

Knudsen, Line Gry

**Doctoral Thesis**

## Collaborative R&D capabilities: In search of micro-foundations

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**Collaborative R&D Capabilities**

# Collaborative R&D Capabilities

In Search of Micro-Foundations

**Line Gry Knudsen**

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Line Gry Knudsen

**Collaborative R&D Capabilities**  
**In Search of Micro-Foundations**

Center for Strategic Management and Globalization  
Copenhagen Business School

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Line Gry Knudsen  
Frederiksberg, April 2009

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## 1. INTRODUCTION

### In need of Collaborative R&D Competences

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*Many firms are no longer structured like medieval kingdoms, walled off and protected from hostile outside forces. Instead we find companies involved in an intricate latticework of collaborative ventures with other firms, most of whom are ostensibly competitors*  
(Powel, 1990:301)

#### 1.1 Introduction

Throughout the last decades a surge of interest in inter-organizational collaboration has been witnessed in research fields as diverse as strategic management, economics, sociology, and organization theory. Numerous scholars argue that inter-organizational collaboration has become a prominent way for firms to create value and gain competitive advantage (Teece, 1986; Gomes-Casseres, 1996; Teece, Pisano and Shuen, 1997; Doz and Hamel, 1998; Dyer and Singh, 1998; Powel, Koput and Smith-Doerr, 1996).

Not only has inter-organizational collaboration moved to centre stage in many theoretical fields. A rise in the actual number of alliances has been empirically documented as well by studies revealing that in an attempt to maneuver in an increasingly competitive environment, a growing number of firms turn to external partners for innovative ideas and new knowledge. By way of example the number of inter-organizational alliances is documented to be six times as high in 1999 as a decade earlier (Kang and Sakai, 2001). Besides, an increase has been identified not only in the number of firm-external relations, but also in the percentage of revenues pending from strategic alliances (Harbinson and Pekar, 1989). This finding is established by a recent study of the alliance activities of 192 firms showing that where as 38% of the respondents' market value is presently created through alliances they expect 51% of the market value to be created via alliances within the coming 5 years (Heimeriks, 2004).

Especially science-based firms (as distinct from 'supplier dominated firms', 'specialized equipment suppliers' or 'scale intensive firms' (Pavitt, 1984)) are profiting from external knowledge source for example through utilization of 'the underlying science in the university and elsewhere' (Pavitt, 1984:362). It is stressed that even core knowledge used in the various R&D processes does not necessarily need to stem from sources internal to the firm, but is likely to originate externally (Pavitt, 1984; Teece, 1980; Duysters *et al*, 1999; Chesbrough, 2003). Thus in many phases, from discovery to development, collaboration with external partners is chosen as the appropriate way of conducting R&D (Ring and Van de Ven, 1994; Powel, Koput and Smith-

Doerr, 1996). R&D collaboration has become an important means of gaining access to R&D knowledge for many firms, a tendency that even seems to be rising; the number of newly established R&D partnerships grew from 30 a year in the 1960s and 1970s to 500 established R&D partnerships a year in the second half of the 1990s, even with a peak in 1995 on 700 newly established partnerships (Hagedoorn, 2002). The rationale behind this increase in the wish for collaboration is that firms engaged in R&D alliances can enjoy synergistic effects by combining knowledge resources and related capabilities (Doz and Hamel, 1998; Ring and Van de Ven, 1994; Powel, Koput and Smith-Doerr, 1996; Contractor and Lorange, 2004; Bamford, *et al* 2003), and that they additionally can foster opportunities to learn, and to access, transfer and harvest knowledge to create innovative solutions (Grant and Baden-Fuller, 2004; Hagedoorn and Schakenraad, 1991).

Yet, in spite of the adduced virtues of R&D collaboration numerous alliance researchers do—repeatedly—report about high failure rates in inter-firm alliances. In fact, between fifty and seventy percent of all alliances is said not to justify the expectations that was outlined from the beginning (Harrigan, 1988; Parkhe, 1993; Harbinson and Pekar, 1998; Das and Teng, 2000). These high failure rates of alliances bear witness of a general challenge meeting many collaborating firms. This is the challenge of making the corporate aspiration to collaborate meet the goal of enhanced R&D performance. Scholars have not yet dealt sufficiently with the relation between an overall wish for collaboration and the ability to master the partnering activities, for example by developing the required collaborative capabilities. I shall argue that the processes going on internally in collaborating firms are treated like a ‘black box’ in many strands of research. The following example is an indication of this lack of insight.

The Danish pharmaceutical company Novo Nordisk is a case in point of the numerous R&D intensive companies that has acknowledged the importance of external knowledge sources. When venturing into the field of biopharmaceuticals in 2005, the company decided to build parts of this new business area on knowledge sourced externally. This strategy is opposed to the earlier dominant logic of the firm which implied that research must be done on the basis of internally developed knowledge and technologies. As the research manager declared after finishing the first two deals with external partners I 2006: ‘These are the first signals of a much more aggressive approach to external innovation in Novo Nordisk.’<sup>1</sup> According to the CEO, the new externally focused strategy can be based on various collaborative models where the partner retains its independence while working closely with Novo Nordisk on for example potential pharmaceutical

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<sup>1</sup> Interview with Research Manager Terje Kalland, who is the Head of Biopharmaceuticals. Published in the newspaper *Borsen*, March 27<sup>th</sup> 2006.

candidates.<sup>2</sup> This open strategy reveals a company that expects to gain competitive advantage and become even more innovative by interacting with external partners on projects of vital importance to the company. Still, this new partnering strategy brings along a number of challenges, as an R&D manager explains in the following:

The employees at Diabetes Care have lived a much more quiet life because of their ability to be self-sufficient in their area—and they do think that they are the best in the world. But they have been lulled into illusions due to the lack of interaction with others. They have had nothing to strive for, as long as they did well in the insulin field. These people—and it is actually half of those who work at Novo Nordisk—do not know what it means to collaborate with other companies, because they were never forced to do so. (#3)<sup>3</sup>

In this organization R&D collaboration has been strategically accepted as a desired way of acquiring new knowledge, still a gap it witnessed between the corporate aspiration to increase collaboration and the abilities of the organization and its employees to collaborate, and following the organization may never meet the expected outcomes. This empirical example is not an isolated event. Even though a clear upsurge in the research on inter-organizational relations has increased our understanding of the advantages of inter-firm collaboration we still witness a gap in the literature with regards to the knowledge processes that go on inside the firms engaged in collaboration. How, we may ask, does openness towards external knowledge sources lead to enhanced R&D performance? What are the internal organizational mechanisms that facilitate the collaborative processes? How are specific collaborative capabilities developed to ensure collaborative success, and—maybe most importantly—what is their composition in terms of organizational and individual level factors? This thesis will aim at addressing these and related questions.

## **1.2 Research Problem and Aim of Study**

The empirical example described above illustrates the core theme addressed in this thesis, namely the existence of collaborative R&D capabilities. The aim is to outline the capabilities needed for firms to meet the goals they set when engaging in collaborative R&D activities. These collaborative capabilities are firm-specific and organizational in nature and, like organizational capabilities in

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<sup>2</sup> Interview with the CEO of Novo Nordisk, Lars Rebien Sørensen. Published in the newspaper *Borsen* September 22<sup>nd</sup> 2005.

<sup>3</sup> The figures following each quotation refer to a respondent in the firms I have studied. The employees are made anonymous.

general, they can be said to enable a given firm to consistently sustain innovation, new knowledge creation, recombining existing capabilities and reinventing and updating their underlying routines (Nelson and Winter, 1982). The construct of organizational capabilities is used in various strands of research, such as strategic management (specifically in evolutionary economics), in business history, and in innovation management. The terminology varies according to theoretical focus and thus a more thorough reading of this literature is warranted and will be provided in chapter 2. Still, it is reasonable to summarize this diverse body of literature, by stating that organizational capabilities are what enable a firm to attain the goals they set in relation to a given activity. E.g. Amit and Schoemaker (1993) state that organizational capabilities refer to ‘a firm’s capacity to deploy resources, usually in combination, using organizational processes, to affect desired ends’ (1993:35).

In line I will argue that collaborative R&D capabilities are what ‘link’ a corporate aspiration to collaborate with the end goal of attaining successful outcome of these collaborative activities. That capabilities are needed to attain a given goal is somewhat uncontroversial and also relatively well surveyed in the field of strategic management (e.g. Teece, Pisano and Shuen, 1997). What is yet less studied is how these collaborative capabilities come about, and especially how they are attained and developed by the individuals engaged in collaborative activities. I will proceed with the definition of collaborative R&D capability as a dynamic capability consisting of the utilization of strategic and structural resources at the organizational level and human resources (abilities) at the individual level in a way that utilizes external and internal knowledge sources in consonance.

Previous research has established that the bonds between key individuals are central mechanisms that initiate alliance formation (e.g. Larson, 1992) and sustain inter-firm relationships (Seabright, Levinthal and Fichman, 1992). Individuals also embody the knowledge-based resources (Grant, 1996) that evoke problem solving and learning (Larsson *et al*, 1998) and contribute the most to a firm’s ability to utilize external information (Allen, 1977; Simon, 1985). Moreover, the primary basis of the firm’s ability to capitalize on external information rests on the ability of individuals to access, assimilate and utilize information (Cohen and Levinthal, 1990: 131). Still, despite this insight and the more general interest in inter-organizational collaboration in a wide variety of settings, much of the organizational literature still treats the organization as the centerpiece of theorizing when studying preconditions for collaboration. Various theoretical approaches, such as the resource based view and transaction cost perspective, identify specific firm level preconditions for collaboration and use these to predict organizational outcomes. This is, unfortunately, done without consideration for the underlying, individual level mechanisms that conditions these outcomes.



Hence, even though studies have recognized the importance of individuals for alliances and learning more generally, only a few studies have incorporated the role of individuals into explanations for firm learning in R&D collaboration. As knowledge is first and foremost viewed as residing within the individual (Grant, 1996) we have yet another argument for focusing our attention on the individual level when studying how firms benefit from using external knowledge sources. In sum, strategic alliances scholars have placed much greater emphasis on environmental conditions, and organizational level resources, practices and tendencies, than individual level mechanisms as explanations for innovation in R&D alliances.

Thus, the aim of this thesis is to *identify and analyze the influence of micro-foundations on collaborative R&D capabilities*.

### 1.3 Trends and Gaps in the Strategic Alliance Literature

Strategic alliance research has traditionally been successful in providing knowledge about how dyadic alliances are functioning. Numerous studies have focused on critical aspects idiosyncratic to the single alliances, such as individual alliance governance mechanisms (Koza and Lewin, 2000, Kale, Dyer and Singh, 2001); choice of governance structure (Williamson, 1985, Pisano, 1989), and, alliance assessment (see Ireland *et al*, 2002 for an overview). Other studies have been centred on critical success and failure factors related to competitive issues between partners (see Heimeriks, 2004 for an overview).

Yet, strategic alliance scholars have recently requested a more strategic approach to how firms deal with alliances, and managers are urged to view all their alliance activities as one large portfolio. Considering each alliance as distinct activities will limit the firm’s learning abilities (Khanna *et al.*, 1998). Thus, in order to learn how to manage collaborative relationships (Lorenzoni and Baden Fuller, 1995) we need to address issues of alliance formation, alliance management as well as alliance performance issues in a more general manner. As I will show, this need for an strategic approach to the alliance activities is asked for and partly addressed by three different branches in resent alliance literature; namely, the ‘Alliance Portfolio Management’ field (e.g. Nielsen and Mahnke 2003; Heimeriks, 2004), the ‘Alliance Strategy’ field (e.g. Bamford, Gomes-Casseres and Robinson, 2003), and the ‘Collaborative Capabilities’ perspective (e.g. Kale, Dyer and Singh, 2002, Heimeriks and Duysters, 2007). Table 1.1 summarizes the core arguments of the threes branches which additionally will be outlined below.

**Table1.1: Three Perspectives addressing the need for a strategic approach in alliance research**

Trend	Core Perspectives	Citations/Examples
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<b>Alliance Portfolio</b>	<p>An Alliance portfolio view helps to:</p> <ul style="list-style-type: none"> <li>- Elucidate the risk and opportunities of several inter-firm collaborations pursued simultaneously</li> <li>- Clarify how managers of collaborations may optimize the return/risk relation of their portfolio through combining several alliance contracts</li> <li>- Ease the timing of new collaborations or termination of others, reduce complexity, and enable knowledge sharing</li> </ul>	<p><i>'Alliance portfolio management is emerging as the firm discipline of building and managing a focal firms entire portfolio of two partner and multiple partner alliances ... [this] emergent research stream has pointed to the urgency of studying the challenges of simultaneous management of multiple alliances'</i> Nielsen and Mahnke (2003:2)</p> <p><i>'Whereas in earlier studies the dyad was the topic under investigation, recently some scholars use the firm's alliance portfolio as unit of analysis. Looking at portfolio of alliances not only helps firms to reduce complexity, but also enables them to share knowledge to leverage the performance of its alliances'</i> Heimeriks (2004:34)</p>
<b>Alliance Strategy</b>	<p>The Alliances Strategy perspective:</p> <ul style="list-style-type: none"> <li>- Moves focus from the single strategic alliance to the development of a comprehensive alliance strategy</li> <li>- Integrating 4 central aspects: 1) design of alliances, 2) management of alliances, 3) alliance constellations, and 4) development of internal alliance capabilities</li> </ul>	<p><i>'An alliance strategy represents much more than the deal—it is an intent, a dynamic process, and a logic that guides alliance decisions [...] now that alliances are central to strategy, we must adopt this more comprehensive view of how they work.'</i> Bamford, Gomes-Casseres and Robinson (2003:2)</p> <p><i>Being involved in multiple alliances is not sufficient [...] the firm must also manage the constellation as a hole.'</i> Bamford, Gomes-Casseres and Robinson (2003:6)</p>
<b>Collaborative Capability view</b>	<p>Collaborative Capability view:</p> <ul style="list-style-type: none"> <li>- A firm's specific capability to manage collaborative relationships (their collaborative capability) is a predictor of relationship success.</li> <li>- Collaborative Capabilities is a firm-specific ability to capture, share disseminate, internalize and apply alliance management know-how and know-why.</li> <li>- Collaborative Capabilities are not completely tacit, thus they are manageable</li> <li>- Scholars have (still) not settled on and unambiguous definition but are talking about 'Collaborative know how' (Simonin, 1997); 'Relational Capability' (Dyer and Singh, 1998); 'Alliance Capability' (Kale and Singh, 1999); 'Cooperative Competences' (Sivadas and Dwyer, 2000); 'Alliance Competence' (Lambe, Spekmann and Hunt, 2002), 'Inter-organizational Routines' (Zollo, Reuer and Singh, 2002), etc.</li> </ul>	<p><i>'Rather than focusing attention and resources solely at the individual level and managing each venture separately there is now both the chance and the need to build corporation wide alliance capabilities.'</i> (Bamford and Ernst 2003:321)</p> <p><i>'Factors such as the knowledge, experience and management techniques that the organizations have in the alliance field could be examined, making the organization instead of the alliance the frame of reference for research'</i> Draulans, de Man, and Volberda (2003: 152)</p> <p><i>'While early alliance research emphasized factors explaining rent optimization in individual alliances recently scholars try to uncover firm-specific capabilities that help leapfrog the performance of the entire firm's alliance portfolio and therefore explain persistent fixed-firm differences in alliance performance'</i> (Heimeriks, 2004: 32)</p> <p><i>'[F]ew if any observers have pulled back from individual examples or stories to analyze the broader principles and mechanisms underlying the success of creation networks. Those principles ad mechanisms, once understood, suggest specific moves that companies can make to profit from this ambitious form of open innovation and to create greater value than more conventional models of innovation can'</i> Seely Brown and Hagel (2006)</p>

A first fraction of alliance scholars have argued the need for a synchronized view of the complete portfolio of often interrelated alliances a firm is engaged in (Lorentzoni and Baden-Fuller, 1995; Khanna *et al*, 1998). Applying an *alliance portfolio view* will, according to these scholars, provide firms with a better understanding of how their alliance portfolio—being the collection of alliances they are engaged in—, may fit their changing strategic intents and/or the changing market and technology environments they belong to (Dyer and Nobeoka, 2000). R&D alliance portfolio management is an emerging field (Nielsen and Mahnke, 2003), yet, it has been inspired by for example Modern Portfolio Theory (MPT) in the quest for pointing to the urgency of studying challenges of simultaneous management of multiple alliances (Harbinson and Pekar, 1998).

Another group of scholars advocate for a strategic approach to alliances as well, yet in a slightly different way. Alliance scholars have recently stated that even though ‘companies announce ‘strategic alliances’ daily many lack ‘alliance strategies’ (Bamford *et al*, 2003:2). The difference, being more than semantic, is pointing towards the assertion that an alliance lacking an underlying strategy is doomed to fail. What an alliance strategy can provide is a logic to guide alliance decisions. In this branch of the alliance literature emphasis is put on the importance of alignment between a given R&D strategy and the overall business strategy of the focal firm. In accordance to the argued aggregate approach to alliances scholars point to the importance of ‘looking beyond the deal’ and focus the attention on how the alliances contribute to the company’s business strategy (Bamford *et al*, 2003).

A third branch of strategic alliance scholars have addressed the need for a more comprehensive view on alliances. They have done this by articulating the necessity of studying general alliance capabilities (Kale, Dyer and Singh, 1999; Heimeriks, 2004) which if possessed can act as means to gain competitive advantage (de Man, 2004). Examining how firms achieve and sustain competitive advantage is the fundamental activity in strategic management (Rumelt, Schendel and Teece, 1991). In order to be able to explain discrepancy in firm performance, strategy scholars have either studied the structure of the industry (for example its barriers to entry and rivalry among industry incumbents) that a given firm belongs to (Porter, 1980), or examined firm heterogeneity created by the existence of superior capabilities and resources inside the firm. The resource based view (RBV) assumes firms to be bundles of capabilities and resources heterogeneously distributed across firms (Penrose, 1959; Wernerfelt, 1984), creating competitive advantage by being rare, valuable, inimitable, and non-substitutable (Barney, 1991). Although theoretically useful this view neglects to account for the mechanisms by which resources actually contribute to competitive advantage. Recent extensions of the RBV seek to explain how this may happen in dynamic and rapidly changing markets via application of the dynamic capabilities

perspective (e.g. Teece, *et al.*, 1997; Eisenhardt and Martin, 2000). The most often cited definition of dynamic capabilities is that: ‘Dynamic capabilities [...] are the organizational and strategic routines by which firms achieve new resource configurations as markets emerge, collide, split, evolve, and die’ (Teece *et al.*, 1997). I will later argue that collaborative R&D capabilities are particular dynamic capabilities.

