize the compound, organize tests, and evaluate the results. After evaluation of the results, they discuss again, search additional information, change some test conditions and start the cycle again, for as long as it takes to achieve the lead compound. Each more-promising molecule will encourage people to sit down and discuss it in a wider forum to present the new situation to others and gather different opinions – to analyze whether a compound they generated is within necessary parameters or not. For as long as the lead compound has not been generated, all that knowledge that has been built up does not have any significant effect which could be considered valuable in the market.

The evolving actor-network of compound F1

After a number of experiments and struggles in drug discovery to identify compounds which would have had a high enough affinity to the receptor, they find one – a lead compound is created. Now, it is something, which can be labeled with the name, F1, a “thing”, which has substance – a compound that acts properly in the test tube in cell-lines. This is the desired object. The important thing is that knowledge that is created along the journey towards the existence of this object has become a valuable asset for the firm. Their skills and experiences as well as all the information about the production of F1 that is saved in internal databases, laboratory books and meeting minutes, have become a valuable part of the compound, a valuable asset for the firm. Knowledge that has been created (potential capacity) and the activities in which that knowledge has been exploited

¹⁹ The high level of motivation towards the outcome can be explained by the scientific curiosity of the employees, monetary rewards of the valuable invention, and the fact that the desired outcome is collectively defined by the same people who are working for it.

build up a highly valuable set of capabilities in which the compound F1 can be repeatedly produced (realized capacities).

However, the next activities cannot be initiated before clarifying the potential candidate drug – what is the new outcome that we are going to achieve with F1. The firm now has the master compound and a wide array of opportunities is suddenly open, as there are many possible therapeutic fields and treatments in which the compound might be applied. Thus, the managers and scientists sit down and write down hypotheses about what could be achieved with the molecules. The questions of potential markets, partners, and developments in the political and social environments become relevant. They have to choose the particular therapeutic area for the candidate drug so that compound F1 can be further developed.

This is the point where managerial attention is directed towards the existing IC of the firm as well as the potential IC which may become relevant for the future success of F1. As suggested by Cohen and Levinthal (1990) and scholars of the RBV (e.g., Penrose, 1959), the choice between the opportunities is largely path-dependent, depending on the existing potential capacities of the firm. The CEO describes the decision-making, as “very opportunistic. [...] It depends on who we know, what their focus is, what their interest is.” It depends on knowledge and experience in the firm (human capital), as well as existing partners and their competence (relational capital). Existing IC is analyzed in relation to F1. No potential or realized capacity of the firm is analyzed *per se*, but is related to the possible future scenarios for F1. The managers direct their attention to the existing capabilities of the firm in conducting further studies with F1. Similarly, they analyze the existing relationships with partners and consultants related to their possible contribution to F1. In addition, they try to widen their overview of the existing IC by acquiring and assimilating new information from the external environment. They conduct interviews with opinion leaders about the treatment of specific diseases, and investigate the legal and competitive situation in the field.

After the clarification of the existing knowledge and capabilities of the firm, as well as opportunities for IC growth related to F1, new definitions of the desired outcome for F1 with its related therapeutic area are set. They start to develop F1 to form a basis for the drug candidate for a specific disease of an ageing population. The definition of the new goal defines the scientific disciplines that the compound F1 will start relating to itself. Now in acquiring new knowledge from the field a piece of information is considered valuable if it can possibly contribute to the specific chemical, biological or technical matters of the compound F1, or widen the knowledge about the particular ageing disease. The

definition of a new target also determines the patent and trademark activities (structural capital).

From this point, the value of the each new piece of information about the legal matters and environment, as well as the value of contacts and partnerships (relational capital) depend on whether and how they contribute to screening processes, lead development, and preclinical trials of the drug candidate F1. For the lead development and preclinical trials of F1 to be successful, it is necessary to cooperate with partners (relational capital) who have specific skills and the experience to demonstrate the bioactivity and safety of the candidate drug. After F1 has shown the desired effects in the laboratory, the most useful partners are those who have knowledge of the preclinical trials to be conducted on mice, rabbits, or other subjects. In this way, the new IC that is being built is largely determined by the goals that the firm wants to reach with F1.

Many partners play only a temporary role in some phase of the realization of F1. They finish their task of producing a particular type of cell, and leave the actor-network, whereas the result of their work (the cells that they produced) is left to the firm for further development of F1, building the structural capital of the firm. At the same time, relationships and trust that have been built along these collaborations (relational capital) can be used in other ongoing or future projects. In this way each participant in the actor-network of F1 leaves its mark on the structural and relational capital of the firm.

The more progress F1 makes, the more concrete will be the definition of the outcome and the more strict will become the performance evaluation of F1. Regularly written plans and reports become more structured and definite, as the tasks become more clear and time schedules become critical. Through the stages of development the compound F1 has 256 tasks noted on a Gantt chart, some of them already completed, some of them to be completed in 2010. The individuals responsible for the tasks have to apply their skills and experience from the field in a relatively short time period, because the schedule of 256 tasks is tight. Each new piece of information received from the field or knowledge generated internally must be applied quickly in new actions.

The development of F1 may, however, not proceed along a linear path. The certainty of the path may be a mere illusion because the list of necessary tasks defines only the outcomes of what has to be done, providing no particular details of how these results are to be reached. In addition, unexpected scenarios in the external environment may occur that force changes to be made to the plans for F1.

The role of activation triggers in shaping the IC of the firm

The definition of the ultimate target and the list of tasks along the way provide the direction in which the actor-network of F1 is expected to go. The expected path of F1 would be predictable and smooth if there were no events or forces that could destroy the whole actor-network. The truth is that the managers can never be fully confident that the project will proceed along a linear predefined path. Anything might happen internally, or emerge from the external environment, that could force the firm to reconsider the existing status and value of F1, and choose another set of actions to implement. The internal and/or external triggers that occur may show that the achievements with F1 have been mere illusions and the project has to take several steps backwards, or even show that an alternative road must be taken. This may lead to significant changes in IC, having an effect on the potential and realized capacities of the firm.

There are numerous activation triggers that are continuously reacted to, consequently shaping the IC of the firm. These triggers occur almost daily, forcing the protagonists to stop and evaluate the current state of knowledge and relationships related to F1. For instance, one of the issues related to F1 led to the decision to employ external resources, which slightly changed the relational capital of the firm. The case company discovered it had problems in cloning a human receptor with a satisfactory expression level. Therefore, the management decided to find the subtype from the field in cooperation with a partner. As a result, external capacities were exploited instead of internally available knowledge. In another situation, staff responsible for molecular biology learned from pharmacologists that outsourced cell-lines were not satisfactory, thus, they had to clone the cell-lines themselves. The existing skills and know-how of human capital had to be applied to produce these cell-lines, increasing the exploitation of existing potential capacities. These activation triggers do not seem significant in the first instance, but gradually shape the potential and realized capacities of the firm. Step by step new ways of doing things are generated or new relationships started in the field, simply because of the emergence of activation triggers which did not seem significant at first.

Usually, after the emergence of a more powerful activation trigger, the staff will try to re-stabilize the situation. A new set of activities must be chosen to overcome the trigger. As long as it is possible, a solution to the trigger will be chosen that keeps F1 moving towards the initially defined objectives. As the CEO explains:

“The objectives should remain the same but a new path has to be found. [...] First, the project manager makes actions to correct the situation. They

inform and ask guidance from the management team. We might allocate more money and allow an overspend just to get information on whether the issue is solvable.”

As long as it is possible and beneficial for the firm, the progress of F1 will be directed back towards its defined objectives. Sometimes however, it is necessary to totally change direction, as happened with another project, in which an external activation trigger emerged. The CEO describes it:

“We started it [the SF compound project] based on inventions. Suddenly we realized that the markets seemed to disappear and it is still true, it is disappearing because of another type of invention that came and took away the market. So, we started to look for other therapeutic uses, and changed course.”

Because of this external trigger, they abandoned the existing path of SF and looked for alternatives. Luckily they were able to find another hit molecule that expanded their opportunities again. With the new therapeutic area, new goals and sets of actions were initiated. Existing competences and partnerships were applied to different purposes and new contacts created. The new direction captured new functional areas of interest resulting in a growth and development of the firm’s IC in fields previously unfamiliar.

Some triggers may, however, be fatal to the progress of a compound. That was the case with compound M that the firm had been working on for almost four years. The Vice President of Science describes the situation where an internal trigger emerged from the compound itself:

“In that project, we were very excited about how the compounds behaved in animal testing, it was very promising. And then we learned of a very serious toxicity problem and it seemed to be in every tested compound within the glass [test tube]. So, it was the so called “class effect” [related to a feature shared among the class of compounds]. Those are technical issues, which meant that we have to go back, not to square one but square two, and restart the project, go with a different chemical, and find a different chemistry area to work within.”

The difficulty of the trigger (i.e. its potential impact on the initially defined outcome) determines how much effort is put into knowledge exploration activities to find relevant information and make decisions to solve the situation. If the trigger is likely to jeopardize the achievement of the existing objectives, the discussions and analysis of the situation take place immediately after the problem has emerged. It is necessary to interpret the situation quickly, to understand what is happening, what the problem is and what the possible actions are. The difficulty of the toxicity problem with the compound M implied that there was a

general lack of knowledge about certain parameters of the compound and that much more information was required than the company had at the time. Immediate phone calls to partners were made, e-mails with attachments detailing experiments were sent and face-to-face conversations were initiated in order to clarify the extent and severity of the problem, gather opinions about the possible solutions and take quick action. Thus, the emerging activation trigger forced the firm to recognize its lack of knowledge and initiate knowledge exploration activities to fill this void. People are forced to admit their lack of knowledge, to look outside their present realms of knowledge and to find the missing pieces that remedy the shortcomings.

After the identification of an activation trigger, there is nearly always a discussion held to analyze the lack of knowledge that the trigger is pointing at and to choose the proper activities to adopt. In the case of a critical internal problem and identification of a “bad” situation, it is necessary to discuss how bad it really is and what it means to the firm. “Then we have to understand, what to do with it. Do we just accept it or do something”, reports the CEO. It is not enough to merely determine the absence of knowledge. It is necessary to analyze how desperate is the need to redress this absence. Thus, the parties to the issue discuss their options, complementing each others’ views by additional information and opinions to, firstly, reach a common understanding whether this is an important trigger, and then, if it is an important trigger, how critical is the gap in their existing capabilities and then, how large is the threat to the organization’s performance objectives? Is there a need to discuss the issue at a higher level of the organization? Depending on the threat that the trigger represents to the organization’s performance objectives, a wider group may have to be invited to contribute to the discussion and subsequent decision-making. Secondly, analysis and discussion will be necessary to decide what kinds of existing activities should be changed, and thirdly, to clarify whether additional information searches or expertise from partners is necessary before the firm can proceed with a new set of activities.

After extensive knowledge exploration activities and stabilization of the situation, the knowledge and capabilities of the firm will have grown, since the firm will be better capable of conducting certain processes with the compound and handling these things in the future. The tasks related to F1 in which the problem emerged can be executed in a better fashion next time. As the CEO says in relation to one activation trigger:

“We can build this information into planning next time, we will already know that problem with the substance and that there is no way to deal with it. Then the next experiment done with that substance will be easier and

completed within the time calculated. There might be many big challenges which are faults and then they are taken into account in planning the next trials. And in those trials it is not really an issue any more.”

Thus, there will be only a fraction of the time and expense involved in performing the same action next time, because the potential capacity and realized capacity related to the particular set of tasks have grown significantly.

These activation triggers make the path taken by F1 very challenging but also very unique, which makes the actor-network of F1 almost certainly inimitable by competitors. To protect that knowledge a patent family is built along the path of F1. However, patenting means that much of the information about the technology of producing F1 becomes available to the competitors. Therefore, in order to protect this knowledge from competitors, the patenting approach applied with F1 has been rather veiled in the sense that many technologies relating to the compound have deliberately not been filed.

In parallel with the development tasks, objectives are also set for the department of Business Administration. The definitions of their targets accord with the various steps in the commercialization of F1, culminating in attracting a pharma company. The aim is to sell knowledge related to F1, and to license F1 out for further clinical trials. The object of sales is not F1 as a compound or in terms of patents related to its production, but the entire F1 business unit. Since F1 is not a product that is ready for the market, but something that needs to be tested and developed further, the skills and experiences of people in the sphere of F1 are highly valuable in the market. Thus, a complicated and time-consuming process of commercialization is conducted in parallel with the clinical trials. If Business Administration fails to achieve its objectives in one commercial dialogue, the possible mistakes and weaknesses of the product concept will be considered before future collaborations, so constantly improving the capabilities tied to F1.

Managerial intervention in context

Much managerial attention has been on building an encouraging environment that would, on the one hand, facilitate communication and information sharing and, on the other hand, support the outcome controls along the path of F1. Various formal routines and communication structures have been created to facilitate knowledge integration that further enables the control of the progress of F1. By the term *formal* the present study refers to the institutionalized communication structures in the form of regular meetings (see Appendix 10). Managers insist that the comprehensive meeting system is specially built to guarantee that people with different experiences and skills are brought together to discuss a common matter. Although there is a group-level definition of a desired outcome, the knowledge

and experience of the people involved are different and, therefore, barriers to knowledge exist. Therefore, regular meetings are held in every project and department of the firm as well as for specific groups of chemists and pharmacologists.

At the research stage the role of management was merely to create an encouraging and motivating environment and feedback mechanisms. People in the laboratory were working in an obscure means-to-an-end reality, exploring information in the field and choosing their actions according to their beliefs about the desired compound. Managers could not intervene much in their choices of which type of information should be acquired from the field. It was not possible to intervene in types of knowledge that the firm should have to increase in order to be successful. In the research stages the managers could only provide the necessary equipment, databases and software to analyze the chemical formulae, and institute a system of regular meetings to evaluate results and discuss and brainstorm ideas for further activities. Thus, in processes in which the desired outcome is vague, it is not possible to do much except to provide good working conditions for the human actors.

The combination of the two elements, group-level targets for F1 (focus on knowledge object) and the system of meetings (managerial intervention in context), motivate people to act and to complement each other's knowledge, generally enhancing knowledge acquisition and assimilation processes in the firm. Firstly, the structured meetings encourage the groups to deliver and present their results. The chemists and biologists assimilate the available information much more carefully because they are well aware that they have to present the key points in the meeting. It makes them more thoughtful and careful in using the best possible information to hand. Secondly, the clear definition of outcome and the strategically relevant areas allow increasing the awareness of the issues that are important for the firm and the kinds of information that must be shared with a wider audience in the organization.

In addition to the system of meetings, the managerial role in building the context includes (1), implementing electronic tools to keep track of the matters relevant to F1, and (2) databases to store information. The electronic file about the matters relevant to F1 is combined with the quarterly meetings. The file consists of statements and definitions of the topics relevant to reaching the desired outcomes. Clarification of the desired outcome in terms of relevant therapeutic areas as well as markets and customers makes people more aware of the relevant matters. The Vice President of Business Development, who is also a scientist, describes the

mindset of employees before the implementation of the meeting and reporting system:

“In a project management meeting, they really talked pretty much hardcore science – receptors and compounds and those kinds of things. It is the step [implementation of that system] to make sure that what is agreed in here [at management level], is really then put into practice in our operations. It is very easy for experts to start to live their own lives – they do what is interesting and nice and where you might receive good results. [...] But it does not necessarily serve the purpose of the company’s existence.”

In particular after the implementation of special folder with the definitions of outcomes and the critical fields of interest, the people started to recognize relevant information in the field. Now when they participate in international meetings and conferences, they pick up the relevant information not only about the scientific and technical aspects related to F1 but also information about potential competitors and trends in the market. The Vice President of Business development tells happily,

“... there is a little bit more discussion now about competitors, the future, what all kinds of new products are entering the market etc. People are discussing these kinds of things ...”

In effect, the people start to analyze the opportunities and risks related to F1 and communicate these issues to each other raising awareness of the status of F1 in a wider competitive environment. Good news for the managers was that not only formal meetings, but also informal discussions started to be enriched by these topics.

The system of formal meetings has not only proved to be important in directing the progress of compound F1 but has also enabled to detect important activation triggers. Often a manager would say “Ok, that is enough, I do not want to hear it now, let’s have it in a management meeting, they will want to hear it too”. Then the issue is discussed with more people integrating a wider set of opinions before decision-making. This guarantees that the information about the situation is fully understood before making decisions. In other words, it guarantees thorough knowledge integration and assimilation processes before making action choices (before turning potential capacities into realized capacities). In many cases after the discovery of a compound, the results of the experiments may seem very good at first; the scientists’ emotions run high. However, taking the results into the meeting for presentation and objective evaluation, the weaknesses and problems become more evident and the performance of F1 may not seem so good any more. As the CEO says:

“You meet these guys [scientists] in the corridor, they are so proud that ‘we made a good experiment yesterday, we got cells and they are alive, now they have been cultured and soon they will be tested and it is progressing really well’. But when you get the people to put the data together in the meeting, then they realize that, well, it does not look so good.”

Then the neutral environment of the meeting enables the group of scientists and managers to ask themselves whether they are happy with the results. Without the discussion, it is not possible to interpret the results. There are just too many factors and qualifications about F1 that make it perform either well or badly. Wider discussion allows to analyze are these cells worth proceeding with. These kinds of decisions are difficult to make in the corridor and benefit from wider discussion. Neither is it sufficient to express these things only in written report. The CEO explains:

“The communication is much richer with nuances and details. In decision making it is important to read between the lines. You have lots of messages in your informal presentation and you reduce lot of those when you make a formal presentation in written reports. Managing these activities it is very important that you hear all the noise and you pick up all the signals amongst the noise.”

These signals represent possible activation triggers. In addition, the same meeting allows them to discuss the next actions and resolve the possible activation triggers that have hindered the success of the compound. The opinion and ideas of specialists with different backgrounds, education and experience are necessary in order to be able to draw conclusions and choose the next path to proceed.

Still, the heads of the departments complained that their views did not become visible enough in these meetings. Thus, in order to effectively detect and solve the activation triggers, it was not enough just to gather specialists together. For this reason, top managers implemented special meetings to investigate the same issues from different angles. These were special meetings in which the emphasis of the issues was switched and different people empowered to discuss the matters concerning F1. For instance, regular project meetings were held in which the general performance of F1 and the issues related to the biological targets were discussed. Then an operative-technical meeting was held right after the project meeting, but the floor was given to the heads of cost-centres (departments) who see the issues in totally different lights, often revealing the activation triggers that may not have been visible in previous meetings (see also Appendix 10). These meetings showed that various new issues came up that would not have been noticed otherwise and various new ideas emerged that would have gone unnoticed, not to mention that the heads of the departments were happy that their opinion and expertise was valued in the organization.

In addition to the internally built structures of communication a panel of external experts is set up. At the stage where F1 becomes a more concrete subject as a basis for a potential drug, it is possible to start acquiring knowledge from external experts in the field. Therefore, the expert panel, a group of the world's leading scientists, is gathered together. It is this panel that provides the firm with a neutral opinion about the progress and value of F1. They are also a source of information about the ongoing developments and emergent issues in the field, pointing out possible threats and opportunities. The external panel of experts recognizes the activation triggers in the market and, thus, increases the value of F1 and its related capabilities in the larger environmental context.

Summary of the case study

The case study shows that capabilities can be built without the measurement and reporting of IC. The managerial role is to define the desired outcomes and build up formal structures of the context in which knowledge is created and exploited. The case study illustrates how the desired outcome of the firm directs growth of knowledge, while managerial attention to the context evolves, structuring the processes that build up organizational capabilities. The managerial attention to the context involves building the procedures of communication that enhance the processes of knowledge acquisition and assimilation before the decision-making points in the firm.

In the beginning, when the molecule F1 came into existence, it was a single spot, a single molecule that represented a diverse set of opportunities for the firm. After the clarification of the desired outcome, a wide array of activities was launched related to research, development and commercialization. People started to work with the biological and technical elements of F1, exploring and exploiting such knowledge that they expected to lead to the desired outcomes. People recognized the relevant matters in the external environment related to the progress of F1, constantly increasing the knowledge base of the firm. From the birth of F1 to stage II of the clinical trials numerous activities are conducted with F1, simultaneously building the IC of the firm. All this growth has been directed by the management's concept of the desired candidate drug.

At the same time the emerging internal and external activation triggers point the attention to any shortcomings in existing capabilities. The processes of reacting to these triggers shaped the physical parameters of F1 as well as the organizational knowledge and capabilities related to it. The external activation triggers have shown the incompatibility of F1 with the external environment, forcing the developers to adapt their organizational knowledge and capabilities to align the progress of F1 with the environmental circumstances. The internal activation

triggers have shown the incompatibility of F1 with the first planned outcome, forcing the firm to face up to the lack of knowledge and explore new possibilities. In this way knowledge and capabilities related to F1 are constantly shaped and improved, making the final product concept more valuable in the market.

Finally, the knowledge and capabilities, built around F1, become the object of commercialization. The firm is not selling the compound of F1 as a product, but sells the whole F1 “package” – the knowledge about its behavioral properties and production that has been collected and developed over the last four years. In the beginning, it was almost nothing; just a loose association of ideas but now it is a bundle of highly specific and unique knowledge and capabilities that can potentially be applied to creating a drug for the treatment of a particular ageing disease.

4.2.2 *Description of case B*

Overview of the company

Case company B is a Finnish biotechnology company established in 1986. Employing about 25 employees, it operates in the medical biotech industry. The medical biotech sector in general includes the fields of genomic cancer therapy, tissue cloning, genomic diagnostic tools, infectious disease therapies, gene therapy, and xenotransplantation (Bergeron & Chan, 2004). Firm B is active mainly in genomic diagnostic tools, but also partly in other sectors related to diagnostic tools. The firm develops, manufactures, and sells diagnostic tests that are applicable to fertility, veterinary, food hygiene, and various infectious diseases. The tests are based on three technology platforms for which the firm has several patent applications worldwide.

Differently from firm A, firm B has its own production facilities and actively sells products in the market. The firm uses specialized distributors of diagnostic and pharmaceutical companies, which organize sales in their countries for hospitals, laboratories, and home-users. The main markets are in Finland, the Netherlands, Germany, the Baltic states, and China. The largest customers are based in Asia and Europe, but lately, steps have been taken toward the U.S. market.

The company has a flat management structure, with few administrative layers. The functions of the company are organized into six departments: R&D, production, quality control, equipment and facilities, marketing, and finance. As the dominant functions of the firm, the R&D and production departments are the largest, whereas quality control, equipment, and facilities account for much less

of the work force, serving the needs of the R&D and production departments. Marketing activities are conducted in the marketing department as well as the R&D department.

Managerial attention to knowledge objects

While case A had the molecules (i.e., compounds) at the center of managerial attention, the core of managerial attention in this case B is placed on two types of knowledge objects: (1) diagnostic tests that are in the development stage and (2) diagnostic tests that are continuously produced and distributed in the market. Comparing the business models of firms A and B, the important difference lies in the substance of what they sell. In firm A, the object of commercialization is the whole “package” – knowledge and capabilities of producing a compound and knowledge of how this compound acts in a living organism. In case B, knowledge about the technology and its production is not usually revealed; only the physical piece of the product with its application instructions is sold to the customers. Knowledge about the technology stays in the firm, but the result of the exploitation of this knowledge is a marketing and sales object. In other words, firm A sells knowledge about the focal object, which is grown along the path of the actor-network, whereas firm B sells those objects.

Management of the diagnostic tests that are in the development stage is similar to case A. The outcome control is applied in directing the progress of these tests. The knowledge of the individuals and groups of individuals is applied in specific activities to achieve the desired target with each test, whether it is the skill of setting up machinery, purifying a raw material, packaging, checking the quality of the patch, or introducing these rapid tests in international exhibition. Knowledge and capabilities are built according to the definitions of the desired diagnostic test – a rapid test for an infectious disease. At the same time, the equipment and facilities department sets up the production tools.

During the development of the “package”, knowledge and capabilities grow, increasingly accumulating various skills, experiences, and relationships while the test becomes ready for the market. The desired outcome as a definition of the end product (a rapid test for a particular infectious disease) directs the growth of knowledge, determining what kind of information and actions are more valuable. After the rapid test is developed, it is similar to a “package” with a complete set of knowledge about the product’s development, production, and quality. Various marketing activities, collaborations with distributors, exhibitions, and direct contacts with customers are initiated to sell the outcomes of this “package.”

Often the time pressure of issues that need to be solved in the production, marketing, or equipment and facilities department, as well as the time pressure of finishing R&D projects, narrows the managerial focus down on a shorter time period. Focusing on a short-term outcome, however, no longer serves the growth of potential capacities. The short-term tasks and ongoing problems with existing diagnostic tests start representing a hindrance for knowledge growth in other development projects, reducing the number of actions that would have increased the potential capacity related to other diagnostic tests of the firm. For instance, one morning managers *a* and *b* had an argument about visiting a small research center in northern Finland. The research center had shown interest in starting cooperation for the development of new rapid tests. The proposal for the application of the novel tests involved analyzing athletes' specific health parameters. The meeting with the research center was clearly future oriented to discuss the idea for the new test. Manager *a* saw new opportunities and relationships in a possibly growing field, whereas manager *b* wanted to emphasize current resources – directing the activities of human resources toward the current packaging question in production. Manager *b* questioned the time that would be spent driving to another city and sitting in a meeting compared to the uncertain benefits that these meetings may bring to the firm.

In this situation, the managers had to make a choice between two options: (1) the growth of potential capacity in a new therapeutic field or (2) applying the existing knowledge to ongoing activities of the firm, i.e., solving the packaging problem. If growth of potential capacities is chosen, the short-term results with the important knowledge object of the firm may suffer. If ongoing activities are chosen, the emphasis is put on exploiting existing potential capacities while limiting the growth of capacities in other areas. This time, the choice was made to participate in the meeting for the benefit of possible new knowledge.

To sum up, the managerial focus on diagnostic tests (central knowledge objects) can be implemented via short-term and long-term outcome definitions. Therefore, there is always tension between the creation of new potential capacities and the exploitation of existing capacities. In terms of IC, the growth of new potential capacities in the above situation means new partnership opportunities (new relational capital), which widens the activities of the firm to the new area. The new project would lead to structural capital changes in the form of technologies and product concepts, and finally to new elements in relational capital in the form of new distribution channels and customers. However, this decision may be costly for the ongoing affairs in the firm. Hence, there is a constant tension between investing in new capacities and exploiting the present capacities of the firm.

Managerial intervention in actors' behavior

After the R&D stage, the production department will materialize knowledge of each “package” into the firm’s products. In managing the diagnostic tests that are ready for the market, the management control is not directed at the end products but the activities in which the diagnostic tests are produced. People in the production department have to follow the comprehensive instructions that were produced in the R&D and quality departments. These instructions are part of the previously-mentioned “package” and represent explicit descriptions of how each batch of diagnostic tests must be produced. Thus, the focus of management control is not placed on these tests (knowledge objects) any more but the actors’ behavior in producing the tests.

The purpose of the production department is not to widen the knowledge base of the firm. The goal is not to generate new knowledge and IC for the firm but to apply existing knowledge that has earlier been generated by R&D activities. The production department represents the function of the firm in which most of the knowledge and capabilities are documented in an explicit set of instructions and records. Special job descriptions, highly formalized quality standards for each operation, clearly established rules, and routines in performing each task guarantee the necessary quality and sequence of events from material handling to production and packaging. The actors’ behavior is pre-determined by written instructions and standards that do not allow the actors to show much creativity. The main objective is to transfer existing potential capacities into realized capacities of the firm.

At the same time, the objectives of the marketing department are defined via the number of products sold (i.e., via the desired number of central knowledge objects). People engaged in marketing could choose ways to search for information in the field and initiate new contacts and relationships with the aim of reaching the desired objectives. The annual objective to sell 80 000 rapid tests requires the firm to extend its relational capital by finding new distribution channels and big customers. In other words, the actors are free to choose their activities and acquire new information from the field, as long as their activities serve the desired outcome. If the target is challenging enough, the desired outcome forces people in the marketing department to extend the capacities of the firm, whereas the particular type of rapid tests (type of knowledge object) determines which kinds of partners and customers (relational capital) may be potentially beneficial to the firm’s objectives.

The role of activation triggers in shaping the IC of the firm

In company B, no specific plans are made to build particular IC elements of the firm, but IC is constantly built and extended by reacting to internal and external activation triggers. Even the “packages” of knowledge in the production department are not completely closed sets of organizational knowledge, since the changing competition forces the firm to constantly improve its products. The R&D manager claims:

“There are always some important things, which are coming just from somewhere, and we have to solve these problems or we have to do something for production, which we have to do immediately.”

These events often occur as problems and obstacles in the R&D laboratory or production, or appear as particular quality issues, i.e., complaints, that are pointed out by the quality department. The operating managers put in lots of effort to, and a good deal of focus on these activation triggers. Triggers are continuously monitored, as the firm tests new raw materials and options for alternative production technologies. Performance measurement is also related to the triggers. Annual performance measures are usually set for each department, whereas operative performance measures are largely evaluated as the existence of internal activation triggers. The triggers form the real basis of the performance evaluation of each department. Wherever the discussion takes place, the performance is evaluated by the existence of the triggers. As one of the managers explains,

“The success ... I can only see if this is working by asking my subordinates whether there are some difficulties.”

If there are no difficulties that drive the performance of the department away from the desired path, things go on in the previously planned manner, and there is nothing to discuss further. Whenever problems or risks are detected, additional information searches will be initiated, and people will go into the field, look at the samples, and analyze the situation. The emerging obstacles show knowledge gaps, which destabilize the current processes of the firm and initiate searches for new knowledge. When an activation trigger emerges that is related to the diagnostic test in the production department, then the old set of production processes may be changed to update the product. The “package” will be opened again and improved by the new knowledge. When a problem, for instance, emerges in the R&D or marketing department, a whole array of information searches and discussions are held to stabilize the movement toward the desired outcome again. Or, alternatively, a whole new product family will be initiated, and a new set of knowledge “packages” developed.

Sometimes, in the case of negative triggers, if the problem does not have a significant effect on the outcome, the problem might remain unsolved for some time. In those cases when a problem occurs in products that are already in the firm's product list and actively sold in the market, it is known internally as a burning issue, and everything will be done to stabilize the situation. If the sales of the firm are threatened, much more effort is taken to find a solution. Especially, when some test shows false negative or positive results, then immediate action is taken. On the other hand, when the solution is not found in the necessary period of time (and the problem does not affect sales and no R&D partnership is at risk), then the problem is kept on the list of secondary issues, waiting for a solution to come. In some cases, however, the problem is so severe that no kind of externally acquired information would have any effect on the existence of a solution.

In general, the effects of the activation triggers in shaping the IC of the firm have the patterns already described in case A. The emerging triggers can also be more positive in nature; nevertheless, either way most of the triggers change the existing knowledge and activities of the firm. However, in order to illustrate case B, an example of an activation trigger is provided in the subsequent discussion. The following discussion describes the situation in which the activation trigger induces a variety of actions that lead to changes in the capabilities of the firm.

One morning, a Laboratory Assistant came to the R&D Manager and Quality Manager referring to a problem that she wanted to discuss with both managers. She had discovered a quality problem with the test C1. As she was fully aware of the possible threat that the quality problem may create for the organizational performance, she immediately notified these two managers to start a wider search for a solution to the problem. As always, an ad hoc meeting was initiated. The Quality Manager briefly describes the meeting that they held with R&D Manager and production people:

“We discussed the problem with C1. [...] We recognized that there is a difference in quality. We discussed what we could do with that. It is difficult if you have to adjust the sensitivity level with each batch.”

The first discussion did not lead to the solution, however, because the real essence of the problem was not yet clear. In most occurring problems, it is difficult to trace the cause of the problem. The R&D Manager explains,

“We could see that something weird was happening in our test, but we did not know why.”

They know that several factors could affect the results of the test C1, but none of these factors seem to be more likely than the others. Therefore, the managers gathered additional information about the situation and tested various factors to clarify which one is the reason for the emergent problem. The R&D Manager adds,

“Of course, we can make some educated guesses, so that we can think that this can be ... this might be the reason. It could be even the result of some different small things that alone do not make a difference, but if there are many small things, they can together cause some problems. And then it is really complicated.”

Therefore, knowledge exploration activities have been started to, first, specify the problem and, second, to make some educated guesses about the possible solution.

Since customers are waiting, the time pressure forces the managers to speed up their discussions and information searches (i.e. knowledge exploration activities). The test C1 is quite new in the market, but several important agreements with big customers have already been signed. Therefore, the problem cannot wait for long. Additional information is actively gathered, and ideas are generated. The brainstorming sessions, information inquiries from the field, and meetings are quite intense due to the short time period that they planned to finish the product C1.

After a few days, they figure out that the basis of the problem in the test C1 is due to a raw material, an antigen that causes differences in the quality level of the produced tests. It is a serious problem because it is the only suitable raw material in the market. Since they still do not completely understand the reactions with that material, the possible solutions vary. They conduct additional data searches and experiments. Finally, they have an idea. The R&D Manager explains:

“I expect that there is a problem within the first and last rolls, because it seems that the first and last rolls are different from the rest of the material. At least I hope so, because we have just changed from the first to the second one, and we just noticed that [the problem with rolls]. ... At least it is something which we should test now.”

By testing the idea and discussing the results, they finally develop a slightly different method of handling these rolls. The cultivation and purifying processes of the cells remain the same, but the firm manages to change the material handling, to extract the material in a different way, which results in generating a better product. Hence, as a result of the emergence of this antigen problem and the stabilizing actions that the managers perform, the test C1 starts to perform

better than it did before the occurrence of the problem. The R&D Manager says happily: “The final test started to work much better than the original one.”

Hence, the quality problem (i.e. activation trigger) forced the managers to improve the material-handling processes. The trigger showed that the existing processes were not satisfactory. Something had to be changed. In order to find the *thing* that had to be changed and the way it had to be changed, it was necessary to search for new information, activate more communication between the organizational members and partners, test their ideas, analyze the situation, etc. Thus, to change the processes, the firm had to learn the content of the problem and learn about new ways of doing things. All these knowledge exploration activities were initiated because of the trigger, which showed that the existing ways of doing things were not enough and something must be changed in the organizational capacities. With the help of knowledge exploration activities, the firm was able to develop a new set of activities, which finally led to a better-performing product – growth of the firm’s capacities.

The Quality Manager of the firm is particularly responsible for recording these kinds of triggers in the production department and keeping an eye on the ongoing activities. Corrective actions are also recorded in the quality system. If activation triggers force a change in production processes, the changes will be recorded in documents and instructions. As a result of the activation trigger cited above, documentation and instructions for the production department were updated with the new material-handling techniques. In other words, the knowledge “package” of the product C1 was improved.

Usually, there are numerous issues in different departments of the firm awaiting a solution. In other words, there are gaps in organizational knowledge that are waiting to be filled. These gaps largely determine what kinds of externally emerging new information and knowledge are recognized, acquired, and exploited in the firm. A solution may come from the field or even from other biotechnology sectors. The firm is constantly alert to the types of information that would fill the gap in existing capacities. The firm is also alert internally; whenever somebody has good results with some product, the results may also work in another product. Whenever new information occurs that can be helpful to resolve the outstanding issue, the information will quickly be discussed, and the necessary actions taken.

Individual and collective memory has a large role in associating new information with these unsolved issues of the firm. The possible fit of any new information and existing problems is continuously examined in their minds. If asked how often people check on the outstanding problems, the R&D Manager says, “In my

mind, every night.” Basically, there are several people in the firm alert to the kind of information that they think would help the firm. They intuitively relate the potential benefits of new information to the existing issues of the firm, and are able to continuously interpret and analyze new knowledge in the context of ongoing issues in the firm. The emerging opportunities are usually mentioned and discussed via phone calls or face-to-face meetings with the partners, or a contact met at some exhibition, for instance. Several managers in the firm (especially the R&D Manager, CEO, and Marketing Manager) hold the “lines open” with many players in the field, just in case interesting ideas and technologies emerge, or the firm needs help to solve some internal activation trigger. As one of the managers says, “...they are somebody I want to keep in touch [with] and have a line open, in case I really need something.” Thus, the contacts are kept active, even without ongoing co-activities with the partners. In doing this, the firm is holding and nurturing its potential capacity – in case some opportunity or problem emerges, the potential capacity will be turned into actions, that is, realized capacity of the firm.

Managerial intervention in the context

Since the quality system provides the framework for detecting possible internal activation triggers, people have a lot of freedom in choosing the ways and tools to communicate and choose their best ways to react to these triggers. Managers imply that the quality control system provides the only rules in the firm to detect activation triggers. The system of internal and external complaints enables the discovery of critical problems and later records the solutions of these problems in documents and instructions. However, the formal structures in the quality system represent only a fragment of the overall communication and decision-making in the firm. The system enables the detection of some internal problems, and sometimes some external risks, related to the products, but has still low significance compared to the overall information flow of the firm. The way people possibly detect activation triggers depends on what they read, what they notice, who they talk to, etc. Differently from case A, formal (regular and structured) meetings are kept to a minimum.

In most departments the way internal and external triggers are noticed depends largely on people’s working habits and information sources. The highly informal context (in terms of the knowledge triangle) largely evolved based on informal relationships and communication. Managers like to do things informally, and not overload departments with meetings and formal types of controls. They do not like long meetings, suggesting they waste valuable time. The CEO is convinced

that all kinds of reporting and a system of formal meetings are justified only in theory. He states:

“Theoretically, of course we can do that, but it is extra work, does it help, can we follow better? How does it help us? [...] We can load ourselves full of [these kinds] of different counting and work, without giving real value. If there are systems, which are out of our hands, which we cannot control, then we must look and count them. But [if] they are under our control, then the most important thing is that we do not waste time [on] this kind of things, we are wasting time for real things, which are driving further our business.”

Since there is no system of regular meetings in place, the meeting is not the tool for discovering an activation trigger, but the other way around: the emerging activation triggers tend to induce ad hoc meetings. Many managers often explain calling a meeting as: “The meeting was held, because there was a problem.” The R&D Manager says:

“If there are good results, they [people working in the laboratory] definitely come and [talk about] it. If there are bad results, they also come and ask me to see those results.”

Good and bad news are the main triggers that induce all kind of communication and actions in the firm.

Since formal structures are kept to a minimum, the knowledge integration methods largely evolved along their own path. Even in ad hoc meetings, the list of participants does not often depend on the formal hierarchy of the firm but the patterns of the relationships and the methods employees have used to discuss things. Often the issues are discussed with people whose job descriptions would not suggest their involvement. Individuals’ prior knowledge, personal preferences, and even the arrangement of working desks have influenced the evolution of communication lines. For instance, it is very common for the R&D Manager and Quality Manager to discuss production issues and, furthermore, largely affect production decisions, even if the issue is not directly connected to quality or R&D concerns.

Habitual communication patterns and informal relationships have also shaped the decision-making of the firm and the ways it reacts to emerging activation triggers. Every middle-level manager has developed his/her way of communication in the firm, following his/her routines of informing the others. For instance, one manager particularly dislikes big meetings and prefers to communicate things to each and every person individually, explaining it as follows:

“I am not good at telling something in meeting. That is not my way to do it. If I have to discuss something, I would tell it several times to every person individually, maybe in a [slightly] different way to each person. ... If I [say something] to marketing people, I have some way of doing it. If I tell it to some other people, then I use some other way.”

Most discussions and decision-making in the firm take place via face-to-face discussions either in the office or corridor, or even outside the office. As two managers carpool, numerous issues are discussed during the long drive out of the city, and important decisions may also be taken during these conversations.

The ways the communication patterns are built influence the knowledge integration of different functions of the firm, creating internal blocks of knowledge flows, which further influence the way activation triggers are reacted to. As one of the managers describes communication with another department:

“I do not talk with manager *b* or actually I talk with every person in that department [*b*], but they do not talk with me. So, usually I do not get information from department *b*, or I get the information [because] somebody in department *b* happens to speak to manager *c*.”

Normally, manager *a* gets information about the issues of department *b* via the manager of department *c*, and if manager *b* wants to disseminate information to manager *a*, manager *b* does it via manager *c*. After information about the emerging activation triggers has reached manager *a*, department *a* can contribute to the solution of the problem. Nevertheless, department *a*'s advice about possible solutions is often communicated to department *b* via manager *c*. These communication peculiarities involve not only managers *a*, *b*, and *c* but also other departments and their managers.