Even though convincing in their argumentation about the need for a more strategic approach to alliances these three prevalent perspectives do not provide us with a thorough understanding of how firm-level concepts, such as organizational capabilities, explain firm-level outcomes such as enhanced R&D performance. The firm-level concepts are, at best, useful shorthand for complicated patterns of individual action and interaction (Abell, Felin and Foss, 2008). To fully understand how a strategic view on alliance activities may lead to enhanced R&D we need to redirect our attention towards individual-level constructs such as beliefs, values, motivation, and behaviour—and especially we must examine how these individual level constructs are related to our organization-level outcome. I will argue for the importance of this examination in the following.

#### **1.4 Motivation of Study**

As I agree with the need for a strategic view on alliances (as opposed to viewing each single alliance at a time) a critical examination on the three outlined branches of alliance research is timely and warranted. I will deal thoroughly with the three streams of alliance research in chapter two, but for introductory purpose I will reveal my core point of critique that motivates this study. The main critique is that all these leading edge studies do not treat the individual level issues properly and thus we lack understanding of how individual level attributes can ensure the effective embeddedness of collaborative R&D capabilities. While promising in clarifying the meaning and application of resources and capabilities under different conditions, the perspectives briefly outlined above largely assume capabilities to be ‘processes embedded in firms’ (Eisenhardt and Martin, 2000: 1106) and conceptualize them as ‘strategic and organizational processes’ like product development, allying, and strategic decision making (Eisenhardt and Martin, 2000: 1106). From this perspective, performance differences between firms are driven by efficiency differences that can somehow be attributed to organizational (collective) level constructs while fundamental questions related to the individual level attributes of the phenomena are ignored (Felin and Hesterly, 2007). These studies do, by and large, neglect to empirically account for the *individual* level attributes that ensure the effective development of collaborative capability. Thus, we need to develop a

comprehensive understanding of the mechanisms that foster collaborative R&D capabilities in general and specifically we need to focus on the micro-foundations of these capabilities.

A central reason for the importance of dealing with the micro-level foundations and especially focus on the explanatory mechanisms is that these explanations are necessary for providing a complete understanding of the organizational-level phenomenon that we study, i.e., our dependent variable (Coleman, 1990; Abell, Felin and Foss, 2008). I will provide a more detailed discussion of this belief in chapter 3, yet to reveal a few central points of this discussion I will state that what we gain by opening the ‘black box’ of our research field (or reject the short hand) and search for individual-level explanations is at least three things. First of all, we get a chance to delineate the various alternative individual-level explanations that can not be disentangled in an organizational-level explanation. Second, we provide an opportunity to be precise about prospective managerial interventions as we deal with the need for interventions at the level where they ought to be directed, viz., at the level of individual action. Third, since the phenomena we study are most likely an outcome of the action if their components (for example the behavior of individuals of a given collaborative project) knowledge of how the actions of these parts combine to produce the systemic behavior can be expected to give greater predictability, than will statistical relations of surface characteristics of the system. In other words, ‘an explanation based on internal analysis of system behavior in terms of actions and orientations of lower level units is likely to be more stable and general than an explanation which remains at the system level’ (Coleman, 1990:3).

However, despite all the arguments for scholars to contribute to the ‘micro-foundation project’ (as the search for individual-level explanations has recently been labeled (Abell, Felin and Foss, 2008:2)), only a few have made this venture in the field of strategic alliance research. Searching out studies that may be capable of informing the present investigation of explanations to successful R&D collaboration the field of innovation studies is found highly promising. A core theme in innovation studies is that any innovation consists of new combinations of existing ideas, skills, capabilities or resources, and that the greater the variety of these elements the greater the scope for them to be combined in different ways and thus create new innovative knowledge (Schumpeter, 1939; Fagerberg, 2005). This quest for new combinations is not a internal activity that stops at the gate of the firm; rather it leads the firms to search for valuable knowledge externally resulting in numerous collaborative constellations (Powell, 1990).

Unfortunately the search for individual-level antecedents of collaborative R&D capabilities in the field of innovation studies seems almost as unrewarding as in the strategic alliance field. In the division of innovation studies dealing with collaboration in the most focused manner; that is the studies of the Open Innovation paradigm (Chesbrough, 2003), much focus is put on how

openness can be witnessed at the organizational level and how it affects the organizational design and corporate strategies. It is shown how openness can result in increasing vertical disintegration, outsourcing, modularization, use of open standards and the growth of the market for specialized technology (Christensen, 2006:35). But very little is said about how openness affects the individuals in their daily work processes. This focus on organizational level issues is also apparent when we look for guidelines on how to structure the internal R&D function in order to benefit from openness/collaboration: this is primarily described as principles<sup>4</sup> directed towards organizational level issues. In any case these studies do not deal with either general micro-foundations or the implications at the individual level. In fact, very few scholars working in the field of Open Innovation studies have actually dealt with how this perspective affect the employees of the firm engaged in open ventures (see Vanhaverbeke, 2006:207 for a discussion on this missing part of the open innovation literature). Since open innovation is basically about relations between firms, it may be argued that it is expected that these studies deal especially with organizational level matters (Vanhaverbeke and Cloudt, 2006:277). However, because the open innovation model is said to challenge the traditional views on innovation activities, I argue that the open innovation perspective is especially challenging for the employees of the collaborating firms. The employees may need to change their attitude towards working with external colleagues and externally produced knowledge as well. For example, they need to settle with the Not-Invented-Here syndrome according to which employees traditionally resist to accept knowledge produced externally (Katz and Allen, 1982). Further, they need a specific bundle of competences to collaborate (Dyer and Singh, 1998) for example the capacity to absorb the knowledge they are presented with in different collaborative projects (Cohen and Levinthal, 1990). The absorptive capacity of the employees is of particular importance as it can be argued that externally sourced knowledge will only be beneficial if it is assimilated and thereby made ready for commercial ends in the focal firm (Cohen and Levinthal, 1990). All these individual level matters and the way they impinge on the organizational level outcome need to be studied in a much more exhaustive manner.

I will not fail to appreciate that a firm benefits from applying a more general view on all their collaborative activities as it is dictated from various strands of strategic alliance research. Yet, I argue that a strategic view, as for example the alliance portfolio view, needs to be accompanied by a

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<sup>4</sup> According to Chesbrough (2003), four principles must be introduced in the R&D function. First, it is important to identify, understand and access the wealth of available external knowledge. Next, the missing pieces of knowledge must be filled in order to make up for the knowledge that is not being developed internally. Third, there is a need to integrate internal and external knowledge in order to form more complex combinations of knowledge and to create new systems and architectures. Finally, ways must be discovered to generate additional revenues through the sale of research outputs to other firms for use in their own systems (Chesbrough, 2003).

more fine-grained analysis of the individual level perceptions and behaviors that affect the various collaborative activities of a given firm. By undertaking an analysis of the individual-level factors we will develop an improved point of departure for studying how openness towards external knowledge sources enhances a given firm's innovation capacity and to study how collaborative R&D capabilities develop and how they can be characterized, *both* in terms of organizational and individual level factors.

### **1.5 Study Design**

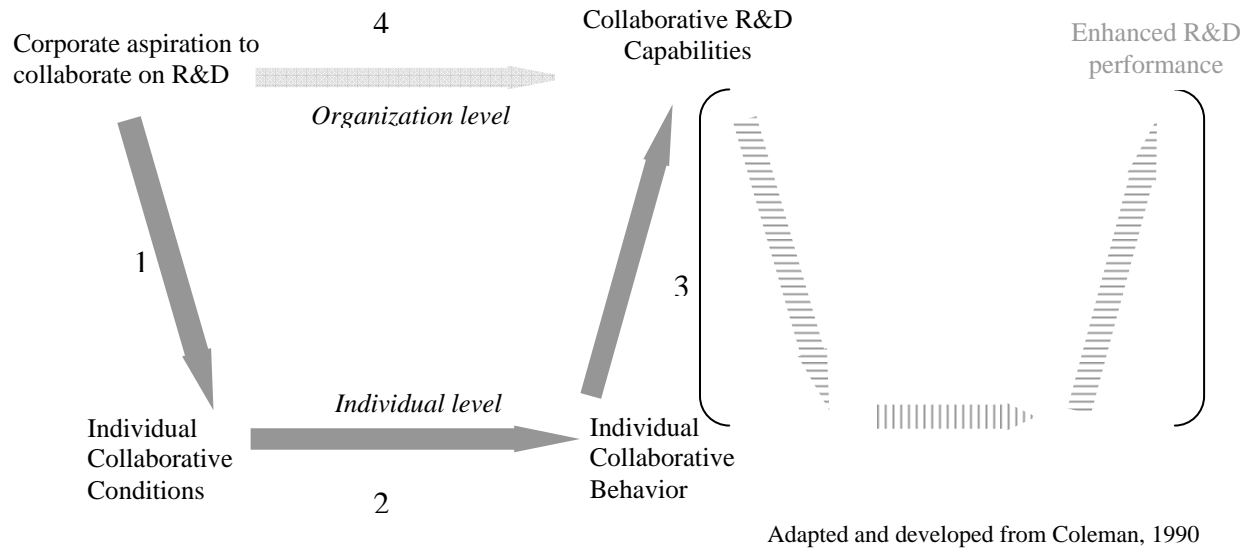
The overall objective of this study is to: *identify and analyze the influence of micro-foundations on collaborative R&D capabilities*. I seek to address this aim by undertaking both empirical and theoretical analyses. It is argued that studies of strategic alliances and R&D collaborations specifically have suffered from being mainly conducted on large datasets and with little attention to process factors that may be key factors behind alliance success, and the case-study methodology is emphasized as a useful complementary method as it entails the option of learning from the employees engaged in the formation and operation of collaborative arrangements (Shenkar and Reuer, 2006:13). I undertake three case studies to *identify* the organizational and individual level determinants of collaborative R&D capability in the case companies. This is done to provide an explorative overview of the determinants rather than evaluating the degree to which the capabilities have been implemented successfully, leading to better performance. The objective of the case studies is thus to challenge the existing theories in the alliance field and to qualify them by joining theoretical knowledge about firm level benefits of alliances with theories on individual level work motivation, and behaviors in connection to R&D collaboration. The cases studied are instances of a specific class of event, namely inter-organizational collaborative R&D projects. The aim of the case studies is to enhance our knowledge in the field of collaborative R&D capabilities and to shed light on the individual level factors that affect the dependent variable, the organizational level collaborative R&D capabilities. Subsequent to the within-case analysis of the three case narratives I do a cross case analysis in order to provide a comparison of commonalities and differences in the events, activities and processes that are the unit of analysis in the case narratives.

The structure of the core analysis follows an analytical framework provided by James Coleman (Coleman, 1990). This framework set the scene for analyzing how different empirical states affect beliefs and actions of individuals in a given case and this structure enables me to outline and discuss various types of connections or causal explanations (Abell, 2001) between macro level (organizational) and micro level (individual) conditions, actions and outcomes. An inherent conviction of this analytical framework is that too often organizational phenomena, such as

collaborative capabilities are mistakenly explained only by other organizational level factors. Still, explanations of this kind do not provide us with stable and useful explanations. For this to happen we need to search for explanations at the micro-level (below the level of the phenomena that we study) and thereby provide explanations that include e.g. actions and interactions of individuals. This analytical framework that is put forward by Coleman will be thoroughly discussed in chapter 3 and 4. What needs to be addressed here is the fact that instead of studying the complete relation between a corporate aspiration to collaborate and the expected enhanced R&D performance this study will focus solemnly at the first part of 'the equation'. This means that this study is limited to analyzing how a corporate wish to collaborate may lead to the development of collaborative R&D capabilities. What happens after these specific capabilities are achieved is so to speak 'black boxed' in this study (see model 1.1) as this process is already well established. I will devote the main attention to the analysis of the micro-level factors that lead to the development of collaborative capability. What I study is the preconditions for individual collaborative behavior in the case firms. I have already argued that a study of the micro-foundation of collaborative R&D capabilities is essential due to the need for detailed analysis and additionally it is missing in the field of strategic alliances. More over, the present study is valuable due to the fact that it provides new insights into core issues in collaborating firms. These are issues such as the dynamics of collaborative behavior, how to foster a collaborative mindset, and aligning organizational and individual level factors in the quest for collaborative capabilities. In sum, the scope of this study is limited to the exploration of the micro-foundations of collaborative capabilities in R&D alliances.



### Model 1.1: General model of social science explanation in the present context



#### 1.6 Structure of the Thesis

The thesis is structured as follows. In *chapter 1* I sketch the empirical and theoretical motivation of my study. I delineate the constructs I will be studying and I describe recent trends in the field of strategic alliances and innovation studies. Through this brief overview I show existing gaps in the literature on the basis of which I explain the need for an investigation of the micro-foundations collaborative R&D capabilities. I put forward and clarify the research question of this thesis.

*Chapter 2* starts with an outline of the theoretical foundation of the present study. I review antecedents and forms of collaborative R&D capabilities and I commence the theoretical study by analyzing the motivational factor that make firms wish to collaborate. On the basis of this apparent aspiration to engage in inter-organizational collaboration I argue for the need of a better understanding of collaborative R&D capabilities. I explore the nature of collaborative R&D capabilities and conclude with a wish for a better understanding of actions and inter-actions of individual engaged in collaboration. In *chapter 3* I outline the method of the study. I describe the philosophical assumptions of the study and outline the meta-theoretical standpoint. The core assumptions in this study are influenced by the perspective of methodological individualism. Data gathering and of data analysis in discussed and I map out the sources of information used in this project. Validity and reliability of the study is examined.

In *chapter 4* I address the search for micro-foundations of collaborative capabilities and I start to investigate the relationship between firm level collaborative strategies and the actions and

interactions of individuals. Subsequently the main analytical framework is presented. The framework is based work done by James Coleman (1990) and it will direct the attention towards the importance of actions, abilities, norms and behaviors of individuals in the preceding analysis. *Chapter 5* provides an introduction to the focal firms that play the main part in the three narratives of this study and subsequently *chapter 6, 7, and 8* entails the presentation and discussion of the three narratives. In *chapter 9* the cross-case analysis as well as the discussion and conclusion is put forward. The chapter concludes with a section on limitations and directions for future research. Model 1.1 below outlines the flow of the thesis.

## Model 1.2: Outline of Thesis

### Chapter 1: Introduction. In need of an individual focus on collaborative R&D competences

- 1.1 Introduction
- 1.2 Research Problem and Aim of Study
- 1.3 Trends and Gaps in the Strategic Alliance Literature
- 1.4 Motivation of the Study
- 1.5 Study Design
- 1.6 Structure of the Thesis

### Chapter 2: Literature Review. Collaborative R&D Capabilities: reviewing the Antecedents and Forms.

- 2.1 Introduction
- 2.2 R&D Collaboration: Drivers and Forms
- 2.3 Collaborative R&D Capabilities
- 2.4 Organizational Mechanisms
- 2.5 Conclusion and Central Assumptions

### Chapter 3: Methodology. Implications of the Micro-foundation Perspective

- 3.1 Introduction
- 3.2 Individual Action and Interaction
- 3.3 Case Study Research
- 3.4 Research design

### Chapter 4: Theoretical Framework. The Antecedents of Collaborative R&D Capabilities

- 4.1 Actions and Interactions: Introducing the theoretical framework
- 4.2 The corporate Aspiration to collaborate
- 4.3 Individual Conditions
- 4.4 Individual-level Collaborative Behavior
- 4.5 Conclusion

### Chapter 5: Introducing the Narratives

**Chapter 6:**  
**Novozymes: Matching Corporate Strategy & Collaborative Reality**

**Chapter 7:**  
**Novo Nordisk: Knowledge Sharing Practice at Novo Nordisk**

**Chapter 8:**  
**CSC: Innovation through partners and customers**

### Chapter 9: Discussion and Conclusion

- 9.1 Introduction
- 9.2 Resume of Case Narratives
- 9.3 Cross-case Analysis
- 9.4 Managerial Implications
- 9.5 Limitations and Future Directions



## 2. LITERATURE REVIEW

### Collaborative R&D Capabilities: Reviewing the Antecedents and Forms

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*To be capable of something is to have a general reliable capacity to bring things about as a result of intended action. Capabilities fill the gap between intention and outcome, and they fill it such a way that the outcome bears a definite resemblance to what was intended.*  
(Dosi, Nelson and Winter, 2000)

#### 2.1 Introduction

This chapter will provide a survey of the main theoretical perspectives on why firms engage in R&D collaborations. The reasons as to why firms decide to engage in collaborative projects vary greatly and they bring about many different types of collaborations; from the short term, narrow scoped project with a low degree of interaction to the long term and very integrated project that is based on high degree of communication between the partners. The variation will be outlined and discussed in order to comprehensively portray the specific organizational activity we are dealing with in this study; that is R&D collaboration. By this descriptive venture I aim to build a solid foundation for elucidating and analyzing the concept of collaborative R&D capabilities. It is argued that capabilities in general fill the gap between, on the one hand, an organizational intention to engage in a given kind of activity and, on the other hand, the outcome of this activity (Dosi, Nelson and Wither, 2000). Applied to the present setting we may thus suppose that the relation between a corporate aspiration to collaborate on R&D *and* enhanced R&D performance is mediated<sup>5</sup> by the existence of collaborative R&D capabilities.

This relationship was suggested in chapter 1 where I further illustrated the focus of the study by highlighting the first part of a double ‘Coleman-diagram’ (model 1.1, page 19). In the present chapter I will argue that we are not yet provided with thorough knowledge of how collaborative R&D capabilities are developed. Thus, in the present chapter I will deal with the unsettled matter of the relation between the intention to collaborate and the development of collaborative R&D capabilities. I will focus mainly on factors that affect this relation. The main aim is to open up the ‘black box’ of collaborative R&D capabilities. The review of literature contributing to the elucidation of this ‘black box’ will show that a gap is witnessed in regards to understanding the role that especially individual level factors play in the development of collaborative R&D capabilities,

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<sup>5</sup> I state that collaborative capabilities act as a mediating variable as it explains the actual relationship between collaboration and enhance R&D performance. ‘In general, a given variable may be said to function as a mediator to the extent that it accounts for the relation between the predictor and the criterion’ (Baron and Kenny, 1986:1176).

and because this gap exists we will focus our attention on the actions and interactions of individuals in the following parts of the thesis. In order to start at the beginning of the process of collaboration I commence by studying the underlying rationale of collaboration.