On the one hand, people in the organization have developed a collective understanding of these patterns of communication. They know who speaks to whom, and the peculiar communication methods are taken as a natural feature of the firm. People implicitly know who needs to be informed, from whom to ask advice, and who has to be invited to the ad hoc meetings. When some problem or question emerges in production, for instance, then the production people immediately know who should be involved, whether they need to discuss it with either the Marketing Manager, Quality Manager, or R&D Manager and when the issue should be brought to the attention of the Managing Director. When a particular activation trigger emerges, they intuitively know who to discuss it with. The patterns of knowledge integration have evolved over the years and been embedded in people's behavior in such a way that things are not questioned but implicitly acted upon. Everybody intuitively knows who has the necessary knowledge and skills, and, also, who is the easiest to communicate with.

On the other hand, people claim that the informal and ad hoc nature of communications hinders knowledge integration, blocking information flows between the different functions of the firm. This has led to mutual blaming and defensive reactions. This has sometimes made the internal knowledge integration processes slightly difficult. People complain that these peculiarities in communication have led to a lack of acceptance in decision-making, which makes the processes that solve the emerging activation triggers sometimes problematic. Lots of bargaining is necessary to reach a common decision. Important decisions are frequently made by only a couple of people during a conversation in someone's office, in the corridor, or over lunch. This increases the flexibility of the firm but also increases irritation and lack of acceptance by other managers and specialists of the firm. Later, the decisions are sometimes changed after other people have provided their opinions and additional information about the issue.

However, when the emerging activation triggers are more critical to organizational performance, then the institutionalized communication patterns have less impact on knowledge integration. People tend to overcome the difficulties in their communication, talking directly to each other and involving a wider audience in the discussion. Hence, in critical cases people concentrate their attention on the issue at hand, and overcome the difficulties in communication.

Summary of the case study

In the present firm, two types of knowledge objects have been at the center of managerial attention: diagnostic tests in R&D and diagnostic tests that are already distributed in the market. Differently from case A, the aim is not to commercialize the whole "package," only the effect of this knowledge. The definition of the desired outcome determines the direction in which the activities with the diagnostic tests (focal objects) tend to evolve in R&D, marketing, and the equipment and facilities department. The role of the production department is to turn potential capacities into realized capacities in which the organizational knowledge and capabilities are materialized in the diagnostic tests. Hence, the behavioral controls in the production department can intervene in the activities in which the existing knowledge and capabilities are exploited.

Similarly to case A, the external and internal activation triggers have a large role in shaping the organizational knowledge and capabilities of the firm. Emerging problems highlight the points where existing processes are not fully aligned with organizational objectives, and force the firm to improve its processes (i.e. existing realized capacities). Organizational members are forced to analyze the existing situation and acquire new knowledge to become able to change the existing way of doing things. As a result, the trigger leads to an increase of the potential and

realized capacities of the firm (or at least changes in the exploitation of existing capacities).

The formal and informal structures of performance evaluation and communication enable detection of and reaction to these activation triggers. The formal structures in the quality system enable monitoring of the activities in the R&D and production department to detect possible problems and risks with these focal objects. The formal system, however, builds only a narrow part of the overall context in which the activation triggers are detected and solved.

The context in which organizational members detect activation triggers, explore knowledge, make decisions, and act largely evolved without significant managerial intervention. Consequently, the patterns of knowledge integration do not follow the functional hierarchy of the organization but are largely based on other individual and organizational factors. This consequently has an effect on the effectiveness of the firm in reacting to the activation triggers. The processes of knowledge exploration and exploitation sometimes are not as smooth as the managers want the processes to be, since often there are blocks in information sharing and decision-making caused by too much bargaining among the organizational members. As a result, this determines how effectively the firm is able to adjust its IC (potential and realized capacities) to the internal and external threats and opportunities.

4.2.3 Discussion

Management as an implicit endeavor

The two case studies show how IC is constantly built and extended without measuring and reporting the elements of human, structural, and relational capital. In literature it is suggested that in order to make knowledge and IC valuable for the firm it “must be made explicit or “structuralized” to be owned and then profited on by a firm” (Johnson, 2002: 416). Managers are often advised to identify knowledge and make it explicit and accessible for managerial intervention (see e.g., Heng, 2001). The case studies show that IC management is rather an implicit endeavor, in which knowledge is not visualized and measured but managerial attention is directed to the actor’s behavior, knowledge objects, and the context in which knowledge is created (see Figure 13). The present study applies the term *implicit knowledge management* when referring to the modes of managerial intervention in which knowledge and IC is not objectified but managerial focus is on other organizational phenomena, consequently affecting organizational knowledge and capabilities. The managerial focus on knowledge

objects, actors' behavior, and the context can have a significant effect on the IC of the firm.

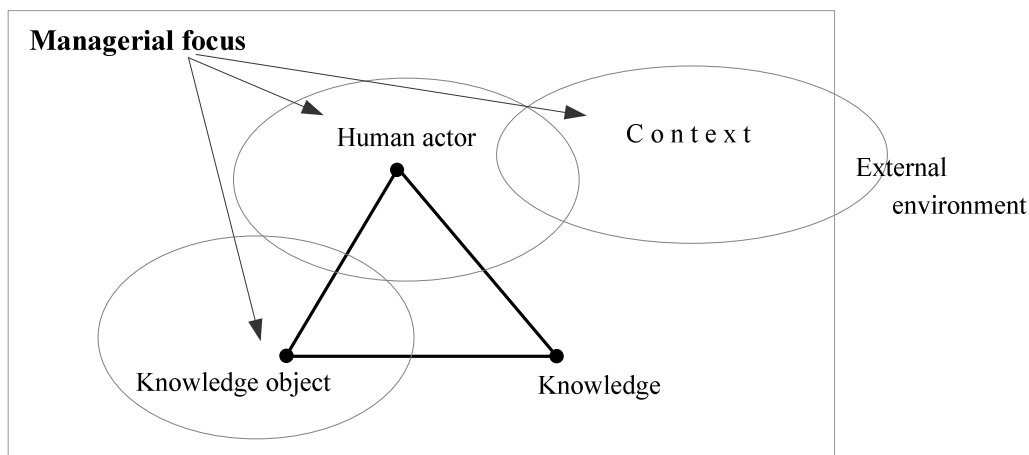


Figure 13. The focus of managerial intervention²⁰

In the firms, there are number of things that people know about and act upon. These are knowledge objects, things and artifacts of the real world, that are available for direct managerial manipulation. Knowledge, which is invisible, is highly entangled with these more visible kinds of objects. In both case studies, particular objects stand in the center of other objects – the focal objects that attract other things and relationships with them. In case A, these objects were compounds (molecules) that attract people and things (material resources, chemical substances, for instance) to themselves, forming an actor-network around each compound. In case B, there were two types of focal objects: products in the development stage and products already distributed in the market. These objects stand in the center of organizational activities, attracting people, other objects, and relationships with themselves. Each new partner, new material, or new piece of technology brings new knowledge to the actor-network of the knowledge object, widening the range of activities around the object. In this way, capacities are built by a multilayered structure of various types of knowledge (Kasunoki, Nonaka & Nagata, 1998; Sanchez, 2001b).

²⁰ In Figure 13, the spheres of managerial interest are drawn as overlapping because there are no clear boundaries between them. It should also be noted that for managerial purposes the meaning of the context here is rather narrow compared to the wider meaning of the context in the sociology of knowledge.

Despite slight differences in the business models of these firms, the patterns of knowledge and IC management are similar. By focusing managerial attention on the focal objects of these firms, the IC is implicitly built in the areas relevant for the firm. In the literature, it has been suggested that to create valuable firm IC human capital should be transformed into structural capital and customer capital of the firm (see e.g., Edvinsson & Malone, 1997; Stewart, 1997). In the above case studies, the focal objects attracted individuals, groups (human capital), and external partners (relational capital) to develop product concepts (structural capital). There, product concepts were further developed to attract customers (customer capital). These processes did not happen, however, due to explicit management and reporting procedures of IC, but the capabilities were implicitly created by directing managerial attention to more visible phenomena of the firm: the knowledge objects, human actors and the context in which the organizational capabilities were built.

The role of outcome controls

The managers' role is to direct the activities with the focal objects toward the desired outcome. Not all kinds of knowledge and relationships add value to the important focal objects of the firm. Not every piece of technology is beneficial to learn; not every relationship is necessarily valuable for the firm. Without care and attention, the knowledge and capabilities of the firm can grow in a wide variety of directions with no significant value for the firm. The firm could have a portfolio of IC spreading in different disciplines and functional areas, knowing a little about everything – and ending up with nothing but a waste of resources. Therefore, control is needed to direct the decision-making in such a way that IC would grow in directions valuable for the firm.

The goals and strategies of the firm define the direction in which the focal object is expected to evolve. The definition of the desired outcome determines the fields of activities and knowledge along the way toward this outcome. Clearly defined outcomes determine the diversity of knowledge generated and exploited in the firm. To achieve the objectives, the firm has to perform various kinds of tasks that have to be completed with the focal object. Employees with the necessary skills and experience are engaged in activities that contribute to the progress of the focal object. The desired outcome determines which information and contacts are more relevant to consider, which information needs to be saved for the future, and which is useless for the firm.

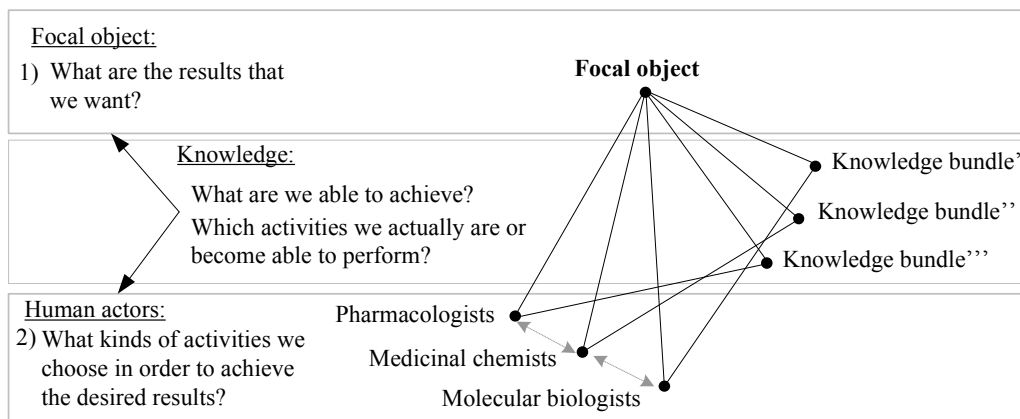


Figure 14. Decision-making in creating the actor-network²¹

Knowledge has various roles in the actor-network. Figure 14 illustrates the reasoning of the outcome control commonly applied in every R&D project in cases A and B. The figure presents the role of knowledge and the main questions related to the focal object, knowledge, and human actors. First, the goal-setting is conducted in the way suggested in the literature that considers the existing resources of the firm (e.g., Penrose, 1959; Itami & Roehl, 1987; Cohen & Levinthal, 1990). The initial experiences and skills, on the one hand, and managers' perception of the environment, on the other hand, provide the grounds for establishing the goals with the focal object. Nevertheless, the target is defined as the status of the knowledge object, not knowledge as a desirable asset. The targets are set considering the existing competences, the potential to learn, and the external contacts, but they are not about knowledge. The targets are about visible and more definable objects of the firm. For instance, in case A, the desired outcome was determined as a desirable compound F1 with technical and biological requirements. In case B, the marketing department had a sales target (80 000 rapid tests). These outcome definitions are defined via central knowledge objects of the firm (i.e. focal objects) – something that the firm wants to achieve with these objects.

Second, the existing knowledge and capabilities define the set of activities that the firm is capable of rendering. The targets, however, tend to denote a challenge

²¹ The correct term for the human actor in the actor-network is *actant*, and the focal object is an *actor* (Latour, 1987, 2005). Nevertheless, the present study applies the term human actors and knowledge object (or focal object) throughout the study to maintain terminological coherence with the initially introduced elements of the knowledge triangle (in Figure 3, chapter 2.2.1).

to the existing organizational capacities, encouraging human actors to learn and engage new knowledge in the actor-network. Formulating seemingly impossible goals is a way of “resource leverage” to overcome the constraints that existing resources represent for the firm (Prahalad & Hamel, 1990). The actor-network functions on the edge of its constraints, constantly aiming a bit more than the existing capacities would suggest. To reach the goals, the firm has to widen the edge of its constraints by continuously acquiring and assimilating new information, taking risks, and trying different sets of activities. The activities are conducted under conditions of scarce resources and incomplete knowledge about the ways the goals can be achieved. The greater the challenge for the existing knowledge base, the more new knowledge must be acquired and assimilated into the firm. Knowledge exploration activities, such as data searches, new interorganizational contacts, experiments in laboratory, and brainstorming sessions, can widen the existing knowledge base to reach the desired outcome.

The present study argues that by defining the outcome of the focal object the outcome controls has an effect on diversity of knowledge. Turner and Makhija (2006: 199) have suggested that the diversity of knowledge means that knowledge is related to the distinct disciplines and functional areas of information. In the present study, the question of diversity can be explained via a three-dimensional framework of knowledge. It was discussed in chapter 2.3 that it is important to align the disciplines and functional areas of knowledge and capabilities with the firm’s strategies. The value of organizational knowledge and capabilities relies on whether the diversity of knowledge in the firm is aligned with its business strategies, in other words, whether the firm has knowledge and capabilities in the areas of its strategic interests. The present case studies show that the outcome controls with the outcome definition via focal objects allow the firm to build its capabilities in the disciplines and functional areas necessary for the firm.

Organizational goals define which kind of knowledge is necessary and more valuable for the firm. The definition of the desired outcome plays a large role in influencing choices in knowledge exploration, favoring new knowledge from certain disciplines, and ignoring others, consequently shaping the diversity of knowledge and capabilities of the firm. To be more precise, there is a step called “recognizing the value” before the process of knowledge acquisition (Cohen & Levinthal, 1990; Todorova & Durisin, 2007). With this step, important information will be recognized. The present study argues that the definition of the desired outcome largely determines that value. External information is recognized as valuable if it is expected to contribute to the desired outcomes. In this way, the defined output induces the growth of knowledge that is valuable for the present strategies of the firm. Todorova and Durisin (2007) proposed that power

relationships have a moderating effect on recognizing the value and exploitation of new knowledge. In this light, outcome control can be seen as part of internal power relationships directing the choices of the knowledge acquisition, assimilation, and exploitation processes.

The outcome definition usually includes a time period in which the outcome is expected to be achieved. In this light, the outcome controls affect not only the diversity of knowledge but may also affect the speed with which knowledge is acquired and turned into realized capacities. The time period to reach the targets puts pressure on the people accountable and forces them to speed up knowledge exploration activities around the focal object. Kim (1998) has suggested that the higher the speed and intensity of the efforts in gathering knowledge the more quickly the firm will build its capabilities. Nevertheless, the speed and intensity are worthless if the direction of the knowledge acquisition is not congruent with organizational strategies, i.e. if the knowledge does not contribute to the desired outcome. Thus, it is necessary to have both speed and diversity to maintain the desirable development of the organizational capabilities.

The speed of knowledge growth and diversity of knowledge have, however, different meanings in the management of research activities. In research, it is possible to define only some qualifications of the focal object, which would be valuable for the firm. Leitner and Warden (2004) have suggested that in research the goals are interpreted more as “corridors,” defining the direction with enough room for evolution. The diversity of knowledge as necessary disciplines and functional areas of organizational interest can be defined only in a rather broad sense. Neither is there a specific definition of the deadline in which the desired result must be achieved. Managers cannot use time pressure to make inventions come more quickly. The time limit has no influence on how fast the outcome will be achieved. At this stage, the potential capacities of the firm will be significantly increased, but no one can determine exactly how fast the new valuable piece of knowledge should be created. The main managerial role here is to create an encouraging context for the human actors – a motivating environment that allows the human actors to choose their own ways of learning and doing things.

In development activities, and in marketing and sales departments, speed becomes highly important, since the definitions of the desired outcome become more concrete and manageable. The speed and direction of knowledge growth become more controllable. At the same time, the growth of potential capacities would slightly decrease. The efforts are directed at establishing solid ground for turning the generated potential capacities (i.e. new product technology) into realized capacities (that is, to transfer the technology to the production department and

commercialization processes). The basis of the new knowledge becomes more and more solid and ready to be engaged in productive actions. The managerial focus on the focal object considerably increases with clearer targets and deadlines. The diagnostic types of controls become relevant, whereas the extent of interactive control decreases (Simons, 1995). Particularly during the last phases of development, the speed and targets become very critical, directing the managerial focus clearly onto the focal objects, and less onto the context of knowledge creation (see case A).

The extreme pressure of time and outcome would, however, increase only the kinds of knowledge that are quickly turned into realized capacities, raising the risk of losing organizational flexibility. This strengthens the path dependency of existing organizational capacities (Levinthal & March, 1993; Weiping, 2006), not leaving time and motivation for tentative studies and learning in areas potentially beneficial in the future. The extreme pressure on a short-term outcome would force the employees to direct the knowledge search only toward the domains where immediate actions are needed. For instance, in an extreme application of diagnostic controls (Simons, 1995), knowledge acquisition would help only the existing tasks and outcomes leading the firm into the competency trap described by Weiping (2006). In this situation, the creation of the potential capacity follows the existing needs but ignores the long-term threats and opportunities in the business environment. It is especially risky in a highly changing environment, where the firm is not capable of reacting to changes in the competition (Weiping, 2006).

In addition to the speed of knowledge growth and diversity of knowledge in building organizational capabilities, the group-level definition of the outcome would affect knowledge flows from the individual to the organizational level. Especially, a high level of uncertainty in choosing the activities toward the desired outcome forces people to integrate their knowledge that consequently increases knowledge flows from individual- to organizational-level knowledge. The outcome controls include the output measures (focusing on the focal object), as well as the procedures for evaluating the output and discussing further actions (providing the context). In cases A and B, the outcomes are defined for entire projects, departments, or a particular manager who leads the group of individuals. One individual is rarely responsible for the success of the focal object. Instead, people are part of larger actor-networks, since individual knowledge remains incomplete for the desired organizational goals. Turner and Makhija (2006: 199) define the completeness of knowledge as the “degree to which the knowledge for making decisions or completing tasks is entirely sufficient and available for the decision maker’s use.” Knowledge is usually incomplete in high task-uncertainty,

forcing people to conduct more complicated information searches. People search for additional knowledge to make their knowledge more complete for the tasks they have to accomplish. For that reason, the outcome is achievable only through lots of common effort and collaboration, aggregating the knowledge and activities of many individuals. Consequently, individual knowledge from various disciplines and functions becomes integrated into organizational capabilities.

In the R&D, marketing, and sales departments (in cases A and B), the managerial attention was placed on focal objects. In the production department, however, people were instructed and controlled by behavioral controls. To apply behavioral controls, there has to be a “package” of knowledge ready for exploitation. Such a “package” includes explicit instructions and rules of behavior. Production people must turn this “package” into the firm’s realized capacities without adding their own ideas and interpretations to it. Thus, the behavioral control is primarily directed toward turning existing potential capacities into realized capacities. The growth of potential capacities appears only after the emergence of some activation trigger.

Activation triggers shaping IC of the firm

There are external and internal events that may induce the firm to extend its potential and realized capacities, adjusting the IC to organizational strategies and the external environment. These events represent activation triggers that may emerge in the form of new knowledge or some problem that forces managers to reevaluate the existing progress and status of the focal object. According to Levinthal and March (1993), failure is the main mechanism that leads the firm to excessive exploration of knowledge. The activation triggers can be in the form of negative events inside the firm or rapid changes in the external environment that force the firm to redefine its strategy and acquire new knowledge. The activation triggers found in case studies A and B are summarized in the following categories (see Figure 15).

The activation triggers may have a significant effect on the current situation, destabilizing the whole actor-network of some products. The existing organizational goals determine whether a trigger represents an opportunity or a threat. In the case of a trigger that represents an opportunity, the firm faces new knowledge that either encourages the achievement of present goals or creates opportunities for new ones. New knowledge may create an opportunity to define new goals and strategies for either improving existing products or starting new projects. Various information processing procedures and meetings (knowledge integration mechanisms) will be initiated to analyze the opportunities and gather

additional knowledge. Thereafter, the activities are chosen to pursue the opportunities and build up new capabilities of the firm.