As firms collaborate at an increasing rate (Anand and Khanna, 2000) it becomes still more important to understand how they can be instrumental in organizing and managing the various collaborative knowledge processes, and especially how they can develop and maintain collaborative capabilities that ensure a positive outcome of their efforts. As I will show in the following not much is said about the capabilities that facilitate R&D collaboration specifically; thus, a specific purpose of this chapter is to enhance the understanding of the composition of collaborative R&D capabilities and furthermore to arrive at a delineation of the individual level antecedents of collaborative R&D capabilities.

The collaborative R&D capabilities will, when present, be the link between the intention to collaborate on given R&D projects and the successful outcome of this intention. These capabilities are general in the sense that they are not tied to any unique collaborative relation between two firms; once they are held by, for example, a researcher of a given firm, they are applicable to different collaborative activities. This belief matches the change in analytical focus that can be witnessed in many strands of alliance research. In chapter 1, I established the fact that alliance researchers have recently altered their level of analysis, when studying why some firms perform better than others when it comes to collaborative activities. Researchers have started to focus on the collection of alliances of a given firm instead of dealing with how the firm performs in each individual alliance. In the field of portfolio management scholars are arguing for the benefits of dealing with a firm's collaborative activities in total instead of analyzing one alliance at a time, as this view will help managers optimize the resource allocation process, reduce complexity and enable the sharing of experiences across different alliances as well as between different business units. Similarly, scholars are accentuating the importance of developing an overall alliance strategy for the collection of strategic alliances in a given firm. An alliance strategy is believed to be beneficial both as a guideline for decision makers in alliances (to make sure that decisions are taken in accordance with purpose and abilities) and in order to ensure that alliances are aligned with the overall strategy of the firm.

This more strategic and comprehensive way of dealing with a firm's alliances has led to a demand for understanding the generic capabilities needed to prepare the employees to engage in any alliance in a successful manner. The underlying assumption is that some firms hold collaborative capabilities that enable them to outperform other firms, in other words; the existence of these specific capabilities is what explains why some firms witness a high degree of alliance success

while others seem to be less successful in their collaborative endeavors. Even though influential academic work has suggested that capabilities can be developed in order to help closing the gap between intention and outcome of firm activities (Nelson and Winter, 1982; Dosi *et al*, 2000), not enough effort has been put into the delineation of the nature of these capabilities and especially their micro-foundations. In this chapter the attention will be directed towards analyzing the specific branch of capabilities that may facilitate collaborative R&D activities; viz. collaborative R&D capabilities. The central aim is to enhance the understanding of the composition of collaborative R&D capabilities.

This chapter contains two main parts. First (in section 2.2 *R&D Collaboration: Drivers and Forms*), I will summarize the arguments as to why firms decide to engage in collaborative projects. Enhancing the understanding of the drivers of collaboration—which are argued to be founded in needs for exploitation and/or exploration of resources—will foster a solid ground for studying the capabilities needed to facilitate the collaborative activities. This first part of the chapter, will also relate to the various forms of collaboration and I will deal, as well, with the limitations of collaboration. In the subsequent section (2.3 *Collaborative R&D Capabilities*) I will pursue the argumentation about the importance of collaborative R&D capabilities. The purpose of section 2.3 is to develop a theoretically founded understanding of the specific part of organizational capabilities that I label collaborative R&D capabilities. This sub group of capabilities has with only a few exceptions not yet been subject to systematic examinations. As a matter of fact the few studies of collaborative capabilities that do exist are characterized by a focus on organization level issues as the centerpiece of theorizing. But this situation neglects individual level factors that may affect capability development, and thus I will work specifically towards a better understanding of the individual level mechanism that may facilitate the development of collaborative R&D capabilities.

## **2.2 R&D Collaboration: Drivers and Forms**

Inter-organizational collaboration is an organizational form that is used by an increasing number of firms to meet a wide range of organizational aims (Hagedoorn 1996; 2002; Narula, 2004; Casson and Mol, 2006). Inter-organizational alliances are, by way of example, a preferred way of sourcing a variety of resources (Eisenhardt and Shonhoven, 1996; Gulati, 1999), and particularly a given firm's need for new knowledge has been shown to be a dominant reason for engaging in collaboration (Dyer and Nobeoka, 2000; Inkpen and Crossan, 1995; Larsson, Bengtson, Henriksson, and Sparks, 1998; Mowery, Oxley, and Silverman, 1996). In fact, knowledge intensive projects, such as technology development and R&D, are among the most often observed activities that firms collaborate on (Casson and Mol, 2006:24). Core resources are increasingly being sourced

externally and core knowledge is produced in close collaboration with external partners. Thus, it is acknowledged that a firm's critical resources may span firm boundaries as they are embedded in inter-firm resources and routines. This has led Dyer and Singh (1998) to propose the idea of relational rents, which is '...a supernormal profit jointly generated in an exchange relationship that cannot be generated by either firm in isolation and can only be created through the joint idiosyncratic contributions of the specific alliance partners' (Dyer and Singh, 1998:622). Relational rents are determined by the degree of knowledge sharing between firms, investment in relation specific assets, the mix of complementary resources and capabilities and, finally, by effective governance. This perspective draws attention to the value that can be created in the interaction between two firms, yet it is important to keep in mind that the focus of the present study is solely at firm-internal factors for example capabilities held by a focal firm. Still, a core point is important to derive from the relational rent perspective, namely that in the quest of gaining and sustaining competitive advantage firms do potentially benefit from having close relations to external partners.

The benefits of tapping into the 'knowledge pool' of the partner do not only relate to the increased speed of the process of gaining new resources; also the quality of the knowledge that is developed may be improved. This is based on the assumption that diverse knowledge is needed to produce a new product or service (Kogut and Zander, 1992). This variety is best attained when the pool of exciting resources, skills, and capabilities is bigger—which it will be when the focal firm has more non-redundant relations. This logic is parallel to the assumption behind innovation studies stating that innovation is best understood as the process of combining existing knowledge and resources (Schumpeter, 1934). In sum, access to a diverse pool of knowledge and other resources is a precondition for new knowledge creation in a given innovation process.

Still, this logic may not be taken to imply that firms need to open up towards external partners without taking into consideration the downsides that may follow: The risk of losing valuable knowledge; the threat of being exposed to the opportunistic behavior of the partner; the risk of losing the freedom to act; or the need to give up control are all situations that ask for a thorough analysis of the relation to a potential partner (Suen, 2005). In fact, when studying how firms relate to each other in the innovation process, *competition* among firms has conventionally been the focus of attention (Schumpeter, 1942), while *cooperation* is seen as a less important issue (Teece, 1992:1). This focus is, as described, now being fundamentally challenged. It is the case in studies of innovation specifically, but also in studies of firm behavior in general a prevalent position is that the relations between the firm and its external environment play an important role in shaping performance (Laursen and Salter, 2006). Knowledge networks and collaborative activities play an increasingly important part in innovation processes in many firms. This upsurge in both actual



numbers of alliances and in the academic interest of the phenomenon has, however, not yet supplied us with an unambiguous explanation as to why firms collaborate. Still, in the following section I will seek to summarize the diverse drivers of collaboration.

### *2.2.1 A Theoretical Lens on why Firms Collaborate on R&D*

A central idea in strategic management research is that firms are, simplistically put, self-sufficient entities that have a preference for doing business alone (Contractor and Lorange, 1988; Gomes-Casseres, 1996), and that they will engage in partnership only to overcome constraints shaped either by the market or the specific industry (Heimeriks, 2004:30), or as pointed to by Grandori and Soda (1995) collaboration may be chosen as a consequence of bureaucratic failure. The argumentations about the causes of inter-organizational collaboration are formed by the theoretical lens put upon collaboration. Traditionally, studies of strategic alliances have been founded either in a transaction cost logic (Williamson, 1985; 1991; Hennart, 1988), emphasizing transaction cost efficiency as the motivation for collaboration, or they have their out spring in a resource based logic assuming firms to be bundles of capabilities and resources heterogeneously distributed across firms (Penrose, 1959; Wernerfelt, 1984). Recently scholars have aimed at integrating these perspectives as we shall see later, yet for the purpose of understanding the different arguments and their origin I will outline these perspectives and their take on collaboration one at a time.

Scholars of the Transaction Cost perspective explain why firms engage in alliances by referring to the opportunity to minimize production or transaction cost (Williamson 1991; Hennart, 1988; 1991). Internalizing the activities is the best way to control transaction costs (such as writing and enforcing a contract) effectively, and therefore this will be preferred if transaction cost of a given exchange is high. It is thus argued that collaboration will be preferred 'when the transaction costs associated with an exchange are intermediate and not high enough to justify vertical integrating' (Gulati, 1995: 87). The TCE perspective, focusing on either the conditions that lead the firm to produce resources in house rather than buying them externally (Coase, 1937; Williamson, 1985) or allying with external partners to get what is needed (Dyer, 1996; Williamson, 1991), takes a micro-analytical perspective, looking at 'one transaction at a time' (Jacobides and Billinger, 2006). Even though the transaction cost perspective is and has been very influential, its focus on alliance formation as being dependent on a wish for cost minimization in relation to single projects may prevent us from seeing the bigger picture of inter-organizational collaboration.

Scholars adhering to the resource based view on the other hand make a more general statement by saying that firms ally when they 1) find themselves in a strategically vulnerable situation and need the resources that collaboration can bring them, or 2) are in a strong position that

makes it possible to capitalize on their assets through alliances (Eisenhardt and Schoonhoven, 1996). Closely related to the resource based view scholars of the knowledge based view (KBV), argue that collaboration can be beneficial because it will link a focal firm to knowledge that the external partners possess (Hamel, Doz and Prahalad, 1989), and accordingly collaboration is a vehicle for organizational learning, giving partner firms access to each other's knowledge (Kogut, 1988; Hamel, 1991; Grant, 1996). The learning motivation for engaging in alliances has been a growing theme in recent literature and the interest in how organizations develop new competencies and learn from their partners takes centre stage in many studies (e.g. Inkpen, 1998; Larsson *et al.*, 1998; Kale, Singh and Perlmutter, 2000; Muthusamy and White, 2005). For example scholars of evolutionary economics have pointed to the fact that organizations change and adapt their technologies both by internal processes and by interaction with partners (Nelson and Winter, 1982). The ability to adapt organizational routines which are building blocks of a firm's capability is what explains a firm's success and survival. I will return to how capability development is perceived in these different perspectives, but first I will summarize how scholars have pointed to the differences in reasons for collaboration between these different perspectives (Table 2.1).

**Table 2.1: Drivers of Collaboration Explained by Different Theoretical Perspectives**

<b>Theoretical Perspective:</b>	<b>Drivers of collaboration:</b>	<b>Factor affecting performance:</b>
<b>Resource Based View (RBV)</b>	Strategic need to gain resource from external partners, because of entrance to new market, many competitors, pioneering technology, etc	Opportunity to capitalize on internal resources by collaborating, e.g. due to firm size, connectedness to partners, high status top management team Characteristics of the firm
<b>Transaction Cost Economics (TCE)</b>	Minimize transaction cost by collaborating	Characteristics of the specific transaction/ project/activity
<b>Knowledge Based View (KBV)</b>	Create links to partners knowledge base	Knowledge complexity and knowledge tacitness
<b>Evolutionary Economics (EE) (capability View)</b>	Superior means to access or acquire capabilities (since capabilities are often organization-ally embedded)	Similarity of organizational property

Source: Eisenhardt and Schoonhoven (1996:137); Heiman and Nickerson (2002)

Tensions have risen between the perspectives for example due to incompatibility of the ideas about the best possible governance choices to make in a collaborative situation. Thus, scholars adhering to

the TCE perspective argue that governance choices need to include the expectation of opportunistic behavior of the partner whereas scholars of the knowledge based perspective point to the existence of bounded rationality as the most important basis for the choice of governance model. In trying to reconcile these perspectives and provide a broader frame for understanding the dynamics of collaboration Heiman and Nickerson (2002) have proposed a framework for handling the supposed debate between the TCE and KBV. They state that ‘the empirical observations of KBV and theoretical predictions of TCE are *not* at odds once transactions are more completely specified with respect to knowledge transfer attributes’ (Heiman and Nickerson, 2002:113). The basic idea that is said to sort out the debate is that knowledge transfer attributes—based on characteristics of knowledge to be transferred in an exchange—act directly on governance choice. These attributes are knowledge tacitness and problem solving complexity (Heiman and Nickerson, 2002). The knowledge transfer attributes need to be handled as the most important factors in deciding on governance model instead of focusing on cognitive limitations of man. The character of the two knowledge attributes will lead to definition of two distinct knowledge management practices; high band-width channels of communications and idiosyncratic communication codes respectively. I will relate to these findings when dealing with the managerial implication of collaboration in the conclusion section, still this discussion has an additional and important finding namely that different factors affect collaboration (such as the character of the knowledge at stake) and must be perceived as the most important influence on the design and that such factors do cut across different theoretical perspectives.

Across theoretical perspectives scholars also explain the rise in collaborative activity by referring to the specific characteristics of the firm. The size and age of a firm are some of the characteristics that may inform the motivation to collaborate (Narula, 2004); thus, smaller entrepreneurial firms and larger corporations do tend to have different motives to engage in alliances and they may play very different roles in collaborative projects as well (Schumpeter, 1942). Where as larger firms typically have the resources for creating formal R&D laboratories and exploiting economies of scale in the R&D function (due to better access to external finances and benefits from complementarities between R&D and other activities), they might lack the adaptability that often characterizes smaller firms. Smaller firms for their part often benefit from being more flexible due to a lower degree of bureaucratization in research and innovation activities, yet they are motivated to collaborate because they need access to the resources that the larger firm holds. Numerous empirical studies have sustained this finding for example by showing that innovation output appears to be less proportional to size, meaning that R&D productivity declines

with size and that larger firms therefore need the creative inputs that smaller and more innovative firms can provide (Cohen and Levin, 1989; Cohen, 1995; Hagedoorn, 2002).

R&D collaborations are in most cases based on a variety of motives that can intervene and might change over time as the firms develop their knowledge base or as the projects undergo changes (Hagedoorn, 2002). In addition to size and age of the firm other idiosyncratic factors, such as the character of the specific knowledge needed by the firm, may foster a wish for collaboration as well, and thus the disciplinary background of the firm may also spur collaboration. The decision on whether to collaborate or not has traditionally been framed as a trade-off between using internally produced knowledge or sourcing externally the knowledge needed (e.g. collaborating with R&D partners) in the innovation processes. Thus the question of whether to collaborate with an external partner for the purpose of accessing the assets needed or to integrate the activities has been illustrated by help of a flow chart guiding the focal firm through to the end decision (Teece, 1987). Following this perspective, the decision relies first of all on whether or not complementary assets are necessary for commercial success of the firms R&D activities. If the answer to this fundamental question is positive a row of questions will follow, which relates to whether the assets that are needed are specialized? Whether the appropriability regime is weak? To what extent the specialized assets are critical to the firm? And whether or not the cash position is satisfactory? And finally whether the imitators/competitors are better positioned and thus can become a threat to the focal firm (Teece, 1987:636). If the answers to these questions are negative then collaboration/contracting is said to be the most profitable solution, and as such answering the questions will guide the focal firm towards the right decision on whether or not to collaborate.

Other scholars have, in like manner, examined the factors that affect the trade-off between in-house generated and externally acquired knowledge, and they have found that the antecedents fall into to main groups; either technical or organizational in nature (Tidd and Trewhella, 1997). Organizational factors that may spur collaboration comprise, first of all, the corporate strategy and how it may dictates a policy of technological differentiation attainable through collaboration. A second organizational issue affecting the aspiration to collaborate is the level of competencies; if these are weak the firm may be more motivated to source new competencies externally, as also mentioned above in regards to the discussion of small firms' motivation to collaborate. Third, the company culture may affect the decision to collaborate as the underlying values and beliefs have a strong impact on the employees (and managers) attitude towards external knowledge (Sveiby and Simons, 2002). A culture signaling that 'we are the best in the world' may contribute to a rather myopic view of external technologies, whereas firms that consistently reinforce a philosophy that important technological developments can occur almost everywhere are more keen on searching for

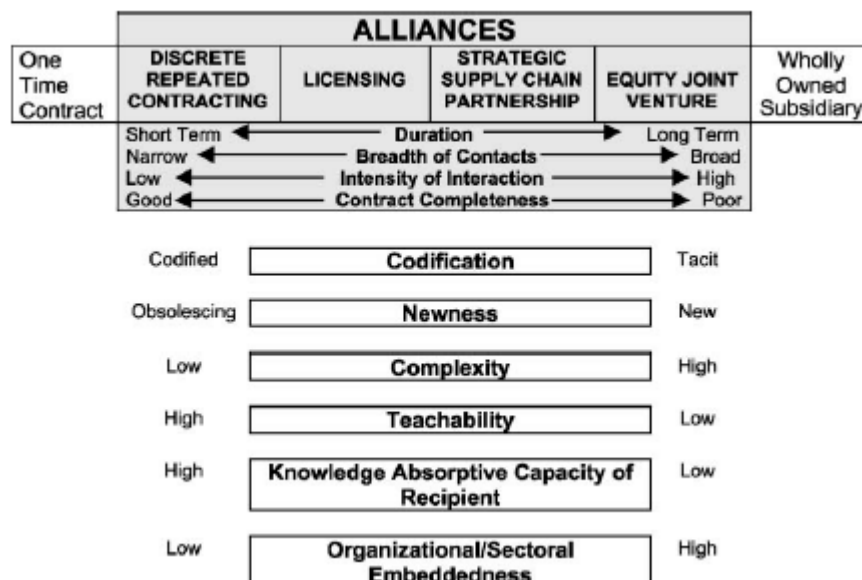
and applying external knowledge (Tidd and Trewhella, 1997:370). Another cluster of influencing factors is related to the technology of the focal firm. These factors are described as, first of all, the manager's comfort with a given technology or in other words how the company culture affects the single manager's view on collaboration. Next the competitive impact is important in influencing the decision to collaborate—or not; in fact, the wish to retain the core technologies as a distinctive source of competitive advantage is shown to be the most important reason for refraining from collaborating. Other issues affecting the trade-off are the complexity and 'codifiability' of the technology and finally the credibility given to the firm by a technology, which means that a firm may want to collaborate with a given partner on a specific technology because they believe this alliance to influence the credibility of the products in the market.