	Opportunities	Threats
Internal	New ideas, inventions, successful experiments	Emerging problems and bottlenecks in production, machinery Unexpected failures in R&D
External	New ideas and inventions from partners. New markets and partnership offers.	Problems with suppliers. Obstacles in patenting New competitors, negative changes in the market.

Figure 15. Types of activation triggers in the case studies

A trigger that may jeopardize organizational performance is categorized as a threat. An internally emerging threat tends to show that the organizational knowledge and capabilities are not congruent with the existing strategies of the firm. The triggers show the gaps in existing knowledge and encourage the firm to more actively acquire and interpret knowledge, increasingly raising the firm's potential capacity (Levitt & March, 1988; Zahra & George, 2002). It shows that the existing capabilities of the firm may be incomplete for the desired outcomes. In other words, the activation trigger generates a situation in which people feel the absence of knowledge. Spender (2006) has suggested that people generally feel the absence of knowledge rather than its presence, and managers react most strongly to knowledge absence. The present study suggests that triggers can show the lack of knowledge that needs to be fulfilled. Individuals of the organizations are forced to conduct a whole array of actions to fill the gaps in knowledge and stabilize the situation to move it back towards the initially planned output (see Figure 16).

The trigger points to the lack of knowledge in some areas, showing that the things that the firm does and the way the firm does these things are not enough for the desired outcomes. Usually, a lack of knowledge is identifiable as incomplete knowledge about some thing or a process that the trigger points at – quality problems with some focal object or a lack of ability to perform some task, for

instance. Consequently, information searches and learning would be particularly directed to the areas where the trigger shows the lack. People are forced to acquire new knowledge or exploit existing unused capacities to fulfill this specific lack of knowledge. Knowledge exploration activities lead to the increase of potential capacities that enable organizational members to respond to the trigger, adjusting the realized capacities to fulfill the specific lack. The existing knowledge and partnerships are applied for different purposes, or some skills and know-how are exploited whose existence had not been recognized before.

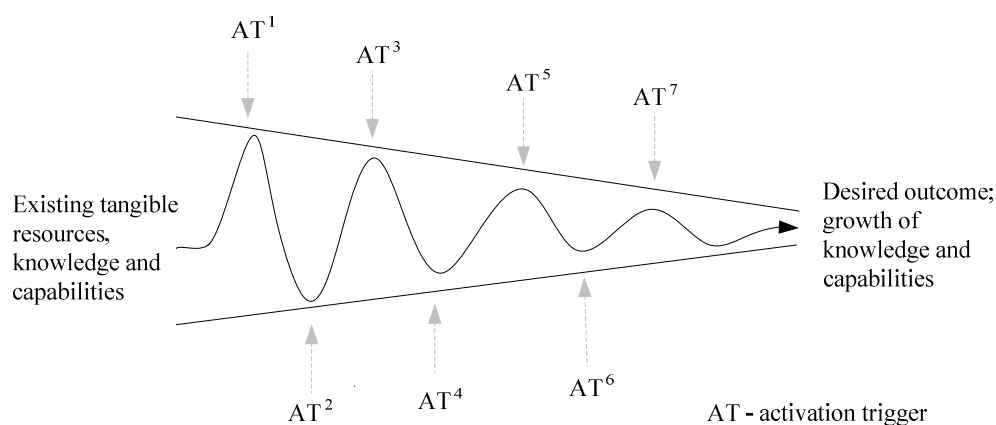


Figure 16. The directing force of outcome control

Zahra and George (2002) have suggested the characteristic of intensity to further describe an activation trigger. In light of the present discussion, the intensity of the trigger can be defined as the degree to which the trigger jeopardizes organizational performance. When there is a high risk that the trigger jeopardizes the achievement of the organizational objectives, the information searches and actions to stabilize the situation are conducted as quickly as possible, speeding up the whole array of processes. For instance, the toxicology problem described in case A could be defined as being very intense and representing a large threat to the organizational performance. Similarly, in case B, the quality problem with the test C1 was critical, since the customers were waiting. Acquisition of new knowledge and necessary actions were conducted as quickly as possible to normalize the situation again. The analysis of the circumstances and new decisions were completed within days. In many other situations in the case studies, the triggers were not as critical to the organizational performance.

Consequently, less time and effort were invested in knowledge exploration activities to react to those triggers.

The intensity of the activation trigger also defines the level of knowledge integration. Problem-solving and knowledge integration are highly related. Knowledge integration induces problem-solving and learning, especially when people share cooperative goals within the groups (Tjosvold, Yu & Hui, 2004). As a problem can be discussed and solved at various levels of the firm, such as at the individual, group, or organizational level (Lang, Dittrich & White, 1978), the intensity of the problem influences the level at which knowledge integration takes place. For instance, after the emergence of the toxicology problem in case A, meetings were initiated that gathered the people on the project, as well as the firm-level management. Finally, the matter had to be discussed at the level of the board of directors. The exact level of discussions is also affected by the communication and management control systems' organizational routines. In case A, the range of relevant people was defined by the organizational structure and formal meeting structures. In case B, people developed their own personal ways of communicating and reacting to activation triggers.

The triggers emerge almost every day, shaping the IC of the firm and making the development of organizational knowledge and capabilities unique and firm-specific. Numerous activation triggers that emerge and are being solved over time leave a trail to the organizational capabilities. The outcome controls and formal structures of communication and decision-making, on the other hand, shape the ways the firm reacts to those activation triggers. Barney (1991: 107-108) has argued that inimitability of a resource can be achieved when a resource is obtained along a unique historical path of the firm. The present study suggests that internal and external activation triggers influence the historical path of the firm, making the organizational capacities difficult to imitate or substitute by competitors.

If the firm is able to adequately react to emerging activation triggers, then the IC of the firm also becomes more valuable in terms of Barney's resource attributes (Barney, 1991). Chapter 2.3 of the present study discusses that in addition to the inimitability and non-substitutability, organizational knowledge and capabilities should also be valuable in the market. The present study suggests that an externally emerging activation trigger represents a sign that the existing strategies, as well as organizational knowledge and capabilities, may not be congruent with the external environment. Therefore, the firm is forced to stop and analyze the situation, search for more information about the emerging activation trigger, and find ways to adapt the existing capacities to the environmental

circumstances. Consequently, the IC of the firm becomes more valuable by being better aligned with the environmental circumstances.

Managerial intervention in the context

Whereas the definition of the desired outcome provides the direction in which the IC starts to evolve, the formal and informal communication, information-sharing, and decision-making structures facilitate the processes through which the IC evolves. These structures build up the context in which knowledge and capabilities are developed. Organizational hierarchy and procedures of communication represent formal structures, whereas organizational culture, personal relationships, and social ties build up informal structures for the creation and application of knowledge. It is possible to managerially intervene in the development of organizational knowledge and capabilities by building the firm's formal structures. A general outline of the managerial role and the processes in which an activation trigger shapes the potential and realized capacities of the firm is illustrated in Figure 17. The opportunities for managerial intervention in creating a suitable context are elaborated in the left column. The organizational learning processes are drawn in the right column. The definition of organizational goals would lead the general direction of these processes, whereas the formal performance evaluation, communication, and decision-making structures would affect the smoothness of these processes.

The processes start with performance evaluation procedures in which reports are presented in a monthly meeting or ongoing issues are simply analyzed during managers' informal discussions. Usually the outcome measures are defined for a longer time period, such as a quarter or a year. Nevertheless, in the short run, the real performance indicators are the existence and intensity of an activation trigger. In many departments, operational performance is evaluated mainly based on the scope and intensity of the activation triggers. Hence, one of the roles of the reports and discussions is to discover these triggers. The narrative form of reporting, either in a combination of reports and structured meetings (in case A) or only in the form of ad hoc meetings (in case B), allow the detection of internal and external activation triggers. So, if there are no problems and unreasoned risks, the processes will continue according to the plans. Conversely, if there are obstacles and problems, then the second step is to initiate discussions and information searches to find a possible solution for the trigger.

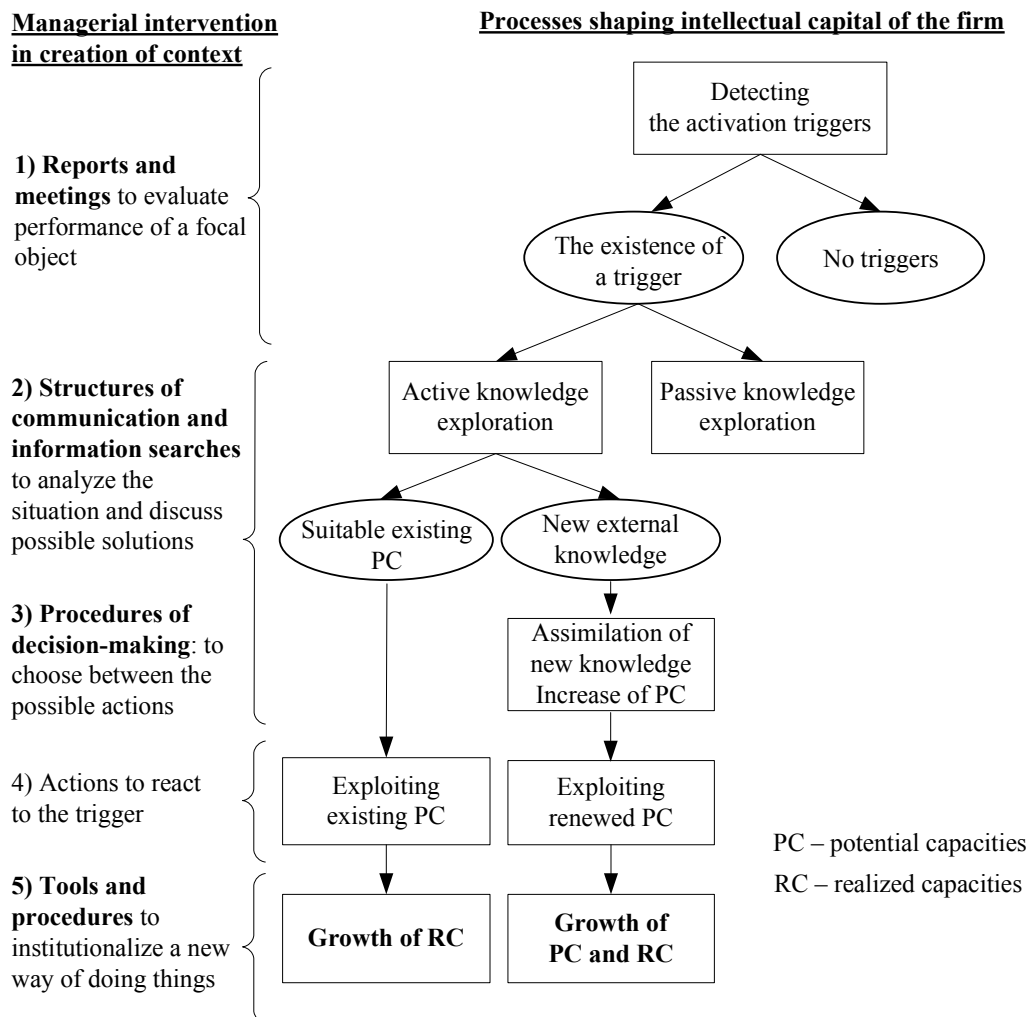


Figure 17. The managerial role in building IC of the firm

As a result of the trigger, the existing knowledge suddenly becomes incomplete (Turner & Makhija, 2006). It creates an impulse to re-evaluate the existing processes of the firm and search for additional information to fill the gap in existing knowledge. If the activation trigger is intense in terms of high risk to organizational performance, active knowledge exploration activities will take place. People who are accountable for the particular focal object initiate immediate searches of internal and external knowledge to address the trigger. At the same time, the desired outcome and the scope of the trigger would determine the kind of information that they will recognize as more valuable in addressing that trigger. If the activation trigger does not represent a high risk to organizational performance compared to other ongoing affairs, a passive knowledge exploration takes place. In the passive mode, people are not actively

engaged in resolving the situation. They merely stay alert to possible solutions. Thus, passive knowledge exploration means that the issue is “left on hold” until suitable knowledge emerges in the industry or during other activities of the firm.

To enhance the processes of knowledge exploration, managers can intervene in the context in which the organizational learning processes take place. The firm can build formal structures for communication and decision-making. Organizational structure affects the efficiency of problem-solving (Becker & Baloff, 1969). In case A, a comprehensive system of meetings was built to enhance the knowledge acquisition and assimilation processes in the firm. In case B, the lack of formal systems created a significant role for informal structures in communication and decision-making. Sometimes, however, the activation triggers are so intense that the influence of the formal and informal structures of the firm is lower than the effect that comes from the trigger. The decision-specific characteristics, including the threat/crisis component, may have a larger influence on the process than the organizational and managerial context (Papadakis, Lioukas & Chambers, 1998).

The third step is decision-making, that is, the choice between the possible actions. After knowledge exploration activities, the information base is wider, and it is possible to make a choice between a set of actions. Here, the definition of the outcome plays a significant role in directing the choice between the actions. The definition of organizational objectives and scarce resources plays a large role in choosing the possible actions, i.e., influencing the types of potential capacities that are going to be turned into realized capacities. Usually, the choice is made in favor of these kinds of actions that would maintain the initial journey toward the organizational goals. This is because of the stickiness and path dependency of organizational learning (Dierickx & Cool, 1989; Cohen & Levinthal, 1990; Levinthal & March, 1993). Overly rigid organizational goals would increase the path dependency even more.

The fourth step is conducting the actions that would solve the situation and improve the firm’s existing capabilities. As a result of these processes, capabilities are extended in two primary ways (see also Cohen & Levinthal, 1990; Grant, 1996b; Zahra & George, 2002). First, the existing capacities are exploited in new ways, or unused capacities are recognized and exploited. Second, new knowledge is acquired and assimilated in the firm to exploit the knowledge in new activities (i.e. new potential capacities are built and turned into realized capacities). Similar paths can also be detected in Appendix 6. In the first path, the potential capacity is recognized inside the organization, and in the second path, potential capacities are extended by externally acquired or internally generated

new knowledge. Both paths lead to the extension of organizational capabilities, that is, realized capacities of the firm. Some parallels can be drawn with single-loop and double-loop learning (Argyris, 1978). In single-loop learning, capabilities can be extended without the extension of potential capacities. In double-loop learning, significant changes in potential capacities are conducted.

The fifth step of the above-given processes (Figure 17) is necessary to institutionalize new (or usually modified) ways of doing things. It happens through establishing new technological practices, forming written instructions how to perform certain tasks, making changes in partnerships, or creating new rules of organizational behavior. In terms of IC categories, these kinds of changes would most commonly affect the structural and relational capital of the firm.

The role of the present study is not to describe the processes of organizational learning but to outline the means of managerial intervention, however. First, the outcome controls affects the direction in which these processes would usually evolve, determining the strategically important domains of knowledge for the firm. Second, the managerial role is building a suitable context that shapes the procedures in which the activation triggers are detected, discussed, and acted upon (in the left column in Figure 17). The reporting and meetings procedures enable the discovery of activation triggers on time. The structures of the context that support interorganizational communication and decision-making also enable the firm to react to these triggers, facilitating the organizational learning processes. In addition, tools and procedures for recording and formalizing the changes enable the institutionalization of new capabilities of the firm. It was seen in case A that a comprehensive system of meetings was built to support outcome controls and induce knowledge integration mechanisms. In case B, the context evolved by itself, shaped by personal relationships and conventional lines of communication. As a result, people built their own structures of communication, creating peculiar ways of information sharing and decision-making, which consequently affected the organizational learning processes.

To sum up the two case studies, it can be concluded that the development of organizationally valuable knowledge and capabilities is not a deliberate managerial agenda with a clear plan and acts of execution. It is rather an implicit endeavor, influenced by several means in which more visible kinds of phenomena are managed in the organization. Bijker and Law (1992: 7-8) have studied technologies and argued that technologies are not purely technological. They are highly heterogeneous and affected by social, political, economic, and professional skills and boundaries. Similarly, in the present case studies, the products that are developed and produced are not purely technological constructs. They are shaped

by numerous circumstances and activation triggers. The experiences and skills that are bundled with the activities around these products are shaped in a similar way. In this way, organizational knowledge and capabilities evolve along their firm-specific path, shaped by the internally and externally emerging activation triggers. Taken to another organization, for instance, similar knowledge and capabilities may start to take completely different forms and shapes as a response to new circumstances.

The role of activation triggers is, however, not merely to affect the creation of IC in arbitrary ways but to show the absence of knowledge in the existing capabilities of the firm. Internally emerging triggers have the potential to show the inconsistency between the existing capabilities and organizational goals, whereas externally emerging activation triggers may show that the organizational capabilities are not aligned with the environmental circumstances. Reacting to these activation triggers makes organizational capabilities more valuable and dynamic in terms of the RBV. Despite the implicit nature of management, the interventionist power of management control determines the intensity of the activation triggers, affects the choices in reacting to these triggers, and allows the enhancement of the organizational learning processes. Hence, a combination of management systems and emerging triggers makes the path of the developing organizational capabilities highly firm-specific and unique. Consequently, these kinds of capabilities are most likely valuable, inimitable, and non-substitutable by competitors (Barney, 1991; Teece, Pisano & Shuen, 1997).

4.3 Case study C

4.3.1 *Description of case C*

Overview of the firm

Case company C was founded in the late 1990s. The company is significantly larger than the firms cited in the previous case studies, employing about 100 employees and having several business units worldwide. The firm operates in the biomaterials' sector, in a very fast-growing segment of the global orthopedics market (Bergeron & Chan, 2004), developing and producing biodegradable medical implants, such as biodegradable plates, screws, pins and membranes. This field and the other fields of pharmaceutical, agricultural, and medical biotech industries are very interdependent. The activities of the company are closely linked to the medical biotech industry in that the company produces enabling technologies that surgeons and other physicians can use in their practices.

The main difference from the other case firms is the rapid growth and multinational nature of the firm. In addition to Finland, the company has corporate offices in the United States and Central Europe, and also several research centres and sales forces in other countries around the world. The firm has developed and launched 10 different product lines in over 40 countries in the fields of surgery, sports medicine and orthopedic traumas. It has more than doubled its sales in few years (2004-2007) as a result of new product releases and an increasing demand for its products.

In this case firm, the general patterns of knowledge management are similar to those in cases A and B. The IC management is rather implicit, as there are no particular tools for identifying and measuring IC (patents being the only exception). Similarly to the previous case studies, there is no IC measurement and reporting in the firm in the way suggested in the literature. Most managerial attention is placed on three types of focal objects in the firm: (1) biodegradable materials and technologies at a stage of research, (2) products and technologies in development, and (2) the products that are already distributed in the market.

The actions and general logic of organizational learning in addressing the activation triggers are similar to the previously discussed cases. As in cases A and B, case company C also uses an outcome control in most of its functional areas. The general role of outcome controls in building the IC of the firm is the same. The outcome definitions determine the disciplines and functional areas of knowledge that are beneficial in reaching the desired end. The actions and general logic employed in addressing the activation triggers are also similar to the previous case studies. The main difference lies in the scale of these processes, crossing multinational boundaries of the firm.

There are some differences and additional evidence, however, which emerged in case study C. The case study shows how the formal and informal structures of the context affect the creation of the potential and realized capacities of the firm, generating the circumstances in which the firm suddenly realizes that there is too much knowledge in the firm. In the following sections the formal and informal structures of the context are described along with the effects on the potential and realized capacities of the firm. During the field visits for case study C, issues of excess knowledge exploration emerged that eventually forced the top managers to rebuild the context in which knowledge was created and applied in the firm. Thus, the case study shows the circumstances that finally led to the firm changing its forms of managerial intervention, and paying more attention to the potential capacity of the firm. The study shows the circumstances that led the firm towards a more explicit kind of knowledge and IC management.

Formal structures of the context

Compared to the previous case firms, the present firm is significantly larger in its scale and representative structures. The comprehensive formal structures are built to manage organizational actions according to the restrictions that are represented by three competing discourses – the economic, legal and regulatory. In order to effectively manage organizational actions in considering these discourses, various formal structures are built covering the areas from R&D, manufacturing processes to distribution and marketing.