Additionally, timing is potentially a very important determinant for the decision to collaborate. One main characteristic of R&D opportunities is that they are often temporary which means that an innovator needs to exploit the opportunity quickly before the information leaks to competitors, or before the opportunity is replaced with a technologically more advanced alternative, that is; before the window of opportunity closes (Katila and Mang, 2003). A situation where the innovator due to competition does not have sufficient time to build the knowledge or complementary assets needed, the time issue can force the firm to collaborate to access the required assets. This is particularly true when imitation is easy (Teece, 1986:634). In fact prior research has shown that discoverers of technological opportunities can access resources for exploitation most effectively through collaboration (Mitchel and Singh, 1996). The reason for engaging in collaborative projects is also stressed to be caused by overall strategic considerations such as the wish for market expansion or extending product portfolios (Atuahene-Gima and Patterson, 1993). The strategic perspective recognizes that sourcing knowledge externally is driven by long term competitive considerations and not only by minimization of transaction costs (Tidd and Trewhella, 1997). Often the acquisition of external knowledge or technology complements internal R&D rather than being a substitute for it (Tidd and Trewhella, 1997). Hence, the decision to collaborate can have a number of antecedents and it is important to recognize that the growing acknowledgement of the value of external knowledge sources gives rise to a variety of collaborative activities, such as joint ventures, partnerships, research consortia, ad hoc network relations, etcetera (Ring and Van de Ven, 1994).

### 2.2.2 Collaborations Come in a Variety of Forms

Collaborative R&D projects come in a myriad of forms and this is yet another reason to why it is difficult to arrive at a general definition of collaborative R&D. R&D collaboration is a fraction of a large and diverse group of inter-firm relationships between firms, situated on the continuum between markets based one time contracts and hierarchical wholly owned subsidiaries (see figure 2.1). It is said that there are as many definitions of what an alliance is as there are alliances (Suen, 2005). Anyhow, the collaborative R&D projects may range from the establishment of joint ventures at the one end to more loosely knitted networks at the other (Hagedoorn, 2002). The specific aim of R&D collaboration may either be to develop new products based on existing technology, or be very broad directed towards the development of the ‘next generation’ of a particular technology or product (Sampson, 2007) or it may be something in between the very focused and the very broad aim. Contractor and Ra (2002) have illustrated the scope of alliances by the following figure (figure 2.1). The figure describes four archetypes of alliances, discrete repeated contracting, licensing, strategic supply chain partnerships, and equity joint ventures, increasing the expected duration, intensity, and breadth of inter-partner interactions and contract completeness from left to right. The strength of this model is that it shows the many parameters along which an alliance can vary.

**Figure 2.1: The Scope of Alliances**



Source: Contractor and Ra (2002)

Even though different in governance form, etc., the various kinds of inter-organizational R&D collaborations have some common features. In this study I define R&D collaboration as a set of different inter-firm R&D activities between two or more independent firms engaging in a process of ongoing resource contribution to create value (Hagedoorn, 2002; Bamford *et al*, 2003). The contributions can include knowledge, technology, staff, customers, brands, capital, and equipment (Hagedoorn 2002; Bamford *et al*, 2003: 12). The activities often take place in contexts involving uncertainty over outcomes (Ariño *et al*, 2001). The R&D alliance is strategic when it is the means by which a firm seeks to implement, in part or in whole, elements of management's strategic intent (Hamel and Prahalad, 1989). Additionally, these alliances are almost always managed by an incomplete contract, as the terms can not be completely specified and agreed upon at the outset of the relationship. This is so due to the unforeseen nature of R&D. As a consequence these inter-organizational projects are dependent on joint decision making and a committed management team (Bamford *et al*, 2003).

In continuation it must be highlighted that R&D collaboration is a means, not an end in itself. A specific R&D project is thus best described by the goals it is set to fulfill (Ariño, 2003), yet the measurement of the outcome of inter-organizational alliances can be very hard to define (Yan and Zeng, 1999). This suggests the need for clear alignment between the goals of R&D collaborations and the organizational design of the collaborative project. R&D activities differ remarkably from other business processes that firms may collaborate on, as for example marketing alliance, due to a high degree of uncertainty and risk connected to R&D activities. In fact various types of collaborations are being managed and organized in many different ways according to how close the relation to the partners is. For example an equity-based alliance, such as a joint venture, may be harder to negotiate and organize than a non-equity alliance, which then on the other hand may be more flexible (Ariño, 2003). A non equity alliances may be more challenging to manage and organize as there is no formal 'alliance organization' and that all activities depend on acceptance from cross firm teams and committees. This inquires a new way of perceiving the mode in which R&D projects are organized.

### *2.2.3 Open Innovation: New Ways of Organizing the Knowledge Processes of the Firm*

One scholar who has been especially vocal in calling for a new paradigm in innovation studies is Henry Chesbrough (2003). Inspired by inter alia the work of his supervisor David Teece (see e.g. Teece, 1986), Chesbrough emphasizes the importance of external sources of knowledge in the innovation process, and he proposes the *open innovation paradigm* to accentuate the idea that 'firms can and should use external as well as internal ideas and internal and external paths to

markets as the firms look to advance their technology' (Chesbrough, 2003:xxiv). A cornerstone in open innovation idea is the purposive use of inflows and outflows of knowledge that can be used to accelerate internal innovation, and expand the markets for external use of innovation (Chesbrough, 2006b). Open innovation scholars state that open innovation means systematically encouraging and exploring a wide range of internal and external sources for innovation opportunities, consciously integrating that exploration with firm capabilities and resources and broadly exploiting those opportunities through multiple channels (West and Gallagher, 2006: 320). Thus, openness in the innovation process can be understood as a firm's *willingness* to make use of a wide range of external sources (e.g., other firms, universities, research labs or small start up firms) in order to enhance the innovation capacity. In addition to defining openness as a firm's willingness to make use of external sources it is also said that openness 'reflects an ability to profitably access external sources of innovation' (West, 2006: 109). This *ability* to profitably access external knowledge is closely connected to the appropriability of the returns from the knowledge at stake, which again depends on the intellectual property rights. Thus, openness can be understood as both the willingness and the ability of a firm to make use of external sources of knowledge in the innovation process.

The open innovation paradigm is asserted to be highly novel and to contrast with previous closed innovation paradigms, namely models that emphasize vertically integrated innovation processes and are highly inward-looking (Chesbrough, 2003; 2006). Still, as various innovation scholars have countered, relying on external sources of knowledge and externally produced assets is not as such a new venture (Christensen, Olsen and Kjør, 2005; Frederiksen, 2007). As I have stated previously scholarly attention has been drawn to the importance of (externally produced) complementary assets for decades. Teece, for example, argues that 'in almost all cases, the successful commercialization of an innovation requires that the know-how in question be utilized in conjunction with other capabilities and assets' (Teece, 1986: 288). Further, studies have, since the 1960s and 1970s, called attention to the value of specific external sources of knowledge such as, customers and lead users (Enos, 1962; Rosenberg, 1963; von Hippel, 1977; 1978).

In order to understand why we nevertheless witness an upsurge in scholarly work based on the open innovation perspective and the general recognition of a more positive attitude towards externally produced knowledge, we must look at a number of developmental changes in the society in general. Introducing a special issue of R&D Management on open innovation, Oliver Gassmann (2006) underscores five developmental trends that seem to succeed in the open innovation paradigm. He notes that the more an industry's idiosyncrasies relate to the five trends the more appropriate the open innovation model seems to be to firms of this industry. The first of the five



trends is the wave of *globalization*: many global firms favor open innovation models because they can achieve economies of scale more swiftly. A second factor is the *intensity of technology*: most firms lack the capabilities to cope with all upcoming technologies and lack the financial capacity to exploit these technologies alone. This leads them towards other firms. Third, *technology fusion* seems to invite openness: the morphing of technologies into new interdisciplinary research fields makes a single firm incapable of doing innovation alone. A fourth trend is the rise of *new business models*. For the purpose of risk sharing, pooling of complementary competences and the realization of synergies, many firms tend to form strategic alliances or corporate partnerships, and thus many new business models are created due to shifting industrial or technological boundaries. The final trend is the focus on *knowledge resources*. The fact that knowledge is seen as one of the most important resources of the firm turns employees into knowledge brokers, trying to relate to relevant persons and knowledge sources outside the firm (Gassmann, 2006: 224).

The open innovation perspective is more far reaching than earlier work on strategic alliances, as this perspective deals with more than one-off partnerships or sporadic relations to external partners; it delineates a new way of perceiving the firm and its relation to external partners. In acknowledging that the trend of openness is diffusing to more parts of the firm Chesbrough has argued for the formation of open business models, namely business models that create value by leveraging different ideas, due to inclusion of a variety of external ideas and knowledge in many parts of the firm (Chesbrough, 2006a:2). This idea contrast with the classical understanding of collaboration as an organization form which is chosen on an ad hoc basis when collaboration fits the purpose of a given need for knowledge. Collaborative R&D projects are not to be treated as single instances designed on an ad hoc basis in accordance with specific goals. Rather we ought to study collaborative activities as a bundle of activities that has a number of specific advantages, which challenge the way firms are organized and capabilities are developed. And therefore we might have to develop new business models that incorporate a more open perspective.

It is, however, important to keep in mind that limits may occur as to when openness is the right strategy to follow. As indicated throughout this chapter the valuation of whether or not to ally does not always redound to the advantage of collaboration. Knowledge production and knowledge utilization are among the most important activities in R&D intensive firm (Dierickx and Cool, 1889; Leonard-Barton 19992; Conner and Prahalad, 1996; Grant 1996). Through these and related knowledge processes the most vital assets of the R&D intensive firm is gained or created. Thus in order to keep control of these processes it is argued that knowledge intensive firms are most likely to wish for an in-house organization of R&D processes in order to be able to protect the valuable assets (Lewin and Massini, 2004). Based on this argument it is expected that firms will acquire only

niche and marginal resources which are less strategically important, through collaborations (Narula, 2004) and will leave the creation of the most central knowledge to the internal R&D department. Limits to the degree of collaboration are not only created out of a wish to protect core knowledge. Empirical studies have shown that even though firms that utilize external knowledge are more innovative there is a certain point where searching for external knowledge becomes unproductive (Katila and Ahuja, 2002; Laursen and Salter, 2006). This finding goes both for the process of searching for new knowledge through a number of different sources, i.e., the search breadth, and for repeating the search from a specific source (partner) numerous times, i.e., the search depth. It is shown that both external search depth and breadth has an inverted curvilinear relation to innovation performance (Laursen and Salter, 2006:143-145). These studies illustrate that in connection to collaboration with external partners in the R&D processes the more is not always the better. This finding accentuates the importance of studying the reasons firms have to collaborate on R&D projects as we might expect that it is necessary to limit the extent of collaborative activities and choose only the most valuable partnerships in accordance with the findings just presented. One of the central reasons for firms to choose to collaborate may be found in the opportunity to learn from other organizations. When firms start collaborating they can utilize the synergistic effects that are an outcome of joint knowledge production.

#### *2.2.4 Inter-organizational Learning*

Strategic alliances scholars have suggested that inter-firm collaboration is a mechanism by which a firm can leverage its skills, acquire new competencies, and learn (e.g. Larsson, Bengtsson, Henriksson, and Sparks, 1998; Huber, 1991; Powell and Brantley, 1992; Kogut, 1989; Hamel, Doz, and Prahalad, 1989; Lyles, 1988). For the partnering firm, alliances represent interfaces with its environment that provide access to valuable external information and knowledge (Powell, Kogut and Smith-Doerr, 1996; Teece, 1992). As such, these arrangements can provide opportunities for firms to assimilate information, internalize skills, and develop new capabilities. Moreover, research has suggested that social networks, competencies, and the relative configuration of skills and organizational practices of the partnering firms can influence the level of learning through alliances (e.g. Hamel, 1991; Lane and Lubatkin, 1998; Mowery, Oxley and Silverman, 1996; Shan, Walker and Kogut, 1994). Even though inspired by the traditional understanding of organizational learning as a way that organizations learn from own experiences by producing and re-producing organization specific routines, standard operating procedures, and other organizational rules (Feldman, 2000; Zhou, 1993) these scholars all, to a varying degree, highlight the specific potential that lies in learning processes that take place in inter-organizational settings. They argue that inter-

organizational learning consists of continuous learning activities that are clearly separated from any intra-organizational learning processes and collective learning processes is a central reason as to why firms ally. The collective learning processes are specified as distinct from organizational learning as they include the synergetic effects or interaction effects that occur as collaboration is initiated – these learning processes would not have occurred had the firms not interacted (e.g. Larsson et al, 1998).

Still, other studies have shown that difference between inter- and intra-organizational learning might not be that immense, or that the difference at best relates to the degree of learning rather than to the kind of learning (Holmqvist, 2003). In referring to the effects of experiential learning, which is the process whereby organizations learn particular behaviors based in individual bargaining over idiosyncratic experiences encountered in a variety of situations, Holmqvist states that : ‘...it appears likely that the variety-reducing effects of experiential learning affect both intra and inter-organizational learning processes in much the same way, although a few minor individual differences may appear, for example regarding the time it takes to learn particular behaviors-- something that can generally be expected to be longer in inter-organizational learning processes’ (Holmqvist, 2003: 461). What Holmqvist’s study show in extension is that it might be more correct to state that intra-organizational learning is what happens in the beginning of a collaborative project whereas inter organizational learning mainly take place in the later phases of a given collaborative project when people know each other better. In these later phases the interaction starts affecting the routines of the respective organizations due shared learning process where the employees start adopting the same routines. This may lead us to relevant discussion of when the borders between two collaborating organizations seem to vanish as a true ‘merger’ of the organizational routines is not wished for in inter-organizational learning projects. At least it is relevant to highlight that inter-organizational learning need to be selective so that it only creates semi-interdependencies between organizations and always leaves a core of organizational identity unaffected by any learning with other organizations. Joint learning may even be a way of maintaining the focal organizations ‘core’ (Holmqvist, 2003). We need to recall that organizations often collaborate with the aim of assessing new and different knowledge that can help develop the focal organization. This will not happen if the collaborating firms hold the same knowledge and consists of the same routines.

Scholars also argue that the way partners manage their collective learning process play a central role in the success or failure of any given collaborative project (Larsson et al, 1998). This is so because all collaborative projects require different management skills that ordinary internal knowledge processes, but also because it takes huge managerial efforts to avoiding what Larsson et al label ‘the good partner fallacy’ (Larson et al, 1998: 287). This refers to the risk of being left by a

more competitive partner when the partner has obtained what they came for and absorbed the relevant knowledge. The ‘good partner’ who is characterized by aiming to make all processes transparent and by having a high degree of collaborative intent may, in spite of all good intentions, be left before the aims of the collaboration is fulfilled. Thus being a good partner may sometimes turn into being a naïve partner, and to avoid this situation all partners need a competent management team that knows how to work towards the right level of transparency and find the best way through the collaborative dilemmas such as the learning dilemma just described. Handling the various collaborative dilemmas is a core task for managers involved in collaborative projects. And as the number of collaborative projects seems to raise the need for managerial capabilities grow as well. The collaborative drivers are many and the fact that knowledge creation and innovation are becoming increasingly multidisciplinary highlights the need for interaction among firms. A combination of scientific skills and intellectual capabilities that normally exceed the capabilities of a single firm is often needed to generate research breakthroughs (Powel, Koput and Smith-Doerr, 1996) and this provides firms with a number of good reasons to approach external partners. In general, the motives for engaging in R&D collaboration can be divided into two main groups; the first comprises the need for new knowledge and can be classified as *exploratory* activities and the second type is associated with the wish for making better use of the knowledge and resources already at hand, namely *exploitation* of existing knowledge.

#### 2.2.5 The Processes of Knowledge Exploration and Exploitation

In order to describe the proper balance between creating new knowledge and exploiting already existing capital and assets James March (1991) has advanced the dual concept of exploration and exploitation (March, 1991:71, Koza and Lewin, 1998:256). The concept of knowledge *exploration* comprises activities such as search, variation, risk taking, experimentation, play, flexibility, discovery and innovation. The core activity of exploration is experimentation with new alternatives. The results of these processes are often uncertain, distant, and thus sometimes even negative. The distance in time and space between the locus of learning and the time for the realization of returns is generally greater in the case of knowledge exploration than in the case of knowledge exploitation. Additionally a collaborative project aiming at exploring of new knowledge will be characterized by a high degree of uncertainty, due to the fact that future knowledge cannot be perfectly predicted—if it could, it would be held already (Popper, 1977).

Knowledge *exploitation*, on the other hand, includes refinement, choice, production, efficiency, selection, implementation and execution. Exploitation is about refining and extending the existing competencies, technologies, and paradigms. The returns of knowledge exploitation are,

in the word of March; ‘positive, proximate, and predictable’ (March, 1991:85). Applying the trade-off between exploration and exploitation to collaborative activities it becomes clear that the ability to create synergies in the collaborative knowledge-processes is affected by the intent of each partner and the presence of appropriate integrative resources (Nielsen, 2005: 1201). In particular, the issue of mutual learning involves conflicts between short run and long run concerns and between gains to individual knowledge and gains to collective knowledge (March, 1991:74). The need for exploration of new and complex knowledge is often the cause of a decision to source knowledge externally as collaboration may ease the process of learning this new knowledge that the partner holds (Teece, 1986; Pisano, 1990). In fact inter-organizational collaboration is most often motivated by the partner firms’ need to learn how to improve some kind of operations (Larsson *et al*, 1998). Especially in times of ‘creative destruction’ (Schumpeter, 1942); that is, periods of big change in technology regimes, firms may not be able to cope internally with the fast changes in the underlying knowledge and technologies, and are thus forced to turn towards external knowledge source to supplement their internal R&D (Pisano, 1990).

The high complexity of knowledge and technologies in many research disciplines is, in fact, often used to explain the need for collaboration, as it is done for example by Teece, who states that, ‘It is well to recognize that the variety of assets and competences which need to be accessed is likely to be quite large, even for only modestly complex technologies. No company can keep pace in all [...] areas by itself’ (Teece, 1986:293). Both exploitation and exploration, on this view, are essential activities for firms; still, they are activities that fight for scarce resources. Thus, it is important to understand the implicit or explicit choices that are made in organizations related to activities of development and use of knowledge. The core driving factor behind the change from and exploratory behavior to an exploitative behavior is dissatisfaction with the ongoing behavior. As referred to above scholars have described that transformation from exploration to exploitation do occur, still it is even more important to examine *how* these transformative processes happen. An empirical study by Holmqvist (2004) concludes that both exploitation and exploration happens at two level, i.e. the intra-organizational level (as just referred to in the section on organizational learning) and inter-organizational learning. For the internal learning processes to happen there must be a translating of the inter-organizational learning taking place. The process where intra-organizational learning is transformed to inter-organizational learning is labeled extension, as one organization extend its learning to the partner. When intra-organizational learning, on the other hand, is turned into intra-organizational learning, Holmqvist talk about internalization. These to modes of learning illustrates that learning is a dynamic phenomenon which is multi-level in nature. In coupling exploration and exploitation with inter- and inter-organizational learning, Holmqvist

(2004) forms a two by two matrix that describes how dynamic processes are taking place and transforming learning both between levels (intra and inter organizational) and between learning mode (exploration and exploitation). Four learning processes is thus coming about as exploration turns into exploitation (a process called focusing) and exploitation turns into exploration (a process called opening-up), and they are respectively labeled: opening-up extension, focusing internalization, opening-up internalization, and focusing extension. By this rather complex model Holmqvist shows that exploration and exploitation is connected to many different learning processes in the firm, at many different levels, and this makes it even more clear that the modern organization is simultaneously a single organization and at the same time a product of a collective of independent organizations. And that a core issue is to understand the organizational mechanism that controls the constant bargaining between group, a bargaining that determines when a given activity is understood as dissatisfactory and thus leads to a change in behavior, whether towards exploitation or exploration (Holmqvist 2004: 78).

An additional reason as to why it is important to identify a firm's motives for collaboration is that the aim of the collaboration will have an effect on the capabilities that need to be developed. If capabilities are what closes the gap between an intention to collaborate and a positive outcome of the collaboration (Dosi, Nelson and Winter, 2000), we need to know exactly what spurred the intention in order to say something about the capabilities. By way of example, let us imagine a focal firm looking for knowledge that can help them in the process of venturing into a new field of research. Due to fierce competition etc., they do not have the time to hire new employees or develop the knowledge internally; they need to source the knowledge externally. But the kind of scientific knowledge they require is not easy to integrate; it is complex and highly codified, and thus they need to build a close relation to the partner firm that holds parts of the knowledge needed. This new collaborative relation necessitate the employment of a wide range of capabilities in the focal firm first of all the abilities to search for and find the right partner, and following to be able to understand and internalize the complex new knowledge that the partner may hold. Adding both disciplinary skills and communication skills does not even make a full picture, but still it gives us a sense of how complex the range of necessary capabilities are. In the coming section we will look into how these various collaborative R&D capabilities can be conceptualized and what their antecedents look like.

### **2.3 Collaborative R&D Capabilities**

An empirical tendency has motivated numerous strategic alliances scholars to study the role of collaborative capabilities in alliances. They are motivated by the fact that while some firms witness

failures in relation to their collaborative projects in only around 10 % of the alliances others face a failure rate of over 70% (Harbinson and Pekar, 1998). This variation in performance has caused a wish to study the determinants of successful in alliances, and the studies are centered on the specific abilities that seem to be present in successful firms. A range of scholars have contributed to this field of study by examining collaborative capabilities albeit under slightly different labels, such as 'relational capability' (Dyer and Singh, 1998), 'alliance capabilities' (Kale, Dyer and Singh, 2002; Heimeriks and Duysters, 2007) and 'collaborative know-how' (Simonin, 1997). I will return to these slightly different forms of collaborative capabilities, yet to get an understanding of the concept of collaborative capabilities we must begin with understanding the concept of capabilities as such.

### *2.3.1 The Role of Capabilities: a Review*

We commence from the advanced definition of capabilities as bundles of routines, as originally defined by scholars belonging to the field of evolutionary economics (Nelson and Winter, 1982). This work was based on the logic that a firm experiences superior survival and growth rates because of the existence of superior capabilities which enable them to consistently sustain innovation, new knowledge creation, recombining exciting capabilities and reinventing and updating their underlying routines (Nelson and Winter, 1982). Building on the behavioral theory of the firm (Cyert and March, 1963) evolutionary economics are founded on principles concerning behavior in situations of uncertainty. It is argued that people only possess a limited cognitive ability and therefore they can exercise only bounded rationality when making decisions in complex, uncertain situations (Simon, 1976). Thus individuals tend to 'satisfice', that is, they attempt to attain realistic goals, rather than maximizing a utility or profit function. Further it is argued that the firm cannot be regarded as a monolith, because different individuals and groups within it have their own aspirations and conflicting interests, and that firm behavior is the weighted outcome of these conflicts (Cyert and March, 1963).

In general alliance capabilities will, if possessed, act as means to gain competitive advantage (de Man, 2001). Examining how firms achieve and sustain competitive advantage is a fundamental activity in strategic management studies (Rumelt, Schendel and Teece, 1991), and as described previously the resource based view (RBV) assumes firms to be bundles of capabilities and resources heterogeneously distributed across firms (Penrose, 1959; Wernerfelt, 1984), creating competitive advantage by being rare, valuable, inimitable, and non-substitutable (Barney, 1991). Thus, in contrast to more classical strategic management scholars who explain discrepancy in firm performances as caused by the structure of the industry (for example its barriers to entry and rivalry

among industry incumbents) that a given firm belong to (Porter, 1980), scholars adhering to the resource-based views see firm heterogeneity as created by the existence of superior capabilities and resources inside the firm. Although theoretically useful the RBV neglects to account for the mechanisms by which resources actually contribute to competitive advantage. Recent extensions of the RBV seek to explain how this may happen in dynamic and rapidly changing markets via application of the dynamic capabilities perspective (e.g. Teece, *et al.*, 1997; Eisenhardt and Martin, 2000). The literature provides somewhat different classifications of dynamic capability (Zahra *et al* , 2006), still the most often cited definition is that: ‘Dynamic capabilities [...] are the organizational and strategic routines by which firms achieve new resource configurations as markets emerge, collide split, evolve, and die’ (Teece *et al.*, 1997). Most important to acknowledge is that dynamic capabilities are especially associated with change (Eisenhardt and Martin, 2000). Especially in a setting like the present where the aim is to study the nature of the capabilities that can help a firm attain new knowledge in collaboration with external firms, dynamic capabilities is an especially helpful construct. This is due to the fact that dynamic capabilities have the special characteristic of enabling the firm to innovate outside their current routines. I thus perceive collaborative R&D capabilities to be a sub-group of dynamic capabilities.

### *2.3.2 Defining the Core Constructs of the Study*

As it has now become clear a variety of characteristics are connected to the organizational capabilities residing in a given firm. Depending on the theoretical perspective that scholars apply, their definition of organizational capabilities and the related constructs differs to some extent. Thus some core definitions need to be provided before proceeding with the present study.

#### Resources

Based on the seminal work of Edith Penrose (1959) Birger Wernerfelt (1984) defines resources as an important antecedents to products and, ultimately, firm performance. A firm’s resources at a given time are ‘those tangible or intangible assets which are tied to semi-permanently to the firm’ (Wernerfelt 1984:172). Some scholars have followed Penrose’s (1959) initial focus and emphasized how resources contribute to diversification and how diversification must match the ‘core competencies’ of the firm for optimal performance (e.g., Peteraf, 1993; Prahalad & Hamel, 1990; Wernerfelt, 1984). Others, such as Barney (1991), have highlighted two different yet related assumptions about resources, namely that (1) resources are distributed heterogeneously across firms, and (2) these productive resources cannot be transferred from firm to firm without cost, due to the ‘stickiness’ of these resources. Only when resources are rare, valuable, non-imitable and non-



substitutable they may be instrumental in creating competitive advantage (Barney, 1991). Resources are building blocks of organizational routines.

### Routines

It is through the replication of organizational routines that firms evolve (Nelson and Winter, 1982). Routines are units of organizational activity with a repetitive character. Further, a routine is the ability to economise with resources and the ability to learn through repeated actions (Levitt and March, 1988). They are not always based on a conscious choice, and routines may thus even denote organizational activities that people can not explain: it is just ‘the way things are done around here’ (Dosi *et al*, 2000:4). Thereby the idea of routines is dynamic and the construct is said to include ‘the forms, rules, procedures, conventions, strategies, and technologies around which organizations are constructed and through which they operate’ (Levitt and March, 1988: 320). In sum, a ‘routine is a behaviour that is learned, highly patterned and repetitious or quasi-repetitious. It is founded in part in tacit knowledge and the specificity of objectives’ (Winter, 2003:994). Bundles or sequences of routines constitute—together with other things such as contextual requisites (Dosi *et al*, 2000:4) or input flows (Winter, 2000)—the organizational capabilities of firms (Nelson and Winter, 1982).

### Organizational Capabilities

An organizational capability is formulated to be the ability to perform a coordinated set of tasks, utilizing; for example combining and adjusting, organizational resources for the purpose of achieving a particular set of objectives (McEvily and Marcus, 2005). An organizational capability has a recognized purpose expressed in terms of the significant outcome it is supposed to enable. A capability is significantly shaped by ‘conscious decision both in its development and deployment’ (Dosi *et al*, 2000:4).

### Dynamic Capabilities

In order to adapt to a changing environment organizational capabilities need to be dynamic in nature. Dynamic capabilities ‘are the organizational and strategic routines by which firms achieve new resource configurations as markets emerge, collide split, evolve, and die’ (Teece *et al.*, 1997). Dynamic capabilities respond to the rapidly changing environment by effectively integrate, build, and reconfigure internal and external competencies to address rapidly changing environments (Teece *et al.*, 1997). Whether these higher order capabilities are created or not depend on the cost and benefits of the investment relative to ad hoc problem solving developed (Winter, 2003).

### Collaborative R&D Capabilities

In the present thesis a specific type of dynamic capabilities are studied. This is the kind of dynamic capabilities that are applied to the collaborative R&D activities of a given firm. These are what I label collaborative R&D capabilities. Collaborative R&D capability is a dynamic capability by which the firm can utilize strategic and structural resources at the organizational level and human resources at the individual level so that external and internal knowledge sources are exploited. As such, the value of collaborative R&D capability lies in its specific capacity to integrate and leverage the organizational and individual factors jointly.

### Individual Abilities

The interaction of organizational level and individual level factors play a highly important role in the search for micro-foundations of collaborative R&D capabilities. As I will point to later a core factor is the ability of the individuals to perform the R&D task in collaboration with external partners. In general an individual ability is what makes the individual able to perform a given activity and thus accomplish a given aim.

#### *2.3.3 The Elements of Collaborative R&D Capabilities*

In the context of the present study it is especially important to recognize that firms change and adapt their technologies, both internally and as an outcome of interaction with external partners (Nelson and Winter, 1982; Lewin and Massini, 2004). In a collaborative situation the higher level routines will guide the interaction with partner firms and new technologies, and processes or business methods will be internalized in the focal firm through the variation, selection and replication processes of the firm. According to evolutionary economics configurations of routines and capabilities are context specific and reflect firm differences. For example, capabilities for absorbing new knowledge from external partners consists of more elaborated bundles of routines in R&D intensive firms (industries) compared to firms characterized with low R&D intensity (Massini, Lewin, Numagami, and Pettigrew, 2002). This is so because superior firms (innovating firms) hold combinative capabilities being routines for decomposing internal, external and old knowledge and recombining it (Kogut and Zander, 1992). And this dynamic capability respond to the rapidly changing environment by effectively adapting, integrating, coordinating and reconfiguring internal and external organizational skills, resources and functional competencies is exactly what is what determine superior performance (Tecce *et al*, 1997). A firm's ability to dynamically transform current knowledge into new knowledge (exploitation activities) and generate

new applications form existing knowledge (explorative activities) is exactly what makes them innovative (Kogut and Zander, 1992). This combinative capability, being the ability to synthesize and apply current and new knowledge is a central capability of the innovating firm. Collaboration in this context is seen as ‘options on new markets distantly related to current knowledge by providing a vehicle by which firms transfer and combine their organizationally embedded learning’ (Kogut and Zander, 1992:395).

The capabilities construct has been applied to the field of collaboration by many researchers as the following list will illustrate. These scholars have a shared mission in trying to explain alliance performance heterogeneity as a consequence of differences in capabilities of the firms. Whether talking about ‘collaborative capability’ (Schreiner *et al*, 2009) or ‘alliance competences’ (Spekman, Isabella, and MacAwoy, 2000), ‘alliance capabilities’ (Heimeriks, 2004), ‘relational capabilities’ (Dyer and Singh, 2004), ‘relational assets’ (Dunning, 2002) or ‘collaborative know-how’ (Simonin, 1997; 2002); they all argue that a connection exists between the collaborative capability and alliance performance.

**Table 2.2: Overview of Collaborative Capability Research**

Author	Collaborative Capabilities	Organizational Construct / alliance Mechanisms Studied	Organizational Outcome	Specific Challenges and Implications for R&D collaboration
<i>Simonin (1997)</i>	Collaborative Know-how	Collaborative management skills, negotiation know-how, partner search know-how, knowledge and skill transfer, exiting skills	The higher the level of collaborative know-how the greater the tangible and intangible benefits from collaboration	Argue for a split between <i>tangible outcomes</i> (strategic and financial: enhancing profits, market share, sustaining competitive advantage and <i>intangible outcomes</i> (learning or knowledge based: learning skills and competencies, learning to collaborate, learning to learn from partners).
<i>Dyer and Singh (1997)</i>	Relational Capability	Collaboration firms can generate relational rents through relation specific assets, knowledge sharing routines, complementary resource endowments, and effective governance.	Idiosyncratic inter-firm links may be a source of relational rents and competitive advantage	Focus on information (facts, axiomatic propositions, and symbols) or know-how (knowledge that is tacit, sticky, complex and difficult to codify).  Alliance partners that are particularly effective at transferring know how are likely to outperform competitors who are not.
<i>Ritter and Gemünden (1999)</i>	Network Competence	A firm's ability to initiate, handle, use, and terminate inter-organizational relationships. The ability is positively influenced by: access to resources, network orientation of human resource management, integration of communication structure, openness of corporate culture	A firm's network competence leads to innovation success through successful network operations and to improvement of own performance...	This study is based on firms engaged in technology networks. It shows that network competence is embedded within the whole company (access to resources, HR, communication, corporate culture). The ability to manage networks is inseparable from the company itself.
<i>Lorenzoni and Lipparini (1999)</i>	Relational Capability	Development of specialized supplier networks.	Relational capabilities help competence renewal and reduce resistance to change; lead firms can achieve valuable positions using multiple (in) formal ties to knowledge access and transfer; collaboration as valuable to expand and improve core competencies. 50	Firms can achieve valuable positions using multiple formal ties for knowledge access and transfer  Continues...

<b>Author</b>	<b>Collaborative Capabilities</b>	<b>Organizational Construct / alliance Mechanisms Studied</b>	<b>Organizational Outcome</b>	<b>Challenges and Implications for R&amp;D collaboration</b>
<i>Lambe, Spekmann and Hunt (2002)</i>	Alliance Competence	Finding, developing and managing alliances; alliance experience, alliance manager development capability and partner identification process.	Alliance Competence is positively related to alliance performance	Alliance competence linked to alliance performance in general. Not specifically directed towards R&D.
<i>Kale, Dyer and Singh (2002)</i>	Alliance Capability	Alliance experience Alliance function (most significant predictor of alliance success)	Higher alliance success rates obtained through alliance experience and a dedicated alliance function.	Looking at joint ventures, R&D or production agreements, marketing or distribution agreements and technology exchange all together.
<i>Draulans, de Man, and Volberda (2003)</i>	Alliance Capability (Alliance Management Capability)	Alliance training Alliance specialists Alliance evaluation	Higher alliance success rates	Not specifically directed towards R&D.
<i>Heimeriks and Duysters (2007)</i>	Alliance Capability	Prior experience (lessons learned and know how generated, embedded in individuals)	A firm's alliance performance may be enhanced by the use of higher order resources (alliance capability) which is difficult to obtain or imitate	Not specifically directed towards R&D.
<i>Anand and Khanna (2000)</i>	Alliance Capability	Learning to learn from (a portfolio) of alliances through accumulated experience. Individual level and organizational level learning.	Strong and persistent differences across firms in their ability to create value in alliances, is interpreted as differences in alliance capabilities.	Learning effect from accumulated experience in joint ventures appears to exist in R&D and production alliances not in marketing alliances. This is caused by the ambiguous and uncertain nature of high tech alliances implying the importance of learning to manage R&D collaboration.

Inspired by Heimeriks, 2004

Schreiner *et al* (2009) has elaborated on the collaborative capability construct by showing that it can be conceptualized as being a multi-dimensional construct consisting of three sub-capabilities, namely; ‘coordination capabilities’, ‘communicative capabilities, and ‘bonding capabilities’<sup>6</sup>. This study is interesting due to the acknowledgement of the various kinds of capabilities that, in conjunction, form collaborative capabilities. Alliance capabilities are furthermore described as being ‘partly a function of individual skills and capabilities and firm-level attributes that enhance, encourage, and support alliance-like thinking and behavior throughout the firm’ (Spekman *et al*, 2000: viii). This perception of the capabilities as being developed in a consonant process including both individual level and organizational level attributes is, however, not very salient in the capability literature; in general, the attention is concentrated on organizational level factors.

A few exceptions from this organizational level focus deal with the role of the individual in forming the alliance as they focus on for example interpersonal trust as a core factor in supporting the successful alliance (Kale *et al*, 2000; ). Kale *et al* define the construct ‘relational capital’ which they suggest to be ‘the level of mutual trust, respect, and friendship that arises out of close interaction at the individual level between alliance partners’ (Kale *et al.*, 2000:218). Relational capital creates a basis for learning and transfer of know-how across organizational boundaries but it also helps the focal firm to protect itself from the potential opportunistic behavior of their partner (Kale *et al*, 2000:217). Thus relational capital is seen to mitigate the natural tension between learning on the one hand, and protecting on the other hand. Another study makes a related point in saying that the relational capability of a firm, for example, its capability to interact with other firms, can increase its access to knowledge and knowledge transfer (Lorenzoni and Lipparini, 1999). Both transaction and production costs can be lowered through multiple, repeated, trust-based relationships, and collaboration offer the focal firm with access to complementary capabilities and specialized knowledge resulting in positive effects for the firm (Lorenzoni and Lipparini, 1999). In fact the notion of organizational learning has grown in importance during the last decade and plays a central role in many R&D collaborations today.