To cope with the economic discourse, a comprehensive system of strategic and operating planning has been built with budgeting and outcome indicators. The accounting department with several accountants and controllers manages a thorough system of budgetary control in which the budgets of business units and organizational departments are monitored on a quarterly basis. The information flows via accountants and controllers, however, include hardly any non-financial data that could refer to IC. The accounting department produces reports that contain only numbers. The controller states: “Headcount is the only one, which is not monetary, but a number anyway”. The real story about the results of each department is not handled by the accounting department but represented in a set of monthly indicators and short narratives by each department manager. These reports are collected and presented via other channels to senior management. In that way, the control of the processes and results of the firm is highly supported by reports other than those contributed by accountants.

Legal and regulatory discourses force the firm to adapt its activities to a number of regulatory restrictions. It is important to combine technological and scientific knowledge with the knowledge of quality systems and approval procedures of regulatory affairs. Therefore, the comprehensive quality system provides a significant part of the formal structures that determine the rules of action in most of the departments, especially in the production and R&D departments. The comprehensive and strict design control has proved to be effective in gathering professional knowledge and analysis of issues from different fields, such as biology, engineering, marketing and production. It has allowed the firm to bring products to market (including the regulatory clearances) in an efficient manner.

At the time of the first half of the field visits in the winter of 2005/2006, the company had a flat functional management structure. The seven departments of the company were organized around the main functions of the firm, such as R&D, operations, new business development, finance and administration, marketing and sales, and quality. The top management got the information about the performance of each function of the firm based on monthly reports from the

senior managers. Since the results of each department were often dependent on the activities of other departments, it required lots of communication and coordination of activities across different functions of the firm.

The decentralized structure had been combined with a strict system of documentation, storing information about each decision and activity in special databases. Databases have been built in order to create an institutional memory and share information across the whole organization. All the documents are signed and shared in electronic form. In addition, in some functional areas, product development for instance, there are approvals systems the directors have to validate for each completed task. For instance, the director of product development has to approve the deliverables in the system. When his subordinates have completed a particular task, they send him a draft of the written document about the results of the task. The Director of Product Development gets it via an electronic system, reviews it, and signs it electronically, or sends it back with comments appended.

The quality system and outcome controls include numerous structured meetings. Since the desired outcome is often defined for the team not for a single person, people are forced to communicate having an additional number of unstructured ad hoc meetings. Group level responsibilities and the development of products that span the organizational units force the firm to maintain a large number of meetings to integrate relevant knowledge. To facilitate all that communication and to store important information, special electronic team-rooms have been developed. Team-rooms are integrated groupware environments for electronic communication and information-sharing. These enable the firm to gather and share specific kinds of knowledge related to focal objects and processes of the firm.

Thus, an important role of managers has been to develop a suitable context in the form of information sharing tools and databases. The documentation and signing procedures are in electronic form. The web-based team-rooms are used to store a considerable amount of formal and informal information. All kinds of plans and reports, full accounts of discussions and arguments occurring during decision-making are all saved in the files of the team-room system. Since managers cannot always be physically around due to the geographical location of the headquarters team-rooms become more and more valuable for communication. The opening of clinical centres in Europe and North America (16-17 centres altogether) has increased the significance of team-rooms in sharing relevant information and coordinating activities.

Team-rooms are also used for the kind of decision-making that requires a large amount of information and acceptance from many managers and specialists in the firm. During the discussions, different specialists add their opinion and relevant information to the topic in the form of additional text and attached files. The electronic discussion is open as long as everybody has agreed and approved the documents. In this way, the team-room enables the firm to gather necessary information and knowledge from people to build a package of knowledge about a specific topic. Moreover, the topic that is usually discussed is closely related to some focal object of the firm and its activation triggers along the path to the desired outcome.

The structure and exploitation of these team-rooms is flexible, however. Each department has created its own ways of communicating and restoring the discussions. Top managers have left the middle managers to run the team-rooms in the way that is most convenient for them. Therefore, in some departments the relevance of team-rooms is more significant than in others. The most comprehensive team-rooms are related to R&D, intellectual property rights (IPR), quality assurance and control, and the general management of the firm. There are also team-rooms specifically related to the external activation triggers that come from the changing environment. The IPR manager continuously monitors the activities of about 50 competitors which is reflected by providing short overviews of critical activation triggers into a specific team-room.

Informal structures of the context

Despite the comprehensive formal structures, organizational members have a large degree of autonomy in choosing their ways of doing things. People even feel that the majority of communication and activities are organized in rather informal ways. Above the formal structures of the organization there is a significant amount of self-regulation and informal lines of communication and action. Managers grant high degrees of autonomy to the employees of research, development, marketing, legal affairs and other departments (the production department being an exception). The clear definition of the targets provides a lot of freedom for people to choose the most appropriate actions. In relation to performance, then top and middle level managers ask their subordinates to only notify them about emerging problems. There is a high level of trust and confidence in employees. The director of development, for instance, does not require any written overview of the triggers between the different stages of the project. The information flows smoothly by e-mails, meetings and phone calls. He claims:

“The question is...within the phases, why would you like to know all the details within the phase. If you have a group of lets say ten people working on it, people you trust and people that have delivered what they promised for years before, why would you stick your nose in there saying “I need to know about this, I need to know about that” This is ... micromanagement. The project is a project and they are fully responsible for what they are doing.”

Managers explain the autonomy by the need to maintain a motivational environment. As one division managers says, “My philosophy has always been – if I do not hear anything, then it is running OK!” If there is a problem, then middle level managers do not usually load their subordinates with written reports about these bottlenecks, but encourage them to present their problems in a meeting or notify them by e-mail. So, in spite of the formal reporting system the ongoing information about the emerging activation triggers is disseminated informally mainly via phone-call, e-mail or face-to-face discussion. The Director of R&D explains:

“The company is still small enough that you can manage it by walking around and it does not take that much time per day to understand. A half an hour just walking and try to keep the finger on the pulse of what is happening.”

The senior managers are confident that they are always informed about the critical issues. As the director of R&D says: “... they [indicating his subordinates] will come to me, if there is anything that needs to be resolved”. Only middle level managers report these bottlenecks further to the level of top managers in a more formal fashion. Moreover, in meetings, only the kinds of bottlenecks that cannot be solved by the project manager himself are discussed.

High levels of autonomy and self-control are combined with encouraging leadership from the top managers. Top managers pay special attention to creating an encouraging and motivational environment. There is a highly informal information flow across all managerial levels of the organization. A “human touch” is visible in the form of continuous reflection and feedback that top managers provide to the organizational members at all levels. There is an open dialogue through the different levels of management and across the functions of the organization. The CEO reveals:

“People know very well what has been done in the organization and by the top-managers. That is the signal towards the employees that there is a culture of trust and a culture of belief.”

Interviewees enthusiastically tell how important are the CEO's and other top-level managers' comments and advice that they receive face-to-face in brief discussions, through e-mail or just in the form of a short comment in some team-room. For instance, such short comments as "Great!" and "Good job!" provided by the CEO give organizational members the motivation and confidence to make their own decisions.

The combination of a high degree of autonomy, encouraging leadership and clear definitions of desired outcomes plays a significant role in building enthusiasm and motivation among staff. A significant goal of management has been to nourish an organizational culture of innovation. It can be seen at all levels of management and in the different functions of the organization that people are very proud of the innovative products of the firm, and happy to provide their skills and capabilities for the success of the firm. People like their organization very much and everybody wants to make a contribution. They are highly inspired and proud of their work, constantly aiming for better outcomes and improvements to organizational processes. Every member of the organization is eager to find new ways of doing things and communicating ideas to the others. Many interviewees excitedly tell how they have provided new ideas and solutions for the firm and how the motivational environment and good leadership has encouraged them to do so.

The organization has a strong culture of communication and knowledge sharing. There are many meetings on a wide array of topics and involving participants with varied backgrounds. In addition to the structured meetings, ad hoc meetings are very common in everyday practice. Each activation trigger will be discussed with others and often a meeting scheduled for wider discussion. In addition, in order to nourish the innovativeness of the firm, there are also meetings that do not aim to solve concrete triggers but which may "create" new ones. One project manager describes the meetings thus:

"So, necessarily we do not make any big decisions in that kind of meeting, but rather ... it is kind of brainstorming environment when we get new questions more than answers, I would say. And all the people might throw in some new ideas and then you need to start solving those problems."

Thus, in addition to discussing the existing activation triggers they find more activation triggers in these brainstorming sessions. Thus, there are a number of informal meetings every week and lots of discussions via e-mail and phone calls. Often weekly calendars of organizational members are full of all kinds of meetings to conduct numerous discussions within or across different departments of the firm.

The effects of the context

At a point in time, however, people started to feel that the growing level of collaboration in the organization starts to hinder the progress of the firm. During the period of the interviews, the firm was growing rapidly, new people were continuously being hired and new projects started. At the same time the management of the company was still based on a flat organizational structure, and having a culture of sharing and open communication. It seemed that the organization reached a point of having too much knowledge exploration activities, especially activities of knowledge integration that generated enormous amounts of potential capacities at lower management levels. For the general overview of the situation, see also figure 18.

People recognized that there are limits to knowledge integration. There is a limit to the amount of communication in team-rooms, e-mails and meetings that one is able to read and respond to. Most of the interviewees described at least three formal meetings that they regularly attended in addition to the large number of *ad hoc* meetings that filled their diaries. The number of meetings eventually reached a maximum, taking a lot of management time. At that point many managers started to feel that they needed fewer meetings but with better focus. As Divisional Manager reports:

“I try to stay away from meetings that are not clearly focused on something that needs to be clearly resolved. Because there is a meeting mania in this building!”

Managers began to suggest that instead of scheduling meetings, five-minute talks over a coffee might be preferable, since the number of meetings was starting to take people away from their real productive activities; the activities through which the things that had been discussed in the meetings should finally be turned into actions.

In parallel, electronic team-rooms started to become overwhelmed with information. At one point, managers started to claim that there was too much information and knowledge everywhere. As one of the managers said:

“... databases, team-rooms, there is so much information that I do not think anybody knows in the company, all that is stored there. It is a very safe statement to say that ‘it is in a quality system or it is in a database’, because it is most probably there, but whether you can find it, is a different story.”

Thus, much of information existed in the system but its potential remained unused in building the capacities of the firm. People started to have difficulties finding necessary information.

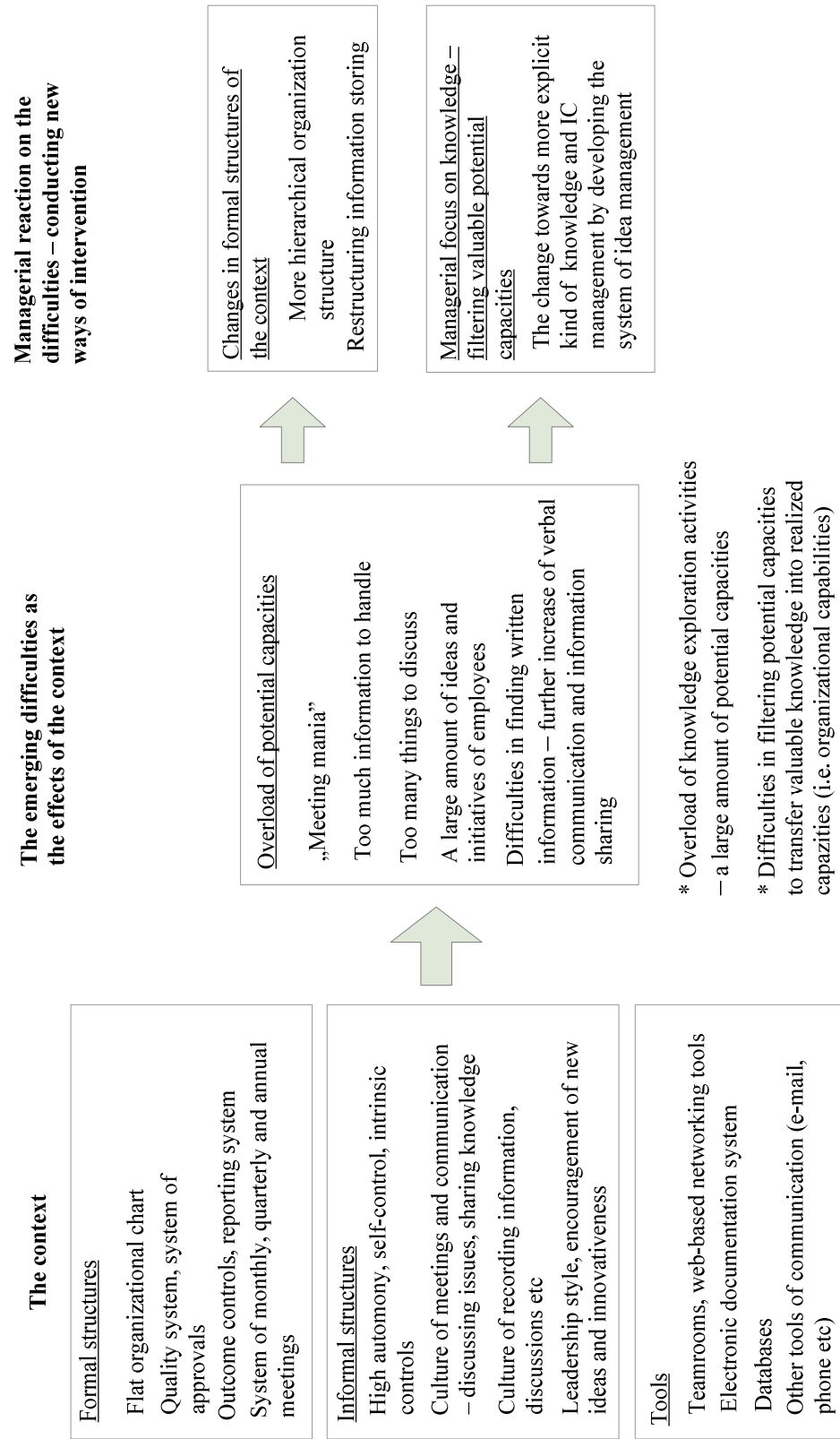


Figure 18. Changes in managerial intervention

People who used to be close to decision-making and had usually provided their opinion suddenly realized that they were not able to follow any more. Many people admitted that they did not understand the ongoing issues any more, since there was too much to read and discuss all the time. One of the managers says:

“I used to be very close to the R&D and know exactly what was going on there but I would say that now I would not be able to keep up anymore.”

An overload of written information in team-rooms (often semi-structured) and databases created a need to have even more face-to-face communication, because it was easier to ask the right person than do the information search on your own from the team-rooms. People increased the direct communication by asking for all kinds of technical, as well as sales and marketing information, directly from people who held such information. So the amount of short informal discussions and e-mails increased even more. Often it became difficult to reach people since they were already very busy communicating with other colleagues.

Consequently, people were busy with knowledge exploration activities in the firm. A large amount of data, information, thoughts and ideas was created at lower levels of the organization. For all kinds of matters in the firm, there was lots of information and knowledge that people could not assimilate anymore. It became more and more time-consuming to filter valuable knowledge and transfer it into the realized capacities of the firm. At the same time new strategies of the firm were developed at higher levels of the organization, to enhance organizational growth and to extend the organizational capabilities to new therapeutic fields and markets. However, top-level managers started to realize that new business strategies could not be executed while retaining the existing structures of the firm. They recognized that there was too much knowledge to handle at lower levels of management. Thus, they realized that in order to manage the growth of the firm and develop organizational capabilities, they needed to change something in the organization.

Changes in managerial intervention

Firstly, the top managers restructured the organization, building a more hierarchical management structure for the firm. Large amounts of information about internal and external problems, as well as the numerous ideas from staff, were difficult to handle in a highly decentralized structure. The CEO explains the necessary changes in the structure:

“We have had quite a bit of discussion about these things now. There is a limit to how much an organization can swallow at any particular time. [...] We cannot afford to keep everybody informed in the organization as we

used to in the early days. Otherwise we would be all sitting in meetings, just hearing what somebody else is doing. We cannot share all the information and knowledge any more. So, you have to focus on your area, remain informed about that and trust that other people are competent at doing what they are supposed to be doing.”

The idea of restructuring was to make business units more independent of each other, being able to lead the processes of focal objects without constantly having face-to-face meetings with other functions of the firm. Some interaction was left but was no longer on a daily basis. The Director of R&D explains:

“There are different geographical units that generate their own systems. I mean, it is similar, it is parallel, but there is less and less interaction. As I see it, there would perhaps in the future be a third and perhaps a fourth group and the internal groups here would be divided into smaller sub-groups. We will have a number of parallel systems.”

Secondly, managers started to improve the electronic team-rooms, structuring the topics of the discussions and file systems. More careful planning of the general structure of the team-room system and access of the team-rooms was conducted. In addition, managers found that training of the employees is necessary to make the application of the team-rooms more consistent across the organization.

Thirdly, in addition to these changes managerial attention was directed to knowledge – individual and organizational level potential capacities, in particular. During the rapid growth of the firm a significant amount of individual or group level potential capacities had been generated in the form of new ideas. A large number of ideas, however, made the firm unable to effectively select those ideas that were worth further consideration. Too many ideas compared to the limited resources, required more careful analysis before a decision could be made. The Technical Director of Marketing explains:

“When we were a smaller company, it was easier to communicate and information was floating around everywhere and everybody was aware of what was going on and decision-making was much easier. Now, we are a bigger company, not very big yet, just a hundred people, but we are present in different places, the UK, the United Arab Emirates, the USA, the Far East and Finland. Communication has become more difficult. We realized that we need to have a more structured way to handle these ideas. We saw that decision-making is difficult. Even, if we wanted to make some new products to get the idea evaluated and make a decision to start this process it was sometimes difficult and took a very long time.”

These difficulties were caused by a large number of ideas and too much unstructured information and knowledge about these ideas. In addition, necessary

knowledge was sometimes located in geographically distinct places. Therefore, a central system to screen and select ideas became necessary. The idea evaluation system was built to systematically select the ideas that the firm would invest in – to engage people and finances in building new realized capacities for the firm.

Challenges in focusing on knowledge

The purpose of the idea evaluation system was to efficiently gather, process and prioritize existing data related to particular focal objects. It was necessary to analyze the opportunities presented by single idea against the organizational resources and strategies, analyze its suitability for existing products and processes, as well as the possible allocation of financial resources. Further, it was necessary to organize the soft issues related to each idea to have a more structured overview of what the organization actually knows about each idea. Therefore, the information about markets, customers, competitors, technologies and legislation had to be systematized in order to get the whole picture of each idea.

The purpose of the whole process was to filter valuable potential capacities that would be beneficial in building new organizational capabilities. The system was expected to ensure a more structured search of data and analysis before decision-making. The collected data was expected to represent a comprehensive set of information about each idea. Necessary documents were analyzed and stored in the specific team-room for idea evaluation. Collected information was further discussed in a discussion forum composed of internal and external experts to analyze the idea and the existing capabilities of the firm. In order to choose the best ideas, the managers agreed that “an idea needs to be made explicit”. Making the idea explicit meant that all the existing knowledge and information related to a particular idea had to be expressed in an easily readable format, a format that would help managers to compare and select the best ideas. All the existing knowledge relating to a particular idea was to be summarized in shorter reports, such as idea screening sheets and idea evaluation sheets. A shorter format was expected to provide a better summary of the idea and to lead to decision-making in which valuable ideas could be turned into actions (i.e. realized capacities).

As managers started to gather ideas into the new system and evaluate them, several challenges emerged. They found that much of the data they wished to gather resided in people’s heads or in too wide an array of other sources (documents, e-mails, oral communications etc). They realized that gut feelings and visions were mixed with the facts and that it was very difficult to gather and structure such a mixture in an objective way. People felt that they knew much more than the idea evaluation reports were showing them, and so questioned the validity of the content of the reports. It was difficult to reduce the rich context of

each situation into charts and tables. Consequently, the decision-making choices of the best ideas, was still largely based on knowledge residing in people's heads rather than in idea evaluation sheets.