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<sup>6</sup> Bonding capability is defined as ‘a firm’s ability to develop and nurture meaningful social exchange by consistently expressing attentiveness, consideration, and support for its exchange partner” (Schreiner *et al*, 2005:9). ‘Coordination capabilities’ are defined as ‘a firm’s ability to organize interdependence among activities of the exchange parties in an effective and efficient way” (Schreiner *et al.*, 2005:6), and ‘communicative capabilities’ as ‘a firm’s ability to credibly convey relevant knowledge and information about itself to the partner” (Schreiner *et al.*, 2005: 8).

#### *2.3.4 Absorptive Capacity*

What becomes especially important in connection to the discussion of learning through collaboration is to analyze how a firm can internalize the knowledge that they are presented to in a given collaboration. This is comprised by the construct of absorptive capacity. A firm's ability to prosper from external knowledge is related to firm specific absorptive capacity; that is; the ability to recognize the value of new external knowledge, assimilate it and apply it to commercial ends in the firm (Cohen and Levinthal, 1989; 1990). Absorptive capacity is the ability to connect existing internal practice of a given firm to new external knowledge in a process where the overall innovation capacity is affected.

Cohen and Levinthal (1989; 1990; 1994) have suggested that firms differ in their ability to recognize, assimilate and utilize external information. The absorptive capacity depends on the cumulative experience within the firm and the extent to which its knowledge is related to external information. Focusing on the process of absorption it is important to bear in mind that some kind of shared knowledge and expertise is a necessary condition to make communication happen between the members of a focal firm and external partners (Cohen and Levinthal, 1990; Borgatti and Cross, 2003). This could be both a basic level of shared language and symbols and of more technical forms of knowledge. Different kinds of knowledge are associated with different kinds of absorptive capacity (Cohen and Levinthal 1989), and when it comes to absorbing scientific knowledge a firm is better off if it has a high number of academic staff employed and has a high R&D intensity. Absorptive capacity is especially important in the setting of this study as it is shown that innovation firms are better at developing both internal and external absorptive capacity for innovation and creation of new knowledge while non innovation firms (imitators) are limited to adopt codified and mature knowledge (Lewin and Massini, 2004). This type of knowledge does not hold the potential to create innovation in R&D intensive firms.

The way a firm deals with organizational problems is said to be a function of the dominant logic of that firm, or the 'common thread' running through all the objectives of the firm (Lane and Lubatkin, 1998:465). As Lane and Lubatkin state: 'Even if the students understand the know-what (scientific knowledge) and the know-how that shaped it (the knowledge processing systems) its ability to commercially apply the new knowledge will largely depend on the degree to which its know-why (dominant logic) overlaps with the teacher's... the more familiar the student is with the types of problems or projects that the teacher prefers, the more readily it will be able to commercially apply new knowledge from that teacher' (Lane and Lubatkin, 1998:466).

Absorbing intra-industry knowledge is shown to be supported by more in-formal contacts between employees. This knowledge can easily be spread between people as this knowledge is easily understood due to the homogeneity of the knowledge from one's own industry. Inter-industry knowledge on the contrary is best shared through formal channels and the employees will need some more general skills in structuring problems and gathering information on previously unknown subjects. The level of absorptive capacity in an organization will depend on the absorptive capacity of its individual members, but it is argued that an organization's absorptive capacity is not simply the sum of the absorptive capacity of its employees; some aspects are distinctly organizational (Cohen and Levinthal, 1990). The organizational level capability relates to the ability of the organization as a whole to stimulate and organize the transfer of knowledge across departments, functions and individuals and even between firms. As absorptive capacity is said to be incremental in nature, a firm's ability to appropriate new external knowledge will depend largely on prior experience with collaboration and of whether the employees hold related knowledge (Cohen and Levinthal, 1990: 128). Various studies have shown that firms benefit more from collaboration when they have some (but not all) technological capabilities in common with their partners (Cohen and Levinthal, 1990; Lane and Lubatkin, 1998; Sampson, 2007). When firms choose to utilize external knowledge sources in their R&D process it often serves the purpose of accessing complementary knowledge, that is, knowledge that adds to and matches the knowledge already at hand.

A potentially useful resource for the accumulation of knowledge via R&D is pre-existing know-how within the firm. This kind of complementary knowledge can produce economies of scope, which 'arises from inputs that are shared or utilized jointly without complete congestion' (Willig, 1979, in Helfat, 1997:340). A firm's exposure to knowledge within its environment will influence the development of future capabilities (McGrath, MacMillian and Venkataraman, 1995), yet this knowledge needs to complement the knowledge already held to ensure learning (defined as the extent to which knowledge is related to, and at the same time different from, the knowledge in their networks) (Lofstrom, 2000). If all researchers in a group share the same specialized knowledge, coding scheme or specific expertise they will be good at communicating with each other, but will have a hard time linking up with an external knowledge source (Burt, 2002) as they may not understand the new external knowledge or can not integrate it with the knowledge they already possess. In fact, the process of knowledge sharing often meets certain barriers that make it difficult to attain the objectives. These barriers should not be ignored, but studied and handled in a



deliberate manner. As stated by Kanter (1992) the different failures and difficulties in collaborative projects are vital sources of insight that need not be concealed.

In spite of the increasing interest in the phenomenon of inter-organizational collaboration, and the capabilities needed to facilitate collaboration among firms, we still know little about these central organizational mechanisms that facilitate collaborative R&D processes and the collaborative competences that they may give rise to (Heimeriks and Duysters, 2007). The lack of understanding of these organizational mechanisms and the role they play is what motivates the analysis of the next sections. As stated in chapter 1 one of the main weaknesses with the studies of collaborative capabilities is that they neglect to empirically account for the *individual* level attributes that ensure the effective embeddedness of collaborative capability. Thus we need to develop a comprehensive understanding of the organizational mechanisms that foster collaborative capabilities in general and specifically we need to focus at the individual level attributes that lead to the development of these capabilities.

#### **2.4 Organizational Mechanisms Leading to Collaborative R&D Capability**

Organizational capabilities, such as collaborative R&D capabilities, are defined as the ability to combining and adjusting firm specific resources. Subsequently I have defined collaborative R&D capability as a dynamic capability by which the firm can utilize various R&D related resources, such as strategic and structural resources at the organizational level *and* human resources or abilities at the individual level. A number of organizational mechanisms facilitate the processes in which these resources are utilized. For example a variety of firm internal organizational mechanisms can be developed to facilitate knowledge acquisition and knowledge conversion (Nambisan, Agarwal, and Tanniru, 1999). In the context of this study organizational mechanisms are understood as initiatives that facilitate the sourcing, creation, sharing and deployment of knowledge. Organizational mechanisms and organizational structures encompass performance incentives, ownership allocations, allocations of decision rights, implicit/psychological contracts, internal division of labor, etc., and they may be implemented to beneficially influence the costs and benefits of building and sharing knowledge between firms (Foss, Husted, Michailova, and Pedersen, 2003).

One recent large scale empirical study of 193 firms aimed at enhancing our understanding of these mechanisms. The firms studied had a total alliance portfolio of approximately 2973 alliances and the study showed that a specific kind of organizational mechanism, namely alliance mechanisms, can play an important role in shaping alliance performance (Heimeriks, 2004). The

study provides a categorization of alliance mechanisms that can be instrumental in developing alliance capabilities. The first of the four categories are 'functions', which refers to an organizational unit in which a number of critical alliance tasks are managed. We also find mechanisms that can help to structurally coordinate alliance knowledge in the firm or functions that support alliance management in a number of ways, such as accumulating and assembling experiences in such a way that it is easily transferable to new situations. The second category is 'tools' which cover practical mechanisms to deal with day-to-day alliance management issues, such as alliance training programs, best practice accumulation or evaluation programs. Different tools support alliance management through their ability to ease conflict situations. Tools can furthermore stimulate sharing of collaborative experience. The third category 'control and management processes' encompasses specific aspects of alliance management, being control mechanisms, reward and bonus systems, formally structured knowledge exchange, etcetera. The last category is 'external partners' and this refers to the use of third parties as lawyers, consultants or experts to complement a firm's own knowledge in the collaborative process.

The study also shows that 11 intra-firm mechanisms are especially conducive in enhancing a firm's alliance performance. The 11 mechanisms are: alliance database, vice president of alliances, use of intranet, use of own knowledge about national culture differences, alliance manager, partner selection program, formal exchange of alliance knowledge, joint alliance evaluation, individual alliance evaluation, alliance metrics and alliance departments. Other studies have suggested that extensive use of artifacts (Hargadon and Sutton, 1997), real-time operating information as opposed to abstract accounting data (Eisenhardt, 1989), joint customer visits (Dougherty, 1992), and tangible representations of problems (Hargadon and Sutton, 1997, Bechky, 1999), help in breaking down communication barriers while increasing analogical thinking and mutual understanding in a way that makes knowledge integration more effective. Yet, rules and routines can both impede (Dougherty, 1992) and improve (Eisenhardt, 1989, Hargadon and Sutton, 1997) knowledge integration. An influential study of 203 collaborating firms has stated that the existence of an alliance management function is vital to a successful outcome of partnerships, as firms with alliance functions has a 25 percent higher long-term alliance success rate than those firms without (Dyer, Kale and Singh, 2002). Other studies have shown evidence for the importance of alliance experience on alliance performance (Powel *et al*, 1996; Anand and Khanna, 2000, Heimeriks and Duysters, 2007). Still, empirical examination shows that collaborations are often performed on an ad hoc basis and that organizational mechanisms that could facilitate the collaborative processes are

not in place. A study of 38 UK and Japan based firms that were all sourcing knowledge or technology externally showed that only two of them had a formal unit supporting external knowledge sourcing processes (Tidd and Trewhella, 1997: 362).

Further, it is important to remember that the mere existence of organizational mechanisms does not guarantee a successful outcome of collaboration. Different organizational barriers exist such as departmentalization structures which limit the ability to transfer and thus leverage knowledge inside the organization and additionally there is a difference between having mechanisms in place to internalize knowledge and then being able to utilize the knowledge (Heimeriks and Duysters, 2007). In sum, the mere existence of organizational mechanisms does not guarantee successful dissemination and utilization of knowledge (Grant, 1996; Simonin, 1997). Thus the important learning from this examination of organizational mechanisms is that if the mechanisms, such as an alliance department, or the use of third parties are to facilitate the various knowledge processes in or between collaborating firms they need to be carefully designed and adjusted on a continuous basis to ensure a beneficial outcome. As we will see in the following the employees engaged in collaborative project may not request the same kind of facilitating mechanisms as their colleagues nor are they all motivated by the same kind of rewards. This implies that designing and applying organizational mechanism is a complex task.

## **2.5 Conclusion: Gaps in the Literature and some Central Assumptions**

It has recently been stated that in order to fully comprehend core issues of strategic management, such as for example firm level heterogeneity, we need to acknowledge that explanatory mechanisms are located at the level of individual action and interaction (Abell, Felin and Foss, 2008) as I referred to in chapter 1. But in reviewing core contributions in the field of collaborative capabilities we discover that the majority of studies focus on organizational level issues such as the importance of designing an alliance strategy or designing an alliance unit. The aim on the following parts of the thesis is therefore to put an explicit focus on the micro-foundations of collaborative R&D capabilities. I will study how a corporate wish to collaborate affects the individuals who are to engage in the collaboration. Such individual level studies are necessary if we want to provide a better understanding of our macro-level phenomena, collaborative R&D capabilities. Still the preceding study will be founded on the existing knowledge about capabilities provided in this chapter and thus some core assumptions delineated in this chapter become particularly important. They will form the basis for our further studies.

First of all, R&D alliances play a major part in forming the competitive strategies of many firms (Larsson *et al*, 1998). Collaboration is an important organizational tool that helps firm to acquire new knowledge at a speed a quality that they could not manage alone. Yet a first and vital assumption of this study is that R&D collaboration is not only about exchange of knowledge between organizations, it is important to acknowledge that R&D collaboration is also about co-creation of knowledge (Kanter, 2004). Thus firms collaborate not only to exploit exciting resources but also to explore new knowledge together. A second core assumption is that the aspiration to collaborate may result in a many different forms of collaborative projects; from loose, short-term relations to long-term and very intense interactions (Contractor and Ra, 2002). The characteristic of a collaborative project will have implications for the organizational mechanisms that need to be applied or utilized. This pertains to the kind of contracts that need to be worked out, the types of managerial boards that need to be appointed, etc. As these organizational mechanisms influence the costs and benefits of creating and sharing knowledge between firms (Foss *et al*, 2003) it is vital to design and implement the best possible supportive organizational mechanisms that reflects the form and aim of the collaboration. Additionally the mechanisms need to be continuously adjusted in accordance with the development of the collaborative project in which they are utilized.

A third core assumption concerns the importance of collaborative R&D capabilities. A collaborative capability is what connects the aspiration to collaborate with the outcome of the collaborative activities and therefore this construct is of outmost importance to alliance practitioners and scholars alike. Collaborative R&D capability is the dependent variable of this study and the primary aim is to explore the micro-foundations of this specific type of dynamic capabilities. As collaborative R&D capabilities is an organizational level construct and in order to fully understand its micro-foundations we need to study, among other things, the individual level abilities that play a part in this setting. In general both organizational level and individual level factors are important to this study where actions of individuals as well as their interactions with others will be studied.

A final yet central assumption is that successful collaboration requires a change in mindset and attitude at both employee level (Spekman, 2002) and manager level (Doz and Hamel, 1998). Doz and Hamel state that, ‘The most important starting point in a successful alliance is the adoption of a mindset and a set of attitudes by managers that allows them to function in environments characterized by instability, few fixed objectives, ambiguity, and evolving partner relationships’ (Doz and Hamel, 1998:32). What is central in this study is exactly to understand how the attitudes, behaviors, and values of individuals affect the collective level outcome.

### 3. METHODOLOGY

#### Implications of the Micro-foundation Perspective

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*Within a single case, we can look at a large number of individual intervening variables and inductively observe any unexpected aspects of the operation of a particular causal mechanism...  
(George and Bennett 2004:21)*

#### 3.1 Introduction

Methodology deals with the rationale and the philosophical assumptions that underpin a given study. Accordingly, this chapter contains a description and a discussion of the ontological and epistemological views which underlie the study, including an exposition of the meta-theoretical standpoint of the study. Meta-theoretical considerations have to do with how the subject can be explained in the light of a given theoretical framework. I will deal with this issue in relation to the main analytical model which is presented in this chapter. Subsequently, I describe the specific research method applied in the study.

Accordingly, the chapter consists of two main parts. In the first part (section 3.2) I outline the philosophical foundation of the study and discuss the implications of the meta-theoretical standpoint. In general, accounting for the function of a social system is a central issue in social science (Coleman, 1990:27). For example, this can be done by explaining how the individuals of the given social system act and interact leading to a given outcome of the system. In the context of this study this will entail a discussion of 1) how the properties of the social system studied creates constraints and orientation of its actors; 2) how the employees in the studied collaborative projects act; and 3) how these actions intervene and affect the outcome of the system. The ‘Coleman diagram’ (Coleman, 1990) illustrates these ‘chains’ of effects. This framework will structure the analyses of the empirical data and its elements and dynamics will be thoroughly outlined in section 3.2.

In the second part (section 3.3 and section 3.4) I deal with the more practical issues, such as the study design, and answer a number of questions related to how the study is carried out. Why is the narrative case study research strategy preferred in this setting? How are the elements of the study (e.g. the interview process) designed? What data sources are used and how is information collected, triangulated and analyzed? And what are the consequences of the chosen design strategy in regard to the results and conclusions drawn from this study? With the aim of preparing the

foundation for answering these and related questions I describe the general strength and weaknesses of the case study strategy with a focus on the narrative method (Abell, 1987; 1993).

By splitting up the methodology chapter in a philosophical and a more pragmatic part I run the risk of presenting these parts as two separate spheres of the study; this is, however, not the intension. Both sections entail important information about the study and I emphasize that the philosophical grounding and the actual execution of the research activities are highly intertwined. This will be illustrated in the following sections where links are made between the epistemological position and the data collection process and I will discuss how this impinges on the conclusions I can possibly draw.

### **3.2 Putting the level of Individual Action and Interaction at the Center of Attention**

In this study I question parts of the classic strategic alliance literature by suggesting that explanations of collaborate performance, whether good or bad, are too often searched for only at the macro-level. By this focus scholars neglect to search for the underlying and relevant micro-foundations. I propose that turning the spotlight towards individual level actions and interactions will enable a more comprehensive account of organizational level outcomes, such as the development of collaborative R&D capabilities. The framework applied in this study highlights this in a unique way as it forces us to look for the lower level explanations to the phenomena under study. According to Coleman (1990:3-5), the strength of this change in focus is that as social analysts we tend to gather data and do our observations at the individual level, mainly by interviewing or doing surveys or observations of individual actions. This is done because data gathered only at the system- or macro-level are often not sufficient, especially when we study only one or few cases. Even when we want to explain system level outcome we do interviews or take accounts of individuals' behavior; that is, we do the data gathering at the individual level, Thus our analysis should be made at this micro-level where we collect our data. Undertaking the analysis before data is aggregated or synthesized will make the results more solid and well founded.

It is debatable whether Coleman's argument about the individuals being the major data source holds true in all cases. One could argue that core data may sometimes as well be gathered at the collective level depending on the focus of the study and disciplinary background. However, it is reasonable to argue that in the case of the present study explanations to the development of inter-organizational collaboration need to be searched for at the level of individual actions and interactions. I consider a thorough analysis of the single individuals' motivation towards

collaborative activities to be a necessary foundation for conclusions regarding the development of collaborative capabilities. The individual attitude will be of great importance to the aggregate collaborative capability of an organization (or a team), yet may vanish if it is only analyzed on aggregated data at a collective level.

A second reason for focusing the analysis at the level of individual actions and interactions is that this is where we are able to make recommendations about future interventions. Even if interventions are needed at the system level, such as new collaborative strategies or policy changes, its implementation will ordinarily occur at the individual level. Consequently, the focus is again at the individual level. Third, an explanation that rests at lower level units will be more stable and general than system level analysis that rests on ‘surface characteristics’ of the system (Coleman, 1990:2). A fourth argument is that internal analysis based on actions and orientations at the micro-level can be regarded as more fundamental as it seeks to uncover the micro-foundations of macro-level phenomena. Finally, it may be argued that a micro-level analysis is more grounded in a ‘humanistically congenial image of man’ (Coleman, 1990: 17) than a collective approach would be. This is due to the fact that the micro-level analysis leaves room for the individual’s freedom of will and for the choice to act and react on the behavior of other individuals. This perspective deals with the individual as a purposive and responsible actor. By focusing on individual level issues I do not intend to reject the notion of ‘*Homo Sociologicus*’, in which the individual is conceived as a socialized part of a social system; yet, as this study intends to highlight how the competences and actions of individuals influence the performance at the organizational level, it makes sense to operate with a fairly individualistic image of the employees.