Still, the idea evaluation system was not a failure. It was useful for structuring different kinds of information. People were quite happy that the system helped them to organize information related to the ideas, since it allowed them to see the general picture and show the relevant matters related to each idea. The structure of the idea evaluation system and its related databases helped in identifying matters based on quantitative data; nevertheless, the real value of each idea still emerged through informal discussions relying on personal experience and beliefs. Sometimes the information from the idea evaluation system was used to gain some confidence and justification for beliefs. Thus, in general, the system represented a good way to structure and retrieve information, but did not replace knowledge. People still persisted with informal ways of analyzing matters, sometimes without even using the idea evaluation system. The actual decision-making was often based on something invisible, not based on written evaluation matrices.

To sum up, the overwhelming amount of potential capacities forced managers to change the organizational structure, improve the database and team-room infrastructure and direct managerial attention towards knowledge. The representation of information in spreadsheets and reports did not, however, enable management to represent knowledge or fully account for decision-making. The basis of actual decision-making often included something else not present in the idea evaluation reports. People knew more than it was possible to show in these spreadsheets. Nevertheless, they found the system useful in structuring important matters about each idea. When asked about any further plans for IC measurement and reporting, managers were quite determined: "No, I do not think so, at the moment. We are pretty much happy with what we have."

4.3.2 *Discussion*

The effects of the context

Case C demonstrates that the context in which knowledge is created and exploited (in terms of the knowledge triangle) has a significant impact on knowledge integration in the firm. The formal and informal structures of the firm, as well as technological tools, influence the ways in which potential capacities are created in the firm. A highly decentralized management system with a low level of bureaucracy enabled rich communication in the organization. People were used to

sharing their ideas and information with other staff members. Literature has also shown that less bureaucratic organizational structures facilitate better knowledge integration (Serenko, Bontis & Hardie, 2007). Flat and decentralized management structures especially support knowledge integration mechanisms (Nonaka & Takeuchi, 1995). Serenko, Bontis and Hardie (2007) suggest that internal compensation structures and rewards are necessary to motivate people to communicate and share their knowledge. In case C, however, knowledge sharing was motivated without particular rewards for such behavior, but induced by facilitating formal structures, an organizational culture of innovation, sharing and open communication, as well as the high level of autonomy of the employees.

It is possible, however, that formal and informal structures of the organization encourage too much sharing and knowledge integration at lower levels of the organization. Consequently, the staff becomes entirely occupied with knowledge exploration activities. In this way a firm builds potential capacities but risks lacking the time necessary for productive action. This leads to a risk of inhibiting the development of realized capacities, or constraining the smooth development of organizational capabilities. Especially when the number of personnel is growing, potential capacities start to rapidly increase at lower levels of the organization. It becomes difficult to filter these potential capacities and make them available to people in other departments who could turn the capacities into productive action (i.e. realized capacities).

A parallel can be drawn with the tension in balancing knowledge exploration and exploitation activities (March, 1991). Weiping (2006: 149) suggests that it is necessary to balance knowledge exploration and exploitation in order not to lead the firm into competency traps. There are two types of competency traps that may occur. Competency trap I occurs in the case of excessive engagement in exploitation of knowledge, whereas competency trap II occurs in the case of excessive exploration of knowledge, which means the main focus is on exploration of knowledge without its application in productive activities (Weiping, 2006, p. 149). Excess knowledge exploration may hinder organizational learning, since organizational learning requires not only an increase of knowledge but the transfer of knowledge into action (Argyris, 1978). Without changes in management structure and information processing, case firm C would have finally fallen into competency trap II – the increase of potential capacities without an increase in the firm's overall performance. Weiping (2006) connects knowledge exploration with an excessive acquisition of external knowledge. This case study shows, however, that excessive knowledge exploration may also happen internally.

Thus, in order to avoid the possible competency trap, changes in organizational structure became necessary to cope with the increased scale of knowledge. The basis for larger scale of knowledge becomes difficult to integrate into the firm's capabilities, requiring a better infrastructure and more structured information sharing. Therefore, the organizational chart of the firm was restructured from the previously flat structure to more hierarchical lines of reporting and communication. With the increase of formal structures and hierarchies, intra-organizational knowledge integration can be reduced (Serenko, Bontis & Hardie, 2007). In a more hierarchical management structure knowledge integration mainly takes place along the vertical lines of the organization, and less along its horizontal lines. Consequently capabilities become integrated at higher levels of the organization (Grant, 1996a).

Explicit knowledge management

The case study shows the circumstances in which managers may be forced to turn their attention to knowledge (potential capacities in particular), trying to measure and report IC – the ideas and knowledge which relate to these ideas. Since the firm had an overload of potential capacities, it was necessary to filter more valuable capacities for further action. The large amount of potential capacities showed that measures might be necessary to diminish information overload and make the selection process of valuable potential capacities easier for those who have to make decisions.

The system played a role in attracting the attention of staff, and directing it towards the important factors which make a piece of knowledge relevant for the firm. The case study shows, however, that the evaluation reports helped to structure information but did not reflect the actual knowledge that the idea was related to. Structured information about markets, customers, competitors, technologies and legislation did not reflect the overall knowledge, but only some identifiable part of it. People still believed that they knew more than could be expressed in short evaluation charts. They felt that knowledge reduced to a form of structured information did not reflect its real value, nor was the information represented in idea evaluation reports as trusted as knowledge that resided in the minds of colleagues. Similarly, Habersam and Piber (2003) conducted case studies in two hospitals and found that IC metrics were generally seen as useful, but reflecting only “a narrow detail of the complex whole”. Their case studies showed that there is much in IC that cannot be explained in written reports; nonetheless, this role of IC is very powerful in decision-making. For the same reasons the decision-making in case study C was still based on something invisible rather than information in idea evaluation charts. Beliefs, intuition and

hunches are still an important part of decision-making, sometimes being even more important than information in spreadsheets.

To sum up, the main role of the above case study was to show the circumstances in which managers may be forced to make changes in their means of managerial intervention in building organizational capabilities. The case study showed how strongly encouraging formal and informal structures of the context can lead to excessive knowledge exploration, which may hinder the creation of organizational capabilities. The increase in knowledge exploration activities creates lots of potential capacities, which consequently force managers to change the structures of the context and direct their attention to the information and knowledge held by the firm (i.e. a part of the potential capacities).

5 THE THEORY OF IMPLICIT KNOWLEDGE MANAGEMENT

This chapter serves to align the previous chapters with the theory that explains how the creation and application of organizationally valuable knowledge can be affected by managerial intervention. The chapter draws on the knowledge triangle introduced earlier, the framework of knowledge flows and the types of managerial intervention along with the results of the case studies. It provides theoretical propositions about the mechanisms and the effects of implicit knowledge management on building valuable IC of the firm. The first section of this chapter outlines the premises behind and the definitions of the theory. The second section introduces the theoretical propositions about the types of managerial intervention and their effect on knowledge flows. The final section outlines the theoretical and practical value of the theory.

5.1 Premises and definitions associated with the theory

Scholars claim that the literature of the RBV has not been able to provide satisfactory suggestions as to how to manage the most valuable resources the firm has (Spender & Grant, 1996; Williamson, 1999; Priem & Butler, 2001). Williamson (1999: 1093-1094) has argued that the knowledge-based and competence-based views result in instructions that are too wide and do not provide a satisfactory explanation for managers to act upon. Quite similarly, it has been claimed that knowledge and IC literature has had difficulty in developing and testing management methods that would satisfy the needs of managers (Marr, Gray & Neely, 2003; Kaufmann & Schneider, 2004). Scholars claim that there is a high level of diffusion in the purposes and issues that knowledge and IC management methods address (Scarbrough & Swan, 2001; Andriessen, 2006). Wilson (2002) has reviewed knowledge management literature and suggests that none of the knowledge management activities cited are actually concerned with the management of knowledge. Styhre (2003: 79) has suggested that knowledge management is: “best thought of as a loosely coupled patchwork of activities and ideas.” Hence, knowledge management consists of rather tentative and pluralistic practices (McNamara, Baxter & Chua, 2004), including almost everything but nothing particularly concrete that can be termed knowledge management.

The present study argues that such confusion emerges due to an insufficient understanding of what is actually managed and what are the effects of management. Obviously it is not possible to define a complete toolbox of knowledge and IC management, but we can improve our understanding about the

general mechanisms in which knowledge is affected by different types of managerial intervention. To achieve this, the present study outlines the theoretical propositions about the objects and effects of management.

There are several requirements for a good theoretical framework. A theoretical framework should identify the phenomenon of interest, provide the key premises (Bacharach, 1989), and explain the relationships among the elements in the framework (Whetten, 1989; Sutton & Staw, 1995; Weick, 1995). In short, a theory must answer the question of *what*, *how* and *why* (Whetten, 1989). The present section identifies the phenomena of interest (i.e. the question of *what*) and provides the three key premises of the framework. The main elements of the theory (the question of *what*) were already introduced and discussed in earlier chapters, however. The general basis of the theory is the knowledge triangle, which was introduced in chapter 2.2. The creation of organizational knowledge and capabilities with knowledge flows were explained in chapters 2.2 and 2.3. Further, the types of managerial intervention and implicit knowledge management were discussed in chapters 3 and 4, showing the implicit kinds of knowledge management also in the three case studies. Therefore, it should only be necessary in this section to furnish a brief reminder of these elements. The next section will provide theoretical propositions about the relationships between these elements, in other words, it will concentrate on the questions of *how* and *why*.

The main phenomenon of interest is implicit knowledge management. To clarify the terminology: the present study applies the term *implicit knowledge management* when referring to the modes of managerial intervention in which knowledge and IC is not objectified but managerial focus is on other organizational phenomena, consequently affecting organizational knowledge and capabilities²². Knowledge is bundled with various objects, processes and relationships in the organization (Latour, 1987; Mouritsen and Larsen, 2005: 373). In implicit knowledge management, managerial intervention is directed at various visible objects that are bundled with knowledge. On the other hand, knowledge management is considered to be explicit when managerial attention is on knowledge – managers take (or are advised to take) purposeful actions to

²² The terms *explicit* and *implicit management* are also used in the fields of computer technology and information systems (Sen, 2004). The term explicit management refers to a case where an operator is responsible for the initiation of operations actively choosing the managerial action. The term implicit management, applied as the opposite of explicit management, referring to a case where a direct operator's intervention is not needed, since the functions are performed automatically.

identify and report the valuable knowledge of an organization, concentrating on its development, leverage and efficient application in the organization.

The feasibility and the effects of explicit knowledge management have already been extensively debated in the relevant literature (see e.g., Spender, 1996; Pfeffer & Sutton, 1999; Johnson, 2002; Chaharbaghi & Sandy, 2006). The role of the present study is to show the relevance of implicit knowledge management. Hence, the focus of the following discussion is implicit knowledge management. Three types of managerial intervention are considered to constitute implicit knowledge management:

1. Managerial intervention in the context in which knowledge is developed and exploited,
2. Managerial intervention in the behavior of human actor(s),
3. Managerial intervention that is directed at knowledge object(s).

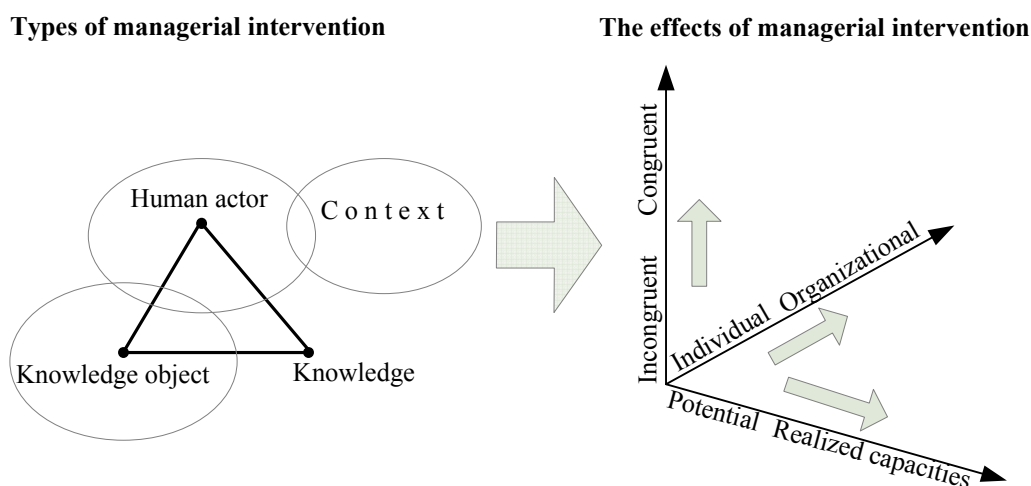


Figure 19. The elements of the theoretical framework

The three types of managerial intervention have their particular effects on knowledge flows of the firm. Figure 19 summarizes the types of managerial intervention and knowledge flows. Knowledge flows and their underlying processes of organizational learning were introduced in chapter 2.2.3. In general, the firm increases its capacities starting with knowledge exploration activities. Knowledge is acquired in the form of data or information from the external environment, and further transformed into the other forms and dimensions of

knowledge. In short, knowledge flows and transforms between the following dimensions in the firm:

1. Individual and organizational level knowledge,
2. Potential and realized capacities of the firm,
3. Incongruent and congruent types of capacities in terms of their alignment with the strategies and environmental circumstances of the firm.

In regarding these dimensions of knowledge, two assumptions are made (see also chapter 2.3). First, managers are expected to choose the strategies according to their perception of a firm's existing resources and environmental circumstances. Second, managers constantly adapt the definition of a strategy to environmental circumstances, but changes in organizational knowledge and capabilities take time. This means that there is often a gap between the chosen strategies and existing capabilities of the firm. Hence, one of the managerial roles is to diminish this gap by building knowledge and capabilities which are more congruent with the organizational strategies and external environment. In terms of the RBV's resource attributes, this makes organizational knowledge and capabilities more valuable in achieving competitive advantage.

This section recalled the main elements in the theoretical framework. Now it is necessary to detail the relationships between these elements to explain the effects of implicit knowledge management. Therefore, the next section provides theoretical propositions about the relationships between the types of managerial intervention and knowledge flows.

5.2 Theoretical propositions

The following discussion outlines the essential elements of the theory, addressing the question of *how* and *why* (Whetten, 1989). It provides the theoretical propositions about the main ways in which organizational knowledge and capabilities can be implicitly affected. These propositions are further related to Barney's (1991) resource attributes, namely the value, inimitability and non-substitutability of a resource²³. The terms potential and realized capacity (Zahra & George, 2002) are applied in the subsequent propositions.

²³ Rareness of a resource is not considered here, since rareness does not merely depend on the intrinsic characteristics of a resource and managerial methods, but also depends on its uniqueness in the market.

The opportunities available to management and the effects they may occasion depend on the nature of the processes that generate knowledge flows. The processes of organizational learning, such as knowledge acquisition, assimilation (or transformation) and exploitation (Cohen & Levinthal, 1990; Zahra & George, 2002), also known as knowledge exploration and exploitation (March, 1991), were introduced in chapter 2.2.3. The effects of implicit knowledge management depend on how observable and predictable these processes are for the managers of the firm and where the effects of knowledge emerge. March (1999) has suggested that processes of organizational learning differ in their predictability and determination. Processes of knowledge exploration are barely observable and are difficult to predict. There are no visible or explicitly definable returns before knowledge exploitation takes place. Processes of knowledge acquisition and assimilation may generate only knowledge about some thing, about some knowledge object, but have no influence on the physical properties of that object. These processes may evolve pure knowledge without affecting the properties of knowledge objects, because learning can take place without manipulation of the object that one learns about²⁴. The process of knowledge exploitation is more predictable and visible for the managers, embodying immediate returns of action and, thus, having a direct effect on knowledge objects (March, 1999).

It is easier to direct managerial intervention to the items and activities where the effect of knowledge becomes visible. It is significantly easier to affect the behavior of organizational members than to affect the creation of individual and collective abilities which their behavior is based on. Knowledge acquisition and assimilation (including knowledge integration) processes are not manageable by behavioral instructions due to the equifinality of the capabilities. Equifinality means that capability can be developed from many starting points and along different paths, but the final outcome will be generally the same (Eisenhardt and Martin, 2000). Due to the equifinality of the capabilities it is not possible to construct the complete lines of actions that lead to the desired potential capacity of the firm. This is especially true since the processes of knowledge acquisition and assimilation vary to a great extent. In principle, the timing and the types of knowledge, as well as specific strategies for knowledge acquisition cannot be pre-determined. The strategies for knowledge acquisition vary according to the context and specifics of knowledge, including open-ended search activities, trial and error, risk taking, experimentation and discovery with a high degree of

²⁴ Of course, the processes of knowledge exploration and exploitation can also take place simultaneously (i.e., learning-by-doing) without any time lag between these processes (Zahra & George, 2002). In this case the effect of knowledge emerges immediately.

subjectivity (Nonaka, 1994; March, 1999). Therefore, Alvesson (2001) argues that behavioral instructions are not applicable in building organizational knowledge and capabilities.

The present argument is that managerial intervention in context influences the environment in which the processes of knowledge exploration take place, consequently encouraging the kind of learning processes that do not have directly visible returns. There are many individual and organizational factors that may either hinder or encourage the processes of knowledge acquisition, assimilation, transformation and integration (see Appendix 7). Managers have various opportunities (such as creating organizational structures and communication procedures) to influence these organizational factors. By influencing the context it is possible to increase the potential capacities of the firm and affect the flows from individual to organizational level knowledge and capabilities (see also Table 6).

Proposition 1: Managerial intervention in the context enables an increase in potential capacities and generates knowledge flows from the individual level to organizational level knowledge.

Several scholars suggest that a suitable working environment nurtures knowledge integration and communicative actions in the organization (e.g., Nonaka & Takeuchi, 1995; Grant, 1996a; Nahapiet & Ghoshal, 1998; O'Donnell, O'Regan & Coates, 2000). The case studies cited here also show that managerial intervention in the context may encourage or hinder knowledge exploration, consequently affecting the potential capacities of the firm. Case C in particular showed how the context influenced the creation of potential capacities and knowledge integration mechanisms of the firm. In terms of Barney's (1991) resource attributes, managerial intervention in the context encourages the creation of inimitable and non-substitutable knowledge, but the firm has less control over the value of such knowledge in terms of its usefulness in a particular market situation. Of course, by encouraging a positive working environment and interactive communication of the organization's goals, people can be motivated to learn things and behave in ways that contribute to organizational goals. Nevertheless, the managerial power of these methods is rather limited and it is often difficult to guarantee that learning is congruent with the organizational strategies and environmental conditions.

The second proposition is related to the behavior of human actors. Managerial intervention in the behavior of human actors includes the specification of the tasks that individuals are accountable for and controlling these tasks through personal surveillance or restrictions of the actions. The argument is that by

instructing the behavior of human actors, it is possible to affect the processes in which the effect of knowledge is more predictable and visible for the managers – the processes in which knowledge is exploited. Yet, behavioral instructions for human actors can influence only the exploitation of such knowledge that already exists in the organization. In other words, in pre-determined activities of the employees the existing potential capacities are usually exploited.

Proposition 2. Managerial intervention in an actors' behavior generates the knowledge flows from potential to realized capacities of the firm and increases the congruence of realized capacities with the organizational strategies.

Managerial methods that prescribe actors' behavior are rarely applicable to the activities of knowledge acquisition and interpretation but are applicable to activities where the effect of knowledge emerges, that is, where, knowledge is turned into actions. In implementing behavioral controls the focus is placed mainly on aligning realized capacities with organizational strategies. Since the focus of behavioral instructions is mainly on realized capacities, managers do not have the tools for a direct intervention in potential capacities. Managers can implicitly affect the exploitation of all kinds of knowledge (as well as inimitable and non-substitutable knowledge) in the firm but are limited in the degree to which they can encourage the creation of such knowledge. Rather, these kinds of methods allow only the exploitation of existing individual and organizational capacities. Therefore, behavioral controls affect the flows of knowledge from potential to realized capacities and increase the congruence of the realized capacities with the organizational strategies.

Managerial focus on actors' behavior can be maintained in various ways, however. The activities of human actors can also be approached by focusing on the collective actions i.e. the processes that a firm is capable of rendering from its IC (e.g., Larsen, Bukh & Mouritsen, 1999; Mouritsen, Larsen & Bukh, 2001). Mouritsen et al. (2002) suggest building a narrative about the activities that the firm is able to maintain from its IC, directing the attention of organizational members to the activities and effects of knowledge that are relevant for the firm. By drawing the attention of the organization to these activities, organizational capabilities are shaped to be more congruent and aligned with the organizational goals. The process of conducting such an IC narrative has an effect on knowledge integration, increasing the collective knowledge about the things that matter for the organization.