To recapitulate, the aim of this first part of the chapter is not only to put forward a precise description of the framework that structures this study, but also to contribute to the ongoing methodological debate about how individual actions affect collective level outcome in a given setting (Coleman, 1990; Abell; 1987; 2007; Felin and Foss, 2007).

### *3.2.1 The Meta Theoretical Standpoint: Methodological Individualism*

This study aims at understanding the micro-foundations of capability development in the context of R&D collaboration. By putting the actions and interactions of individuals at the center stage, the study adheres to the perspective of methodological individualism, which is best described as a doctrine that aims at showing how all social phenomena can be explained as results of individual actions (Weber, 1968 [1922], Elster, 1989:13; Coleman, 1990). Individual actions may then again be understood as results of the intentional state that motivates the individual actor. Basically actions

are founded on modal operations of intentions and beliefs. Or put differently: an individual engages in a given action because he or she believes that this will lead to a certain outcome, that is, a change of the situation in which he or she started. This simplistic way of describing a chain of actions can of course be discussed and modified, for example it may be argued that other issues than intention and beliefs may provoke an action, (as for example unintended behavior), but for now this scheme will illustrate how actions are perceived. The core message is, though, that the causalities in the case narratives are action driven and that upon structuring actions within cases in a particular manner, paths of interactions can be traced (Abell, 2007:12).

The notion of methodological individualism (*methodische individualismus*) was originally coined by Joseph Schumpeter (1908; 1909) but theoretically elaborated by his teacher Max Weber (1968[1922]). Weber states that in sociological work the ‘collectivities’; that is, states, associations, business corporations, or foundations, ‘must be treated as solely the results and modes of organization on the particular acts of individual persons, since these alone can be treated as agents in a course of subjectively understandable action’ (Weber, 1968:13). Weber states that ‘(w)e shall speak of 'action' insofar as the acting individual attaches a subjective meaning to his behavior--be it overt or covert, omission or acquiescence. Action is 'social' insofar as its subjective meaning takes account of the behavior of others and is thereby oriented in its course’ (Weber, 1968: 4). This means that for actions to be social they must be *meaningful* to the actor, they must be *related to the action of others* (whether these actions are seen as positive, negative, or neutral), and they need to be *oriented*, meaning that they have a direction or a purpose. Studying action, specifically, is an advantageous strategy to social scientists because we have interpretive access to action due to our capability of understanding the underlying motives of agents. This permits the social scientists to accomplish something which is never attainable in the natural science, namely the subjective understanding of the action of the component individuals (Weber, 1968).

Methodological individualism has taken several forms throughout the preceding century and has even been conflated with variants of political individualism such as liberalism. Yet the variant that will constitute the foundation of this dissertation is a pragmatic variant which does not assume that a system consists of nothing more than individual actions and orientations (Coleman, 1990:5). In the spirit of the collaborations I investigate, I adhere to the belief that a result can emerge at the collective level that was not intended or predicted by the individuals—whether positive or negative in character. This merely pragmatic form of methodological individualism states that an explanation to a given problem or question is satisfactory if it is useful for the particular action or intervention



for which it was intended. Or stated in a more colloquial vein: even though I aim at understanding individual level actions and beliefs as causes of the social phenomena I study, I will not always find the answer at the individual level; some satisfactory explanations may be found at the organizational level as well. Thus, I adhere to Coleman's variant of methodological individualism (Coleman, 1990).

In my opinion the core learning from the doctrine of methodological individualism is that we need to put the actions and interactions of individuals in focus. This means that we focus our study at the level where actions can be detected. Actions can be studied and understood in a way that other social phenomena can not, because they are motivated by intentional states possessed by individuals. By 'intentional state' I refer to a specific kind of mental state that is directed towards objects and states of affairs in the world (Searle, 1979). Still, not all our intentional states are conscious as they can be for example unconscious reactions to actions of others. Hence, what is important is not only how individuals act and make decisions, however, also how they do this in interplay with the actions of for example colleagues or external partners. Rational decision making entails choosing an action given one's preferences, the possible actions one could take, and expectations about the outcomes of those actions. Research has shown that rationality may be bounded, meaning that perfectly rational decisions are often not feasible in practice due to the finite computational resources available for making them (Simon, 1957).

Additionally, Weber proposed an interpretation of social action that distinguished between different types of rationality. First and foremost, he pointed to the fact that humans are purposive or instrumentally rational, meaning that we have expectations about the behavior of other human beings or objects in the environment. These expectations serve as means for a particular actor to attain ends, which are 'rationally pursued and calculated' (Weber, 1968 [1922]). A second type of rationality is more value or belief-oriented. Here the action is undertaken for what we might call reasons intrinsic to the actor; that could be ethical, aesthetic, religious or other motives. These two types of rational actions are important to the analytical model presented below.

### *3.2.2 Relating the Analytical Levels: Introducing the Main Analytical Model*

Due to the general aim of the research project and the nature of the research question, the focus in this study is on both the individual and the organizational level of analysis. The strength of the analytical model I develop and utilize (see model 3.2) is that it operates at multiple levels and thus prepares the way for studies of how micro-level factors influence macro-level outcomes. As previously stated, while much work on alliances and collaborative capabilities is conducted at the

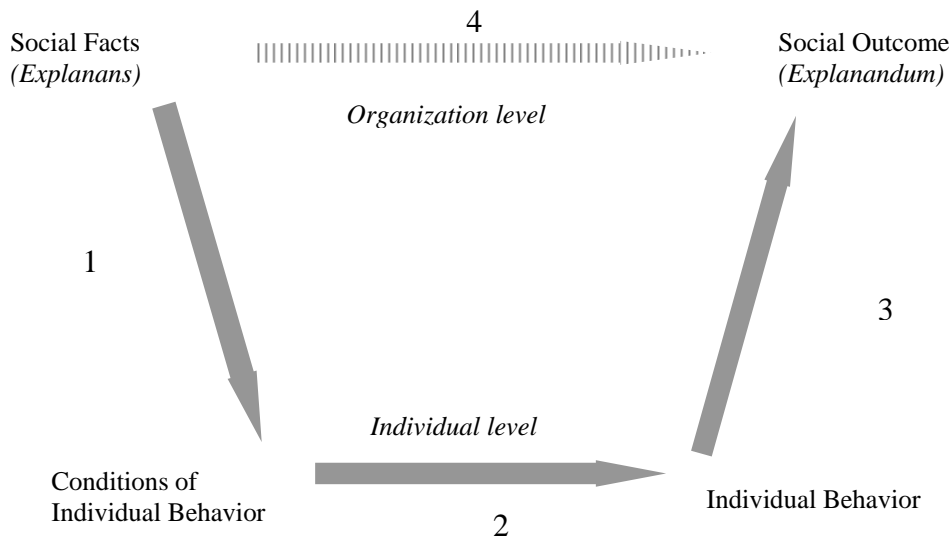
firm level, limited research exists on the involved individuals, and the conditions that affect their attitude towards collaborations as well as their behaviors. By way of example, studies have paid sufficient attention to issues at the organizational level such as the effect that prior relation between two partner firms have on alliance performance (Gulati, 1995) or to firm level exchanges in alliances (Larson, 1992).

I concur with Leung and White who state that, ‘so much is at stake in an alliance, as reflected by the voluminous firm-level research on this topic, but we know so little about the relevant people issues that make or break alliances’ (Leung and White, 2006: 203). A notable exception is the work by Lorange (1992; 1996), who considers several dimensions of human resource management issues in relation to cooperative ventures. However, despite an explicit focus on people related issues, this line of enquiry is primarily preoccupied with developing normative prescriptions of HRM functions.

Challenges may appear because employees hold conflicting identities or because of inter-group challenges such as in-group favoritism (Salk and Shenkar, 2001) or divergent perception of group members (Leung and White, 2006). No matter how beneficial a given collaboration seems to be when following the initial argumentations about firm possible benefits, it will not succeed if individual level matters emerge and are not handled.

In order to shed light on the links between the organizational (macro) and individual (micro) levels at stake I employ an analytical model designed to illustrate the interconnectedness of levels and especially to highlight the importance of the actions and interactions of individuals. The model, which I have already presented and referred to as the Coleman diagram, directs the attention towards the relations between the micro-level and macro-level issues as two inter-dependent levels in social science. As the model illustrates, most explanations (that is, the explanans) to macro-phenomena (that is, the explanandum) in social science are—mistakenly—placed at the macro-level. This is illustrated by the dotted arrow 4 in model 3.1. To fully understand how social facts or mechanisms affect social outcomes we need to investigate the micro-level factors which serve as foundations for macro-level outcomes and study the relations between the levels. This is illustrated by arrows 1, 2, and 3 in model 3.1.

### Model 3.1: General Model of Social Science Explanation



Source: Coleman, 1990

As suggested earlier, extant strategic alliance literature deals primarily with issues pertaining to arrow 4 in the Coleman model; that is, it is typically assumed that when a given firm collaborates with external partners it will obtain better R&D performance through the development of collaborative capabilities. While this may be true in principle, we need more detailed analysis of what is going on in alliances at the individual level in order to help explain the underlying micro-foundational processes leading to superior R&D performance. Thus, if we structure our studies in line with the above model and make an effort to thoroughly analyze the elements underpinning the processes illustrated by arrows 1, 2, and 3, we may be able to provide a more coherent understanding of the dynamics of collaborative capability development. Before I go into details with how this model helps structure the analysis of the present study I briefly outline the different elements and interactions of the model.

#### 3.2.3 Elements and Interactions in the Analytical Model

The analytical model is composed of a number of elements which need to be described thoroughly. The main elements are the four 'corners' of the figure and the arrows that link the corners. Each of

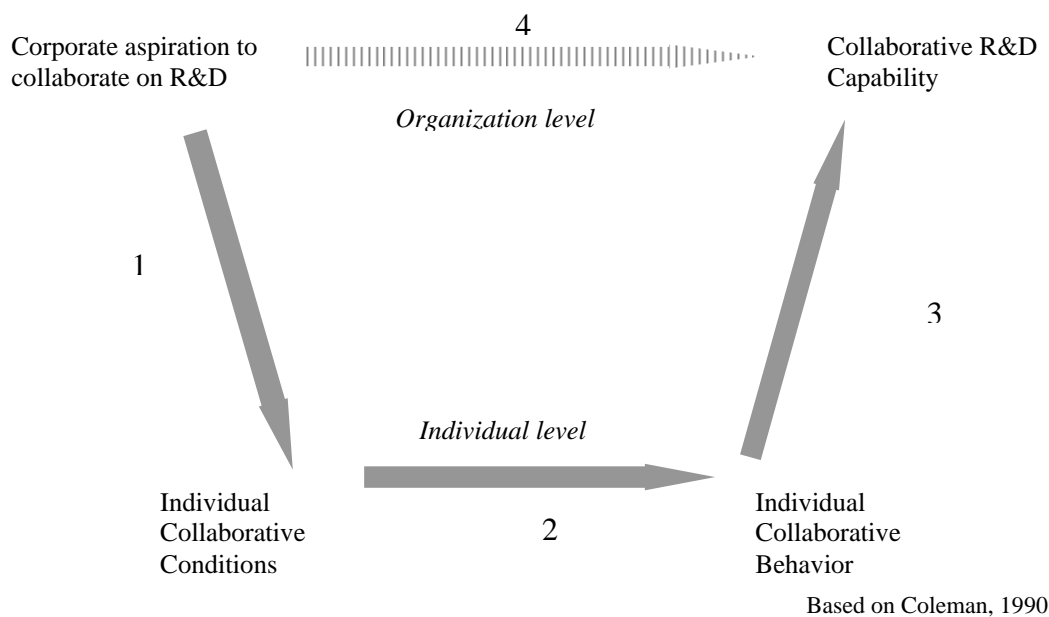
the ‘corners’ in the model can be interpreted as an expression of an empirical state that is influenced by the situation in the other ‘corners’, directly or indirectly. The arrows, then, are causal links that illustrate a *change* of the states represented in each corner. The arrows invite for a theoretical explanation in terms of latent mechanisms which generate the link or the change (Abell, 1993). I will return to the role that these ‘latent mechanisms’ play after outlining the characteristics of the model.

First, it is important to note that arrow 4 differs from the other arrows as it illustrates a macro-level causal link that is often claimed but seldom motivated. A basic strength of the model is that it in all its simplicity shows how this macro-level causal link can be broken into three parts, or three arrows, each with its own dependent and independent variable. This exercise will make the central problems of a given analysis more apparent or as Coleman states: ‘What is necessary to account for the growth or occurrences of any social organization [...] is how the structure of positions constituting the organization comes into being, how persons who come to occupy each of the positions in the organization are motivated to do so, and how this independent system of incentives is sustainable’ (Coleman, 1990:9). By the structure of the model the macro-level proposition (arrow 4) is broken into three parts that begins and ends at the macro-level but in between dips to the level of the individual (Coleman, 1990:8). As mentioned, the arrows can be seen as illustrations of mechanisms that underpin the transitions from one level to another. A mechanism can in this context be defined as follows: ‘A mechanism underlying a behavior is a complex system which produces that behavior by the interactions of a number of parts according to direct causal laws’ (Glennan, 1996:52). This means that a given mechanism is characterized by what it does, or the function it has in a bigger setting. Still, a mechanism is not merely an artifact of the description of the system; it will also play a role in itself.

A central question in this search for causal mechanisms that makes a difference in a given system is of course at what level we should look for these mechanisms. Put differently, at what level of decomposition should we stop our search? The choice of how detailed to define or describe the mechanisms that are part of a given system must relate to the behavior that is to be explained (Glennan, 1996:52). The behavior in question may be something the mechanisms were designed to accomplish but it need not be, as there could be side effects of a given mechanism. A simple example could be provided by thinking of a combustion engine: the engine is designed to move the drive shaft, yet at the same time it produces heat. The side effect may not be intended but it is a function of the system anyhow. Actions can lead to other actions in a number of ways and, as I will

show in the following, the core task is to search for groups of actions that can be ‘collapsed’ in sets of meaningful relations (Abell, 1987). By this exercise we generate narratives that make up the core of the case analysis. In the context of this study the model and argumentation appears as follows. The macro-level arrow, *arrow 4* (going from top left to top right), illustrates the claim that the mere existence of collaborative activities will lead to the development of collaborative R&D capabilities. This claim is thoroughly reviewed in chapter 2 as indeed most extant literature is preoccupied with this relationship. It may very well be that good reasons exist for engaging in collaborative projects and that collaborating will lead to better R&D performance (as illustrated by arrow 4), however, to understand this relation we need to study it at a more detailed level. For example, looking at how individual level values are formed (*arrow 1*) and how they affect change in the individual level behavior (*arrow 2*) and thus lead to an (positive) outcome at the organizational level (*arrow 3*) (see Model 3.2) may provide a more comprehensive explanation for the existence of collaborative capability.

**Model 3.2: Theoretical Framework Model**



*3.2.4 Coleman: Strengths and Weaknesses*

The work of James Coleman will play a prominent part in this thesis. This is first and foremost because of the strength of his theoretical work in regards to outlining the elements of social

systems. In his own words we must aim to ‘discover in real social systems implicit rules and norms, constraints and goals, and the way in which the actions they generate combine and interact to produce system functioning’ (Coleman, 1996:348, in Lindenberg, 2000:91). The work on and modeling of these macro-micro transitions does only represent one element of Coleman’s extensive work that also included work on education and school systems (1966; 1983), social rewards and punishment of the social crowd (1986), the importance of social capital and trust (1990) among others issues and made scholars call him ‘the most prominent sociologist worldwide’ (Lindenberg, 2000). Still, even though highly cited his work has not yet been well tested, and the model that is used to frame this present work still needs refinement to fit a setting like the present. I will return to this refinement at the conclusion of this thesis. Additionally, Coleman did not make must effort to describe how the macro-to-micro transition of his model may possibly happen and thus the model and the theoretical analysis that underpin it are very much in need of complementary work done by others scholars (Abell *et al*, 2007). A last point of critique that becomes clear from the reading of Coleman’s 1990 book is that, in his point of view, people do not jointly produce anything; they only engage in activities of exchange (Lindenberg, 2000). This does not fit well with the activities described in the narratives of this study. However, this critique does not alter the fact that the model offers tremendous explanatory power as it visualizes the importance of the levels and their interaction in social science.

### **3.3 Case Study Research**

Methodological reflections on the case study strategy have increased throughout the last decade (Blatter, 2007) and many different characteristics have been attached to the case study strategy depending on the disciplinary background of the research field. Choosing to do a case study is not a methodological choice as such but rather a choice of what to study (Stake, 2003). Therefore, the decision to undertake a case study does not necessarily provide the researcher with specific research tools or guidelines that need to be followed to ensure valid and rigorous research results. In fact, the researcher undertaking a case study needs to carefully choose between numerous directions that the study can follow. In this section I examine the strength and challenges of the case study research strategy.

Due to the increasing use of the case study approach in many different fields of study (see Miles and Huberman, 1994; Blatter, 2008; Yin, 1989:13 for overviews) the approach has been subject to varying definitions. The term ‘case’ is used to refer to as different things as categories of

data, historical specific categories, substantive categories, etc. Subsequently, when trying to provide a general definition of the case concept, scholars state that ‘there is common ground, but it is shrouded in fog’ (Ragin, 1992:217).

I agree with the definition of a case as an instance of a given ‘class of events’ which is of specific scientific interest (George and Bennett, 2004:17). A case is additionally regarded as a phenomenon occurring in a bounded context (Miles and Huberman, 1994: 25). In the present study the class of events is inter-organizational research collaboration. The cases, or instances, are unique collaborative projects between two independent firms, and they are selected as objects of study in order to shed light on the role that individual and organizational level factors play in the context of research collaboration. In continuation to this classification of a case, a case study can be defined as ‘an empirical inquiry that investigates a contemporary phenomenon within its real-life context’ (Yin, 1989:23). This highly influential definition of case study research accentuates the importance of the context of a given phenomenon to the case study strategy. In opposition to other research tools or strategies, as for example laboratory experiments, a case study can not be separated from its context, or put differently: in case study research ‘the boundaries between phenomenon and context are not clearly evident’ (Yin, 1989:23). The context dependent nature of case studies makes it highly important to specify the aims and procedures that a given case study is guided by in order not to be induced to follow other interesting pathways that may occur during the study.