Table 6. The effects of implicit knowledge management

Focus of managerial intervention	Example of methods	The effects on the knowledge flows	Effects in terms of Barney's (1991) resource attributes
1. The context	Clan controls (Ouchi, 1979) Interactive use of controls (Simons, 1995) Encouraging communicative actions (O'Donnell, O'Regan & Coates, 2000)	The effects emerge in the knowledge exploration and knowledge integration processes. Increase of the potential capacities and the flows from individual to the organizational level knowledge.	Encourages the creation of inimitable and non-substitutable IC, but has less control over the value of such IC.
2. Actors' behavior	Behavioral controls (Ouchi, 1979) The methods or the parts of the IC methods that focus on the processes and activities in the firm (e.g., Larsen, Bukh & Mouritsen, 1999; Johnson, 2002)	The effects emerge in knowledge exploitation. The knowledge flows from potential to realized capacities. Increased congruence of realized capacities with the organizational strategies.	Exploitation of the kind of existing IC that is necessary for the particular activities. Enables a control over the existing realized capacities. Does not lead to the creation of new inimitable, non-substitutable and valuable potential and realized capacities.
3. Knowledge object(s)	Outcome controls (Ouchi, 1979; Merchant & Van der Stede, 2003)	Short-term targets: the effect on knowledge exploitation, knowledge flows from potential to realized capacities, congruence of realized capacities. Long-term targets: increase of potential and realized capacities, congruence of potential and realized capacities.	Short-term targets: effects are similar to the behavioral controls with the slight increase of valuable potential capacities. Long-term targets: the increase of the inimitable, non-substitutable and valuable potential and realized capacities.

The third proposition is related to the knowledge objects. The performance measurement systems can be built to measure and monitor the ways people are doing something (measuring processes, actors' behavior) or the qualifications of the outcome that is desired (measuring focal object). Managerial intervention in knowledge objects includes the definition (i.e. outcome measure) of the "thing" (focal object) which is desirable for the firm. In implicit knowledge management the target is not defined as being the desired state of IC or stock of knowledge, but the target is the object that the productive actions of the firm are directed towards. The object can be a desired amount of goods sold (goods being the knowledge objects) or a new product launched (a new product being the knowledge object). The application of the outcome controls directs managerial focus onto the knowledge exploitation. It directs the focus to the object in which the effect of knowledge becomes visible.

In moving towards the target, it is impossible to predict what the employees have to learn and how they need to behave in order to reach the target. No one can predetermine their knowledge exploration activities and the types of knowledge they particularly need, since such knowledge does not exist before their act of learning. Thus, nobody knows *ex ante* what this knowledge is that has to be acquired by learning. By focusing the attention on the knowledge object, a thing, in which an effect of knowledge should manifest itself, it is possible to direct learning to the areas most valuable for the firm. The outcome control represents a definition of a target that the exploitation of knowledge should finally produce. The desired outcome (a certain type of product to be developed for instance) is expected to direct the attention of the human actors to the matters that will lead to achieving this target. The definition of the desired knowledge object functions as a target towards which the individuals adjust their knowledge processes, so building up their capability to achieve the predefined target. The goal to develop a certain type of product, for instance, encourages data and information searches for the necessary tasks that presumably lead to the desired outcome. Thus, in order to intervene in organizational learning, managers must know the desired effect of that learning. They have to know what is it that they expect to come into existence as an effect of the new knowledge. Without having a clue what the final effect of learning is, an organization can almost literally learn anything about everything.

Proposition 3. Managerial intervention that is directed at knowledge objects generates knowledge flows from the existing potential to the realized capacities of the firm, increases new potential capacities of the firm, and enhances the congruence of the capacities with the firm's strategies.

There are many ways of drawing management attention to knowledge objects, however. Outcome controls can be implemented with short-term or long-term,

individual or group level targets. Long-term targets that represent a challenge to employees tend to have a larger effect on potential capacities, since the definition of a long-term target would provide a greater freedom for creativity and learning. Especially, formulating challenging goals would leverage existing knowledge and capabilities of the firm (Prahalad & Hamel, 1990). Challenging goals enhance knowledge exploration activities, since the existing knowledge is not sufficient for the desired outcome. People search for additional knowledge to make their knowledge more complete for the tasks they have to accomplish.

The definition of a short-term outcome may, however, lead the employees to exploit only the existing potential capacities. Consequently, the effects of short-term measures may be somewhat similar to the effects of behavioral controls, although the outcome control provides slightly more freedom to learn and increase the potential capacities of the firm. Extreme pressure for short-term outcomes would increase only the kinds of knowledge that are quickly turned into realized capacities. It increases the path-dependency of existing organizational capacities (Levinthal & March, 1993; Weiping, 2006) creating risks for organizational flexibility in changing environments (Weiping, 2006).

The significant value of outcome control relies in its ability to affect the diversity of knowledge without objectification of such knowledge. Knowledge is allowed to remain tacit and hidden, since managers define only the desired effects of knowledge. Hence, knowledge that is created is possibly very unique and difficult to substitute or imitate. This knowledge is also valuable for the firm's competitive advantage, since outcome control would direct learning processes towards the domains that are more congruent with organizational strategies and environmental circumstances. In chapter 4, the case studies showed that outcome control also determines how the emerging activation triggers are perceived and the absence of knowledge realized in the firm. In reacting to the triggers the desired outcome directs the learning processes towards the disciplines and functions more valuable for the desired outcome. Taking all these together, the outcome control directed to the knowledge objects, would enhance the value, inimitability and non-substitutability of knowledge and capabilities of the firm – making these capabilities relevant in terms of achieving competitive advantage in the market.

Management methods and tools are usually implemented in combination (Long, Burton & Cardinal, 2002). Thus, a desirable effect on organizational knowledge and capabilities is usually generated by a combination of different types of managerial intervention. For instance, it is usually a combination of outcome, clan and behavioral controls (Ouchi, 1979; Long, Burton & Cardinal, 2002; Merchant & Van der Stede, 2003) or diagnostic and interactive types of

management control in firms (Simons, 1987b, 1995). Similarly, in knowledge and IC management techniques, Mouritsen, Larsen and Bukh (2001) show in their case studies a combination of IC measurement, identification of activities and managerial focus on nurturing the context. Johanson, Mårtensson and Skoog, (2001) demonstrate in their study that the management of IC is a combination of performance measurement and different management control routines. Supporting management control routines were related to attention, motivation and commitment of organizational members. Thus, different types of managerial intervention (explicit as well as implicit) were combined. The case studies (in chapter 4) illustrate a combination of outcome control and the management of the context. The outcome control directed learning processes towards the necessary disciplines of knowledge, whereas the managerial intervention in context enabled to enhance the organizational learning processes.

The combinations of managerial methods can, however, also create a certain tension between these types of managerial intervention. Like a tension between the interactive and diagnostic types of management controls (see e.g., Henri, 2006), there is also a tension between the choice of nurturing the context by encouraging conditions for creativity and opportunity seeking or implementing strict instructions of behavior. These are two opposites that cannot be simultaneously implemented for the same functional processes in the organization. The managers should choose to facilitate some knowledge flows and inhibit others. Hence, the combinations of different types of managerial intervention should be carefully considered in the firm.

To sum up, the three types of managerial intervention significantly differ in their effects on organizational knowledge and capabilities. Managerial intervention which is directed at knowledge objects has a significant role in building valuable, inimitable and non-substitutable knowledge and capabilities in the firm, and thus is a very important tool to achieve competitive advantage for the firm. The two types of managerial intervention – outcome controls and management of the context – complement each other and create significant opportunities to increase the competitiveness of the firm.

5.3 Value for research and practice

A good theory makes a contribution to both the scientific community and practice (Van de Ven, 1989). The theory of implicit knowledge management has an explanatory and predictive power in explaining various approaches of

management in building valuable IC of the firm. It provides several contributions to theory and practice.

First, the theory of implicit knowledge management adds a new explanation to the construct that has been looking for a solution for a long time. By suggesting a new angle of knowledge management the theory overcomes the practical problems that usually arise with knowledge operationalization. The theory of implicit knowledge management suggests the means of managing organizationally valuable knowledge without sacrificing its valuable characteristics – the tacitness and bundled nature – which make such knowledge valuable to competitive advantage. It provides the solution to the problem of knowledge management without trying to operationalise something that it is not possible to operationalise.

Second, the theory of implicit knowledge management highlights the importance of knowledge objects to managerial intervention. Up to now, scholars have searched the options for knowledge management without considering the role of knowledge objects. The relationship between knowledge and the knowledge object has rarely been taken into account. A few studies have considered the existence of knowledge objects (e.g., Mouritsen, Larsen & Bukh, 2001; Gherardi & Nicolini, 2003), nevertheless, they do not propose the ways in which knowledge objects can be important in the context of management. When we consider the role of knowledge objects several new opportunities for knowledge management become available.

Third, the theory of implicit knowledge management is “immune” to the theoretical problem of the RBV (see Appendix 1). The RBV causality statements (Barney, 1991) suggest that if the link between a resource and firm’s competitive advantage is poorly understood, then the resource is imperfectly imitable and consequently has a better chance to be a source of competitive advantage (Powell, 2001; Priem & Butler, 2001; Schultze & Stabell, 2004). This leads to the theoretical paradox in which the explicit management of organizational knowledge and capabilities undermines the sustainable competitive advantage of the firm. The theory of implicit knowledge management provides an explanation for managing the most valuable resources without falling victim to this paradox. The theory does not suggest managers identify organizational knowledge and capabilities in a way that makes these resources imitable for competitors. Instead, it encourages the firm to nurture its knowledge and capabilities with their intrinsic and unobservable processes. Since valuable knowledge and capabilities are not made explicit, their mechanisms do not become visible to competitors.

Fourth, the theory of implicit knowledge management relates disciplines and concepts of management that are often considered distinct. It connects different managerial disciplines showing the importance of management methods that had not been considered to be relevant in knowledge and IC literature. Few studies have discussed the role of management controls in IC and knowledge management (e.g., Kloot, 1997; Johanson, Mårtensson & Skoog, 2001; Ditillo, 2004; Mouritsen & Larsen, 2005; Turner & Makhija, 2006). The theory of implicit knowledge management encourages the scientific community to pay more attention to the many existing management methods that may affect the creation and application of organizational knowledge.

For practitioners, the theory is valuable in at least two respects. First, the theory suggests that before directing significant effort into projects of knowledge and IC measurement, it is reasonable to carefully consider the existing management practices and their effects on knowledge. The wise choice of existing managerial mechanisms may sometimes serve the interests of the firm better than attempts to measure the IC of the firm. Second, by explaining the ways in which various managerial methods affect organizational knowledge, managers can combine managerial methods that best suit their expectations of organizational flexibility, innovation or stability. Simons (1987b) has shown that managers can select the parts of a control system to use on the basis of being more interactive or more diagnostic. It is possible to encourage a freedom of thought and action in some areas, while maintaining control in other areas. Similarly, managers can combine their implicit management mechanisms in a way that exploitation of existing knowledge is maintained in some areas of business, whereas new potential capacities are encouraged in other areas.

6 CONCLUSION

6.1 Theoretical, methodological, and empirical contributions

6.1.1 *Theoretical contributions*

The present dissertation is valuable in several respects. Up to now, understanding about the means of managerial intervention has been limited and, therefore, the management of the most valuable resources of the firm has been problematic. The present dissertation sheds new light onto the existing concept of knowledge management, elaborating on the effects of managerial intervention. It suggests the theory of implicit knowledge management, clarifying the possibilities of managerial intervention in organizational knowledge and capabilities. The dissertation argues that the managerial function of managing knowledge and knowledge-related resources does not necessarily include the identification of knowledge, but should include being aware of the effects that management of various organizational phenomena may have on knowledge. By suggesting implicit knowledge management, the present study is aligned with Alvesson and Kärreman (2001), who argue that knowledge management practice is not about management of knowledge but of people and information in the firm. This study adds to their argument by outlining more elements, such as the knowledge objects and the context, that managerial attention is directed towards, and particularly underlines the role of knowledge objects in management practices.

The dissertation provides propositions on managerial intervention that overcome the theoretical paradox of the RBV. The theoretical paradox implies that the explicit management of organizational knowledge and capabilities undermines the sustainable competitive advantage of the firm (Powell, 2001; Priem & Butler, 2001; Schultze & Stabell, 2004). The theory of implicit knowledge management provides the explanation of managing the most valuable resources without falling victim to this paradox. The dissertation explains how the combination of a managerial system and emerging activation triggers shape organizational knowledge and capabilities in the way that these capabilities are most likely to be valuable in achieving a competitive advantage for the firm. Through implicit knowledge management it is possible to nurture and direct the creation of organizational knowledge and capabilities through their intrinsic and unobservable processes. In this way valuable knowledge and capabilities are not made explicit and their mechanisms do not become visible to competitors.

The dissertation contributes to the literature explaining the role of management controls in building valuable IC of the firm. To date many studies have investigated the effect of knowledge on management controls, but have not considered the effects of management controls on knowledge (see e.g., Ouchi & Maguire, 1975; Ouchi, 1977; Eisenhardt, 1985; Snell, 1992; Merchant & Van der Stede, 2003; Turner & Makhija, 2006). This dissertation suggests that management controls induce knowledge flows between: (1) individual and organizational level knowledge, (2) potential and realized capacities, and (3) incongruent and congruent capacities and effects of knowledge. In managing activation triggers management controls help to reveal activation triggers, provide supporting procedures to react to triggers, and instigate certain directions in developing the knowledge and capabilities of the firm. In particular, outcome control determines the ways in which emerging activation triggers are perceived and show up the absence of knowledge realized in the firm. The desired organizational outcome determines the intensity of the trigger, whereas the intensity of the trigger determines the ways the firm reacts to the absence of knowledge through the processes of organizational learning. At the same time managerial intervention in the context allows managers to enhance the processes of organizational learning. The context may, however, also lead to excessive knowledge creation, hindering productive action and the development of organizational capabilities.

The present dissertation is expected to widen the debate on knowledge management to involve multiple fields of research. Up to now, the literature of management control, IC and knowledge management have relied heavily on the studies of their own areas for their research (Bontis, 2001; Hesford, Lee, Van Der Stede & Young, 2007). The links between knowledge management and management controls have remained relatively unexplored in the literature. Similarly, the relationships between the RBV and IC concepts have got little attention in the relevant literature. Scholars have cross-referenced the fields of IC and the RBV without taking the next step to consider existing contributions to the further development of the theory (e.g., Bounfour, 2003b; Bounfour, 2003a; Nilsson & Ford, 2004; Marr & Roos, 2005). The present study fills this gap by drawing on a wider set of concepts and theories across these disciplines, and through its findings, contributing to several streams of management literature.

6.1.2 Methodological contributions

In knowledge and IC management research theoretical studies largely prevail (e.g., Grant, 1996a; Teece, Pisano & Shuen, 1997; O'Donnell, O'Regan &

Coates, 2000; Andriessen, 2004a; Schultze & Stabell, 2004; Spender, 2006). There are some case studies of action research (e.g., Mettänen, 2005; Bornemann & Alwert, 2007; Lönnqvist & Kujansivu, 2007), but only a few studies that would help to interpret working practices in organizations (e.g., Kloot, 1997; Johanson, Mårtensson & Skoog, 2001; McNamara, Baxter & Chua, 2004). Therefore there have been calls made for more case study research in this area (see e.g., Marr, Gray & Neely, 2003). The case studies presented here take a deeper look at the processes and internal dynamics of knowledge and IC management. Differing from the prevailing knowledge and IC research, the present dissertation does not suggest a normative model of explicit knowledge management, but interprets the reality in practice. The study investigates the management methods in practice providing an explanation for the mechanisms that make these methods relevant in terms of knowledge and IC management. Therefore, the research method of the present study is relevant to the wide terrain of IC and knowledge management research.

6.1.3 *Practical implications*

The theory of implicit knowledge management is primarily of use in guiding future research. However, it is also expected to be useful for practitioners. Managers can benefit from understanding the effects of different types of management methods. They can better choose and combine their management methods in exploiting existing knowledge in some areas of the business and building new capacities in others. Rather than engaging lots of resources and effort in new knowledge and IC management projects, the present dissertation recommends more careful consideration of existing well-known management practices. Management control methods that have been applied in practice can have a significant effect on organizational knowledge and capabilities. The wise combination of existing methods may serve the interests of the firm better than newly developed IC measurement instruments.

6.2 Limitations and suggestions for future research

Every study has its limitations. Therefore, the findings of the present study should be considered carefully. Firstly, findings of any study are subject to the limitations of the method. Conducting field research cannot be considered as an entirely independent and objective act of investigation. A researcher must always be aware of the risk associated with selective perception in collecting and analyzing the data. Researcher bias can be especially significant in studies

conducted by an individual researcher. The researcher's background and prior experience influence the process of data collection, documentation and interpretation. Possible researcher bias can, however, be carefully considered during the research process. Therefore, in this study, the data collection, documentation and analysis were carefully conducted and several methods applied to deal with possible biases (see chapter 4.1.4). Nevertheless, the problem of observer bias cannot be entirely eliminated since an individual researcher can never be separated from his or her background, philosophical views and experiences (McKinnon, 1988: 38).

Secondly, one of the limitations is the researcher's limited time to make the field visits. Consequently in this case, the researcher could not observe the historical development of the management systems in the field, but had to rely on the respondents' descriptions. However, most of the events described in the case studies took place during the period covered by the field visits, so reducing the risk of bias in interpreting the case evidence. Especially in case study C, the researcher was able to follow the evolving situation of the field in which overwhelming knowledge exploration led to the changes in the form of managerial intervention. In relation to case study C, however, there might be a risk that difficulties experienced with the explicit form of managerial intervention were caused by the fact that the idea evaluation system was at an early stage of implementation. A longer period available for the field visits would have diminished this risk.

Thirdly, the study identified the ways in which knowledge and IC can be implicitly affected; nevertheless, the level of discussion was rather general and did not provide a detailed analysis of the proposed relationships. The study preferred to focus attention on general types of managerial intervention without giving many details about the conditions that governed the effects of these forms of managerial intervention. In addition, due to confidentiality agreements several technological details of the processes and decisions of the firms were omitted from the case descriptions.

Fourthly, case studies A and B would have benefited from the application of the original ideas of actor-network theory (ANT) (Latour, 1987). Usually in ANT studies an actor is followed through the whole case study from the beginning to end – creating a story of the actor-network (Latour, 1987; Brown & Capdevila, 1999; Latour, 2005). The present study applied the ANT on a rather broad level, in explaining the patterns of management. More thorough analysis of the human and non-human actors in their interactions would have provided better explanations of the roles of knowledge objects and activation triggers in building

the IC of the firm. However, the general level approach of the present study permitted a broader view of the types of managerial intervention witnessed.

Fifthly, one weakness of the study could be the general simplification of the constructs. The study was looking for a purely functional management technology for a phenomenon which is socially complex and context-specific. Styhre (2003: 157) has argued critically that knowledge management theorists tend to detach themselves from the true idea of knowledge with its complex nature. Furthermore, not only is knowledge a complex phenomenon, but management methods can also be more than just management technologies. For instance, Vaivio (1999: 413) showed that non-financial measures are not only functional management technology, but represent “an active element that restructures organizational reality”. Thus, the simplified view used by the researcher to interpret the means of managerial intervention may have alienated the constructs of the study from the true nature of the phenomena. On the other hand, theorizing in the midst of socially complex phenomena involves the process of abstraction and generating a system of categories that may dissect and simplify the basic properties of the phenomena, but simultaneously allow more insights into their dynamics. It was necessary to simplify the constructs in the study to make the resulting theory more supple and generalizable, that is, applicable in a wider range of situations.

It should be said that the conclusions of the study do not provide propositions about the relationships between resources and competitive advantage. Neither does the study provide instructions for attaining competitive advantage. The study only explains the means of managerial intervention available for developing resources that are possibly inimitable, non-substitutable and valuable. These are three of the resource attributes that Barney (1991) has suggested are related to the pursuit of competitive advantage for the firm. Thus, the theory of implicit management explains the ways in which creation of these kinds of resources may be affected by management action, but it does not provide the roadmap towards competitive advantage. *Ex ante* insights into the link between a firm’s resources and competitive advantage are limited for any manager (Amit & Schoemaker, 1993: 33-34) or researcher.

The results of the study and its limitations also indicate several challenges and new opportunities for future research. Here three avenues for future research are suggested. The first is to further study implicit knowledge management in practice. The managerial mechanisms focusing on focal objects, individuals or the context of knowledge should be tested in relation to the suggested flows of knowledge. In particular, the role of knowledge objects requires further study. In

existing literature the role of management in affecting the behavior of human actors and the context has been acknowledged, but existing studies of managerial implications do not take into account the knowledge-object relationships. The focal object is barely considered as providing implications for management, and thus is not elaborated upon due to its self-evident existence. In bringing the objects to the forefront, various implications for knowledge management emerge. There are numerous ways to direct managerial intervention towards knowledge objects. A firm can have different strategies for its focal objects. In addition, an outcome control may include different measures of one and the same knowledge object. All these possibilities need scientific investigation to clarify the ways in which they affect the development of valuable IC of the firm.

A second avenue would involve studying the possible tension between the managerial focus on context, the actor and the knowledge object. For instance, it is suggested that there is a tension between diagnostic and interactive types of management controls in a firm (see e.g., Henri, 2006). Since diagnostic controls place managerial focus on knowledge objects and the instruction of human actors, whereas interactive types of controls nurture the context, tension may arise between these approaches. How that tension arises and its consequences for organizational knowledge and capabilities, is an area ripe for investigation.

A third avenue for future research would be to study the combination of explicit and implicit knowledge management in the firm. The models of IC reporting facilitate the recognition of several knowledge-based resources of the firm and their evaluation alongside the strategies of the firm (e.g., Marr, Schiuma & Neely, 2004; Mouritsen, Bukh & Marr, 2004; Marr & Roos, 2005). The mechanisms of implicit knowledge management, on the other hand, support the influencing of such knowledge and knowledge-related resources that are not identifiable through explicit management approaches. Johnson (2002) has suggested the codification and reporting of those IC elements that can be made explicit and the treatment of other more tacit kinds of knowledge as processes. Explicit and implicit knowledge management can be so combined. However, the effects of such a combination are not yet clear, and more investigation is needed of just how the more explicit and implicit kinds of management methods can be combined in a firm.

6.3 Conclusion

It is suggested that we live in a knowledge economy (Drucker, 1993), which forces us to make better use of our skills, experiences and know-how. In order to cope with ever-growing information and communication flows, turbulent and uncertain environments and pervasive globalization, various new managerial methods are being implemented which place greater emphasis on non-financial measures (Kaplan & Norton, 1992; Ittner & Larcker, 1998) and on abandoning those traditional methods that mainly acknowledged the primacy of financial information about tangible resources and labor. Living in a knowledge economy the concepts of knowledge management and intellectual capital management also seem very appealing. Hence, scholars aim to find the forms of managerial intervention that allow an explicit and systematic manipulation of the knowledge and IC encapsulated in the firm.

The present dissertation shows, however, that knowledge management is not an explicit endeavor. Management of valuable IC – organizational knowledge and capabilities – is far more complex than management of tangible resources. Firstly, knowledge is a very context-specific and inherently unobservable phenomenon, which makes the management of organizational knowledge and capabilities very complicated. Secondly, the IC of the firm does not evolve along a linear path but is shaped by many internally and externally emerging circumstances. Various positive or negative events (activation triggers) emerge that force the firm to adapt its current capacities and learn new ways of doing things, making the management of IC development very difficult. Objective prediction of these activation triggers is an imprecise art for any organization. In addition, the complexity of the learning processes involved in reacting to these triggers makes the management of those processes highly problematic. At the same time, these activation triggers make the development of organizational knowledge and capabilities very unique, increasing the value of the IC in terms of the possible competitive advantage to be gained by the firm. Along the historical path taken by the firm, numerous activation triggers shape the organizational knowledge and capabilities, making organizational capabilities hard for competitors to imitate and substitute.

In building organizational knowledge and capabilities, knowledge management is rather an implicit endeavor, in which knowledge as the object of management is not directly visible to the managers. Managers place their attention on other more visible and easily manageable objects in the organization. Thus, in building organizational knowledge and capabilities managerial focus is placed on knowledge objects, human actors and the context in which knowledge is created

and applied. By directing managerial attention to these elements different kinds of knowledge flows can be nurtured in the organization. By concentrating managerial attention on the knowledge objects of the firm, it is possible to direct the processes of organizational learning towards the domains of knowledge which are more congruent with organizational strategies and environmental circumstances. At the same time, managerial intervention in context enables managers to affect the ways in which the firm recognizes activation triggers and responds to them with smooth knowledge exploration and integration processes. Management intervention in an actor's behavior allows it to increase the congruence of existing capabilities with the strategies of the firm. The role of managers is to combine the available types of managerial intervention according to the business strategies and environmental circumstances. Consequently the combination of management systems and emerging activation triggers also makes the path of developing organizational knowledge and capabilities highly specific and unique to the firm, which means these capabilities are most likely valuable, inimitable and non-substitutable by competitors.

In implicit knowledge management, various managerial methods, often not considered to belong to the instruments of knowledge and IC management, become relevant in developing the IC of the firm. Management controls play an important part in implicit knowledge management. Outcome control allows for direct managerial intervention in the knowledge objects. A behavioral control directs the focus onto the behavior of human actors, whereas various decision and communication procedures shape the context in which the IC is built. Management controls are not, however, the only possible tools of managerial intervention that do not initially belong to the field of knowledge and IC management (see e.g., Kujansivu, 2008). There are many other managerial methods that may implicitly, but still quite significantly, have an effect on the development of IC. It is necessary to investigate these methods in future research.

The theory of implicit knowledge management will shed new light on the existing problems of knowledge management, so initiating new debates and raising opportunities for future research. In order to improve our understanding of implicit knowledge management, deeper insights into the underlying mechanisms of management accounting and control in relation to organizational knowledge and capabilities are necessary. The links between the field of knowledge and IC management and the field of management controls have remained relatively unexplored in the literature. By directing attention to the role and methods of management controls, the present study intends to increase the level and quality of communication between the abovementioned research areas.

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Appendixes

Appendix 1 Theoretical paradox in managing organizational knowledge

Causality statement of the RBV	Rare, valuable and inimitable resources can produce sustainable competitive advantage for the firm (Barney, 1991). Especially resources that are non-transferable can produce sustainable competitive advantage (Teece, Pisano & Shuen, 1997).
	Tacit knowledge is the kind of resource that is barely imitable and transferable from one person to another (Polanyi, 1958). However, individual level tacit knowledge is considered tradable (Daft & Weick, 1984; Barney, 1991; Alvesson, 2000). Therefore, only organizationally embedded tacit knowledge can be a source of sustainable competitive advantage.
Need of management	To ensure competitiveness, a firm must manage its resources (Barney, 1994).
Existing assumptions of management	In order to manage knowledge, it is necessary to make tacit knowledge explicit i.e. make it available for managerial intervention (Heng, 2001).
Explicit knowledge becomes vulnerable for imitation	According to the RBV, a resource can be a source of sustainable competitive advantage as long as it is not identified, since explicit knowledge becomes more easily imitable by competitors (Barney, 1991; Powell, 2001; Priem & Butler, 2001; Schultze & Stabell, 2004).
	In this way, management of organizationally embedded knowledge may weaken a firm's sustainable competitive advantage.

Appendix 2 Terms and definitions applied in the study

Term	Definition
Resources	All possible tangible and intangible inputs of the firm that are owned or controlled by the firm (Barney, 1991: 101-102).
Knowledge	“That which is known” (Grant, 1996b: 110).
Capabilities	A firm’s specific abilities to deploy its resources (Amit & Schoemaker, 1993: 35). In a capability various kinds of knowledge and other resources are exploited in repeatable patterns of action (Amit & Schoemaker, 1993; Teece, Pisano & Shuen, 1997; Kasunoki, Nonaka & Nagata, 1998; Sanchez, 2004).
Organizational competence	A set of capabilities oriented towards organizational goals (Prahalad & Hamel, 1990; Sanchez, 2004).
Intellectual capital	An interrelated set of individual and organizational level knowledge and capabilities – potential and realized capacities – that are tightly bundled with other organizational resources. In the literature IC is conceptualized through the metaphorical dimensions of human, structural and relational capital of the firm.
Valuable intellectual capital	Theoretically most valuable knowledge and knowledge-related resources i.e. organizational level knowledge and capabilities, which are aligned with organizational strategies and environmental circumstances.
Intangibles	Non-physical assets of the firm. In literature, the terms intellectual capital and intangible assets are often used interchangeably.

Appendix 3 Example of the classifications used in the IC literature

Terminology and classifications of IC	Authors
Intellectual capital: Market assets Human-centered assets Infrastructure assets Intellectual property assets	Brooking (1996)
Intellectual capital: Human capital Structural capital Customer capital Organizational capital	Edvisson and Malone (1997)
Intangible assets: Employee competence Internal structure External structure	Sveiby (1997)
Intellectual capital: Human capital Structural capital Relational capital	Stewart (1997)
Intellectual capital: Human capital Competence Attitude Intellectual agility Structural capital Relationships Organizational capital Renewal and development	Roos et al. (1997)
Intellectual capital: Human capital Intellectual assets	Sullivan (1998)
Intellectual capital: Human capital Organizational capital Relational capital	M'Pherson and Pike (2001)
Intellectual capital: Human capital Structural capital Relational capital	Viedma (2001)
Intellectual capital: Structural capital Human capital Market capital Innovation capital	Bounfour (2003b)

Appendix 4 Epistemologies of knowledge

Realist epistemology			Non-realist epistemology		
Objectivism-Rationalism			Subjectivism-Relativism		
1	2	3	4	5	6
Reality as concrete and conformable to law from a structure independent of the observer	Reality as concrete determining process	Reality as mutually dependent fields of information	Reality as a world of symbolic discourse	Reality as a social construction	Reality as a manifestation of human intentionality
Explanatory Knowledge			Understanding knowledge		
[Explanatics]			[Hermeneutics]		
Cognitivism			Connectionism		
Autopoietism			Constructivism		

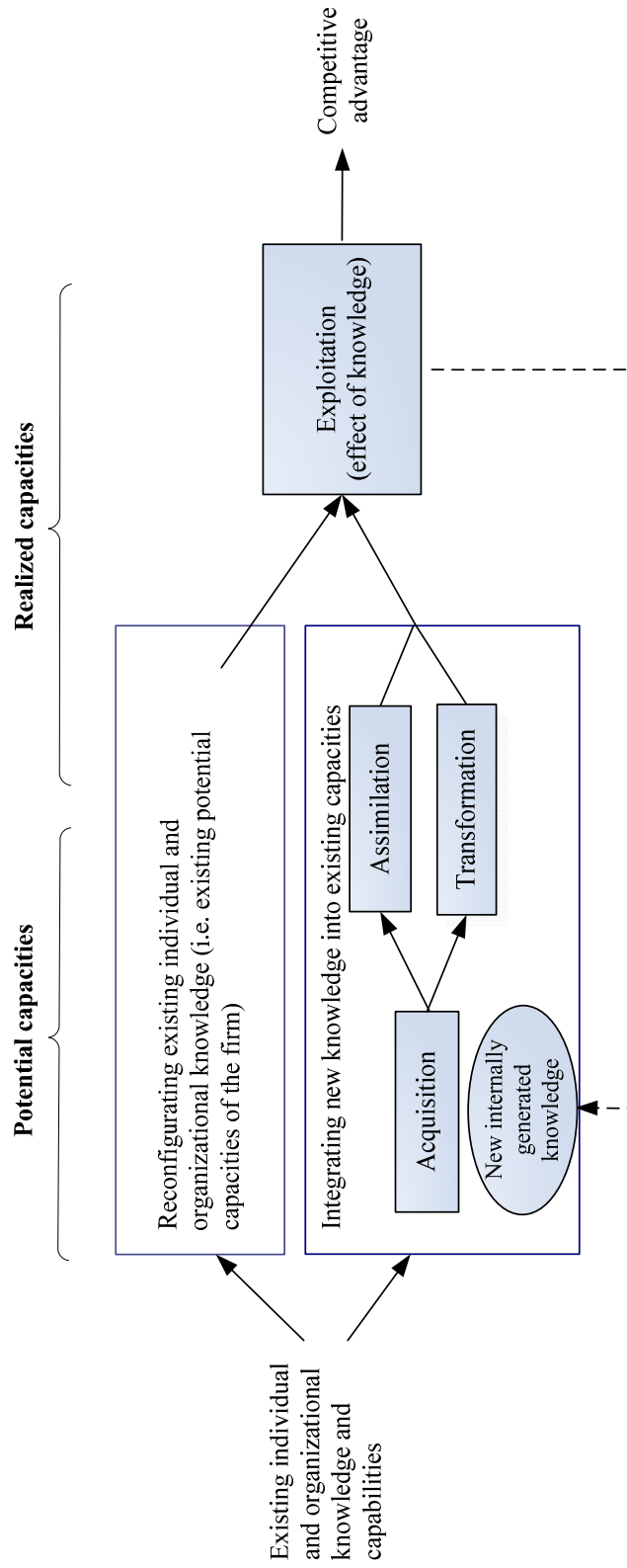
* In this appendix the six views of reality are adopted from Arbnor and Bjerke (1997). The distinction of cognitivism, connectionism and autopoietism is adopted from Venzin, Krogh and Roos (1998).

Appendix 5 Four discourses of knowledge management research

	Duality	Dualism
Dissensus	<p>Dialogic Discourse</p> <p>Metaphor of Knowledge: discipline</p> <p>Role of Knowledge in Organizations: deconstruction of totalizing knowledge claims, creation of multiple knowledges</p> <p>Theories: post-structuralist theories, feminist theories, postmodern theories</p>	<p>Critical Discourse</p> <p>Metaphor of Knowledge: power</p> <p>Role of Knowledge in Organizational Underclass: reformation of social Order</p> <p>Theories: labour process</p>
Consensus	<p>Constructivist Discourse</p> <p>Metaphor of Knowledge: mind</p> <p>Role of Knowledge in Organizations: coordinating action, shared context, recovery of integrative values, generation of understanding</p> <p>Theories: structuration theories, theories of practice, sensemaking, actor network theory</p>	<p>Neo-Functionalist Discourse</p> <p>Metaphor of Knowledge: asset</p> <p>Role of Knowledge in Organizations: progressive enlightenment, prediction, reduction of uncertainty, optimal allocation of resources</p> <p>Theories: resource-based view of firm, transaction cost theory, information processing theory, contingency theories</p>

Adopted from Schultze and Stabell (2004: 556)

Appendix 6 The processes of building organizational capabilities



* The present figure is drawn based on theoretical contributions provided by Cohen and Levinthal (1990), Grant (1996b), Zahra and George (2002), Todorova and Durisin (2007).

Appendix 7 Factors influencing the processes of organizational learning

Processes of organizational learning	Characteristics of the process	Influencing factors	Authors
Acquisition	Intensity Speed Direction	Cognitive limitations Prior knowledge, experiences Knowledge complementarity Availability of external sources Diversity of external sources Structure of external communication	Miller (1956), Cohen and Levinthal (1990), Baddeley (1994), Zahra and George (2002), Kim (1998).
Assimilation Transformation Knowledge integration	Efficiency Scope Flexibility	Cognitive limitations Prior knowledge, experiences Structural barriers, structure of internal communication Common knowledge Different and conflicting views Information withheld Knowledge complementarity Power relationships Awareness of other capabilities in the firm Frequency and variability of task performance Behavioral barriers Political barriers	Argyris (1978), Baddeley (1994), Miller (1956), Nahapiet and Ghoshal, (1998), Zahra and George (2002), Grant (1996a), Cohen and Levinthal (1990), Kim (1998), Todorova and Durisin (2007).
Exploitation	Performance of the final activity in which knowledge is exploited	Success of prior processes Perception of threats and opportunities Availability of tangible resources Practical experience Power relationships	Penrose (1959), Zahra and George (2002), Todorova and Durisin (2007).

Appendix 8 Case study interviews

Respondents	Number of interviews	Interviews total (hours)	Tape-recorded (hours)
Case A			
CEO and Project Manager*	7	10,78	9,43
Project manager/Director of R&D	3	2,83	2,69
Business Development Manager	2	2,17	2,04
Total:	12	15,78	14,16
Case B			
CEO	3	2,73	1,71
R&D Manager*	5	5,67	5,50
Production Manager	1	0,88	0,44
Quality Control Manager*	5	3,96	3,29
Export Manager/Marketing manager	1	0,50	0,35
Total:	15	13,73	11,29
Case C			
CEO	2	1,95	1,81
VP, Director of R&D	1	1,08	0,99
Director of Product Development	2	1,75	1,53
Director of Material Research	1	0,67	0,43
Division Manager	1	1,00	0,87
Controller	2	1,42	1,24
IPR Manager *	6	7,38	5,01
Marketing Manager/Inventor	1	1,00	0,80
Project Manager	3	2,45	2,26
Legal and Human Resource Manager	2	0,84	0,60
Quality Control Manager	2	2,00	1,69
Scientist of Material Research	1	0,50	0,40
Executive Assistant	2	0,54	0,47
Total:	26	22,58	18,11
Interviews total (A+B+C)	53	52,09	43,55

* An informant of the case study

Appendix 9 Documents collected and information systems introduced in the field

	Reports/other documents	Information systems
Case study A	Agenda for a meeting of the board of directors Business development report Management meeting agenda Organizational chart Operative-technical meeting agenda Project meeting agenda Project update report External documents (newspaper articles etc)	Project management system (electronic reporting system)
Case study B	Evaluation of marketing processes Organizational chart Organizational main and supporting processes Performance evaluation of R&D Procurement, production and customer service processes (chart) Technical processes (chart) Quality assurance processes (chart) Quality system of R&D projects External documents (newspaper articles etc)	System of internal and external complaints
Case study C	Annual reports Business Intelligence system review Competitors' review Customer feedback investigations Design and development objectives Design control instructions Design control reviews Financial reporting review Idea evaluation reports Idea screening templates Internal audit, process evaluation Management review instructions Mission and strategy statement Monthly reporting overview Organizational chart 1 (September 2005) Organizational chart 2 (May 2006) Intellectual property review Performance measurement system review Process evaluation reviews Product idea suggestion form Project schedule Restored team-room discussions Quality records, product evaluation reports Quality system meeting reviews External documents (newspaper articles etc)	Team-room system IP Team-room Product Development team-room Competitor Analysis team-room Quality management team-room

Appendix 10 The system of meetings in the case study A

Regular meetings	Frequency	Structured/ Unstructured	Purpose of the meeting, active participants
Board meetings	Every 6 weeks	Highly structured	Purpose: Strategic management Participants: the board and invited guests
Management team meetings	Monthly	Highly structured	Purpose: discussion on financial reports, budgets; activities of the projects, based on project update reports; R&D, IPR; operative plans; action plans. Participants: CEO and managers of departments
Project management meetings	Quarterly	Highly structured	Purpose: Performance management, discussion about objectives and tasks of the projects, emphasizing the key issues (activation triggers); budgets; competition; commercialization. Updating data in project management system Participants: CEO, project managers and manager of business development
Operative-technical meetings	Quarterly	Highly structured	Purpose: discussion of the performance and ongoing issues from cost-centers' perspective; budget comparison. Participants: CEO, heads of six cost-centers, head of laboratory and project managers
Staff meetings	Every 2-3 weeks	Highly structured	Purpose: information sharing and dissemination to employees Participants: all employees
Research i.e. drug discovery meetings	Every 2-3 weeks	Structured	Purpose: discussion of activation triggers in projects Participants: employees from research department and the Director of Research; project managers from development projects
Meetings of chemists	Every 2 weeks	Structured	Purpose: performance evaluation and activation triggers of chemistry Participants: chemists, project manager
Meetings of pharmacologists	Every 2 weeks	Structured	Purpose: performance evaluation and activation triggers of pharmacology Participants: pharmacologists, project manager