As the events investigated are small in numbers, case studies are often referred to as ‘small-N studies’, as opposed to more quantitative studies where ‘N’ is larger. A small-N study (or case study) most often implies that repeated observations are done upon a single unit. Even though the unit of analysis may be composed by a number of sub-units, the core predicates of the analysis will always be projected towards the main unit of analysis (Abell, 2007:3). By way of example, it may be relevant to study how a given sub-group of employees in a given collaborative project organize their work or structure their communication, but the main aim is still to investigate how their specific way of organizing collaborative activities influences the collaborative capability of the focal firm.

The present research project is, as many other studies in the field of social science, structured as a search for and explanation of causal mechanisms inherent in the cases investigated. When causal inference is done on the basis of only a few cases it becomes important to be precise about how the causal analysis (inference) can be convincingly prosecuted (Abell, 2007). Traditionally, case studies were deemed incapable of providing the required ground for generalization and

comparison that is said to be necessary conditions for solid research in the more orthodox large-N context. Case studies are often done with the dubious aim of serving as ‘testing devices’ for results expounded by large-N studies. From this perspective, cases may for example be used to explore insights about causal mechanism which subsequently are used in a large-N context; or case studies may be applied to further test the scope of an applicability of generalization done in a large-N study (Flyvbjerg, 1991). The reason to choose the case study strategy has even *mistakenly* been argued to be determined by the numbers of cases available for a given study: when a large number of cases are available in a given study it makes statistical research possible and thus preferable where as if only a minor number of cases are available in a given study the case study method is to be chosen (Lijphart 1971, in George and Bennett, 2004).

In general, the main strength of case study research is that it enables us to put emphasis on qualities of entities and on processes and meanings that are not, or can not, be examined in terms of quantity, amount, intensity or frequency. This explains why the label ‘qualitative inquiry’ is often put on case study research. The quest for countable numbers is on the other hand the hallmark of quantitative studies (Denzin and Lincoln, 2003:13). Still, the distinction between quantitative and qualitative studies is said not to be a waterproof separation of case studies from other forms of inquiry. In fact, it is argued that the case study strategy may share a similar epistemological logic with those statistical methods that are directed towards empirical research, as both methods may aim to develop logical consistent models or theories, derive observable implication from these theories and test these implications against empirical observations or measurements (George and Bennett, 2004). The results are in both instances used to make suggestions as to how to best modify the existing theories. Even though qualitative and quantitative studies may be somewhat similar in epistemological logic, these two modes of study are very different in regards to the reasoning about different method-related issues such as case selection, operationalization of variables, and the use of inductive or deductive logic (George and Bennett, 2004:5). This variation results in complementary comparative advantages of the different methods.

### *3.3.1 Exploring the Micro-Foundations of Collaborative R&D Capabilities Through Narratives*

The present study is qualitative in nature. It has been argued that studies of alliances and R&D collaborations have suffered from being mainly conducted on large datasets and with little attention to process factors that may be key drivers of alliance success (Shenkar and Reuer, 2006). The case-study strategy is a useful approach that complements quantitative studies, as it entails the option of learning from the employees engaged in the collaborative arrangements. As stated in the most



recent handbook of strategic alliances: ‘Because much alliance research is conducted by using large datasets, we may be forfeiting an opportunity to learn from people who are directly engaged in the formation and operation of such arrangements’ (Shenkar and Reuer, 2006:13). By applying the case study strategy individual level factors that may have an effect on collaborative capabilities are more likely to become apparent. In line with the emerging nature of micro-foundational research on innovation, capabilities and alliances (see Felin and Foss, 2005) the purpose of the work done on the case narratives is to identify the organizational and individual level determinants of collaborative capability in the case companies, rather than evaluating the degree to which this capability has been implemented successfully, leading to better performance. Hence, the scope of this study is limited to the exploration of organizational and individual level mechanisms—and their possible interactions—that influence collaborative capability in R&D alliances. To get a firm understanding of how different variables affect the development of collaborative R&D capabilities in general, it is essential to study if or how it affects the specific case.

As the theme studied is still subject to clarification, the use of a case study strategy is particularly relevant. We know very little about the micro-foundations of collaborative R&D capabilities. For example the relation between two employees at a focal firm is hypothesized to be as relevant to study as the relation between two collaboration group in regards to the development of collaborative capabilities (Leung and White, 2006: 202), yet we have no distinct theories about this relation between micro-level actions and interactions (e.g. two employees’ wish to collaborate) and organizational level outcome (e.g. enhanced collaborative performance). A case study is a superior way to reveal links between events, reactions, decisions, emotions, reflections and behaviors as they emerge in real life situations (Kvale, 1994: 24; Maaløe, 2004:10), which fits the aim of this study. The study aims at exploring a large number of intervening variables and inductively observes any unexpected aspects of the operation of particular causal mechanisms. This will help identifying what conditions present in the case activate the causal mechanisms (George and Bennett, 2004:21) that affect the development of collaborative R&D capabilities.

The present study is exploratory in nature as it aims at enhancing our basic knowledge about a virgin field of study, namely the micro-level issues of the field of strategic alliances, more specifically R&D collaboration. The aim is not to fully describe the field, but to advance a better understanding and to put forward propositions for further inquiry. The present thesis is based on three distinct exploratory case studies with the aim of understanding the dynamics present in each case (Eisenhardt, 1989; Yin, 1989). The cases studied are instances of a specific class of events,

namely inter-organizational collaborative R&D projects. These classes of events consist of ‘states of the worlds’ and a number of factors that change these states (Abell, 1987). By ordering these ‘states of the worlds’, and the factors that transform them, narrative explanations are created. The narratives seek to illuminate the core phenomenon, corporate collaborative capability, which is difficult to measure as it is dependent on complex interactions between individuals, embedded within specific organizational contexts. The narratives conducted in this study enable me to focus on the dynamic processes of developing collaborative capabilities due to the detailed descriptions of both organizational and individual level actions and interactions.

Narratives can be written at different levels of abstraction. By writing up narratives in a simplified manner they can be compared to another narrative in a process where we look for common stories or common traits. Thus, the degree to which a causal explanation can be generalized becomes a matter of comparing narratives. Yet, if a narrative is written in a very detailed and complex way it becomes hard to distinguish the common stories. Hence, the researcher needs to choose a level of abstraction (or level of simplification) in the narratives that allow for comparison. Yet, it is important to be aware that these sequences of interaction are created so that they make cultural sense and in a way that the action path connectivity is neither created nor destroyed by the researcher. Moreover, it is important to be aware that the path of connectivity is not broken when we write up the story—otherwise the narrative may be split into two narratives (Abell, 1987).

The act of creating comparative case-based narratives puts the researcher in a central position in which a number of important decisions are to be taken. These decisions relate specifically to which knowledge to include and which to abandon in the quest for writing up the best suitable case account, that is, under certain time constraints or constraints in the ability to collect data. This may be argued to be a challenge to all social researches whether they work with small or large number of observations, yet it seems to be even more essential in the context of narratives where knowledge is put forward in a descriptive vocabulary. A way to deal with this challenge is to be precise about the objectives of the study and the causal linked actions described in the narrative. As stated by Abell: ‘The question [...] arises as to the nature of the optimal simplification of the metaphysically assumed narrative consistent with the information that is available. Here resides the art of social science!’ (Abell, 2007:24).

In this thesis, the narratives are structured around the adapted Coleman framework (figure 3.2) with particular emphasis on the causal mechanisms (represented by arrow, 1-4 in the diagram).

This makes it possible to ascribe patterns to events across cases and, subsequently, engage in a cross-case analysis.

### *3.3.2 Cross-case analysis*

Cross-case analysis facilitates the comparison of commonalities and differences in the events, activities, and processes that are the units of analysis in the case studies. It enables the comparison of findings in many divergent ways, which would not be possible within a single case study. The comparison can be made against predefined categories, in search of similarities and differences, or by classifying the data according to data sources (Khan and VanWynsberghe, 2008). In the present study the cross-case analysis is used to challenge and qualify the theoretical framework developed in section 3.2. Thus, the purpose of the cross-case analysis is to build a logical chain of evidence for the relationships among key variables studied.

In chapter 9 data will be analyzed across all three narratives in order to identify similarities and differences in the process of fostering collaborative capabilities. Cross-case analysis enables case study researchers to delineate the combination of factors that may have contributed to the outcomes of the case, seek or construct an explanation as to why one case is different or the same as others, make sense of puzzling or unique findings, or further articulate the concepts, hypotheses, or theories discovered or constructed from the original case (Khan and VanWynsberghe, 2008). Furthermore, comparisons among cases can construct and yield meaningful linkages, and cognitive cross-case analysis represents a useful way to produce analogies, make inferences, and develop conditional generalizations for the individual (Khan and VanWynsberghe 2008). As such, cross-case analysis enhances the understanding of how relationships may exist among discrete cases. As the aim of this study is to understand the factors that affect the development of collaborative R&D capabilities, the cross-case analysis will be used to refine and develop concepts that are argued to be of importance to the overall framework.

There are several well-known cross-case analysis approaches and techniques available to the case study researcher. Ragin (1997) for example delineates between variable and case-oriented research as two approaches to cross-case comparisons. In variable-oriented research, variables take center stage; that is, the outcome observed in the cases varies across observations and causes appear to compete with one another. The goal is to explain why the cases vary. Variable-oriented approaches to cross-case analysis are a challenge to conduct because fair comparisons are difficult to achieve and the multitude of factors that are associated with social phenomena are often too numerous to disentangle.

In case-oriented research, commonalities across multiple instances of a phenomenon may contribute to conditional generalizations (Miles and Huberman, 1994). The researcher can thus demonstrate that the outcomes in the cases selected are in fact enough alike to be treated as instances of the same thing. The central question of interest to the case-oriented researcher is in what ways the cases are alike. Therefore, special emphasis is given to the case itself instead of on variables across cases. The core issues here is whether we start by studying the variable across cases or start by studying the cases in a separate manner and then look for how the different variables have influenced the case findings.

In the present study I have used narrative models, which constitutes a mixture of variable and case-oriented approaches (Miles and Huberman, 1994). This approach helps to visualize sets of cases and then bring case relationships to the surface in ways that invites and facilitates comparison. As such, narratives are the keys to cross-case analysis as narratives can preserve the essence of the case during cross-case analysis. At the same time, constructing narrative models helps to facilitate comparison by encapsulating the case as a storyline.

### **3.4 Research Design and Methodological Fit**

The research design is the logic that links the empirical data to the initial question of the study, and ultimately, to the final conclusion (Yin, 1989: 28). This section will outline the logic (or action plan) of this study by putting forward the research objective, describe the process of data collection, as well as questions on validity, reliability and generalizability of the findings. But first I will summarize why I have chosen to do empirical studies and in what way my study relates to already existing research in the field, as this sets the scene for how the actual research has been designed and carried out. In the previous section I carefully outlined the strength of doing narrative case study research. I stated that the reason for choosing to do two narrative case studies on the top of the theoretical work that sets of this project is to be able to identify patterns of action and interactions that leads to the phenomenon I am studying. While doing the narratives I have been searching for empirical elements that can be compared to the theoretical elements of my study and thereby qualify the model presented in this chapter and will elaborate on in chapter 4.

As my field of study is relatively unexamined and characterized by few formal measures I have done this in an exploratory way in order for new elements to appear. In order to ensure quality of a study that is exploratory in nature and based on an open minded approach there must exist a fit between the elements of the research project (for example the research question, prior research or

way of collecting data). This is referred to as methodological fit (Edmonson and McManus, 2007) and this section is devoted to illustrate how this fit is ensured in the present study. Still, before venturing into this argumentation I will state, as I have done previously, that I do not believe in a ‘checklist’ for doing empirical research. That is; we ought not to think that when we have chosen for example the cases study strategy we just need to follow the recipe.

Edmonson and MacManus (2007) have developed what they denote as a ‘formal framework to help researchers uncover areas of poor fit in their own field research’ (2007:1158) in which they outline three archetypes of methodological fit in field research (see table 3.1).

**Table 3.1: Three Archetypes of Methodological Fit in Field Research**

State of Prior Theory and Research	Nascent	Intermediate	Mature
Research questions	Open-ended inquiry about a phenomenon of interest	Proposed relationships between new and established constructs	Focused questions and/or hypotheses relating existing constructs
Type of data collected	Qualitative, initially open-ended data that need to be interpreted for meaning	Hybrid (both qualitative and quantitative)	Quantitative data; focused measures where extent or amount is meaningful
Illustrative methods for collecting data	Interviews; observations; obtaining documents or other material from field sites relevant to the phenomena of interest	Interviews; observations; surveys; obtaining material from field sites relevant to the phenomena of interest	Surveys; interviews or observations designed to be systematically coded and quantified; obtaining data from field sites that measure the extent or amount of salient constructs
Constructs and measures	Typically new constructs, few formal measures	Typically one or more new constructs and/or new measures	Typically relying heavily on existing constructs and measures
Goal of data analyses	Pattern identification	Preliminary or exploratory testing of new propositions and/or new constructs	Formal hypothesis testing
Data analysis methods	Thematic content analysis coding for evidence of constructs	Content analysis, exploratory statistics, and preliminary tests	Statistical inference, standard statistical analyses
Theoretical contribution	A suggestive theory, often an invitation for further work on the issue or set of issues opened up by the study	A provisional theory, often one that integrates previously separate bodies of work	A supported theory that may add specificity, new mechanisms, or new boundaries to existing theories

Source: Edmonson and McManus (2007)

Edmonson and McManus suggest that theory in management research fall along a continuum from mature to nascent. In a mature theory field constructs and models are well developed and have been studies and refined over time. In nascent theory tentative answers are proposed to novel questions on how and why connections exist among phenomena. Intermediate theory positioned in between the to extremes presents provisional explanations of a phenomena often introducing a new constructs and proposing relationships between these and existing constructs.

The present study mirrors nascent theory research the best, as it unfolds in a field where only little research is done so far. As stated previously we do know very little of the micro-foundations of collaborative R&D capabilities and the research question thus takes the form of an open ended inquiry about the phenomenon collaborative R&D capabilities. As I will describe in the following data is gathered through interviews and observations as well as through other material gathers at the site of the focal firms. The data has been analyzed by coding thematic content which I will also describe in the following. Finally the contribution of my work is among other things a suggestive theory including the invitation for others to do further work on the issues (Edmonson and MacManus, 2007). As the field of study is nascent and the measuring of the elements affecting the dependent variable is difficult I have been compelled to study a number of different theories and constructs and different units of analysis. As it is often the case in exploratory studies done in nascent research fields I have be obliged to search in a number of different theoretical field for constructs that can inform my study. As the study is at the same time focusing on constructs at more than one level of analysis the amount of potential relevant constructs have been large. Other constructs could have been relevant to include, but as referred to earlier one need to stop the search for explanatory variables at a given stage and it seems that the issues, theories and construct chosen for this study has made med arrive at the level of explanation that is needed (Abell, 2007), to make satisfactory theoretical analysis and to write up the narratives.

In general the design of the study can be defined as ‘embedded’ (Yin, 1984:49), which means that the study involves more than one unit of analysis. The core unit of analysis is collaborative R&D capabilities, a construct that applies to the organizational level but is affected by organizational factors and individual level actions jointly. It is important to bear in mind that the specific subject of this study, namely collaborative capabilities, is perceived as a firm specific capability. This means that even though the empirical contexts in which these capabilities are most often utilized can be defined as being located ‘outside’ the organization (in an inter-organizational

relationship) the study is solemnly directed towards the focal firms and its internal capabilities. This is not to imply that capabilities are indifferent to external factors such as a specific relation to a partner, but the choice of focusing at firm internal capabilities are taken in order to follow the logic of the research question.

Additionally, the research done in the present study has been undertaken at more than one level of analysis. Data collection (see section 3.4.2. and table 3.2) and analysis is done at individual and organizational level which is due to the fact that the actions at these levels and the way they impinge on each other is exactly what is at the centre of attention in this study. The highest level of analysis is the organization. At this level I have studied the corporate strategies relating to collaboration and focused at how these affect the development of collaborative R&D capabilities. At the lowest level of analysis I have addressed the question of the individual actions in regards to collaboration, such as the individuals' collaborative capabilities and their actions in relation to the collaborative projects. To be able to get relevant and precise answers from the interviewees I have selected a concrete collaborative R&D project in each case company and used this project and the experiences gathered from this project as a frame for illustrations of how collaborations come about in the give firm. Even though the specific projects are not the main target of analysis they constitute the core of the case narratives and the concrete settings in which I search for information about the factors that impinge on the development of collaborative R&D capability.

#### *3.4.1 Research Objective*

The overall objective of this study is to advance our understanding of how individual level attributes ensure the effective embeddedness of collaborative capabilities. This is important because it provides researchers with a more complete foundation for investigating the role of collaborative capabilities in strategic alliances. At the same time, the study may provide alliance practitioners with important insights into the dynamic processes underling successful alliance management.

#### *3.4.2 Data Collection Process*

The empirical data presented and analyzed in this thesis has been collected through a number of sources which will be presented in this section. Primary data has been gathered through interviews, meetings, workshops and expert interviews. Findings and hypothesis was continuously discussed with members of a knowledge incubator (se section 3.4.4 for a description) and at the end of the process findings were discussed with 40 participants at a workshop where employees from the focal firms of my study were invited. The participants were asked to comment on three core topic that

was inspired by the empirical material and a thorough discussion led to the formulation central topics that have implication for partnership practitioners.

The primary data was triangulated with secondary data consisting mainly of company profiles, annual reports, fact sheets, non-confidential presentations and other internal documents and material available on the company's intranet, as well as reports and articles accessible in the media. The secondary data was primarily used to record and analyze the background, development, current conditions and environmental interactions of the firm, both in general and in relation to its collaborative efforts.

**Table 3.2 Kinds of Data at Different Levels**

Data source	Organizational Level	Individual Level
<b>Written materials</b>	Annual reports Employees magazines Homepage Intranet News paper articles	Job descriptions
<b>Observations</b>	Meeting style, communication style  <i>By inference:</i> Organizational values about collaborations Group behavior	<i>No observations at individual level</i>
<b>Informants (expert interviews)</b> 2 or 3 interviews were conducted with the key informant in each firm	Facts on general collaborative activities Support initiatives Meeting structures in the project	Group members' attitudes towards colleagues or towards collaborative partners Backgrounds
<b>Personal Interviews</b> All members of the collaborative research project were interviewed. This amounted to 10 interviews in Novo Nordisk and 12 in Novozymes, 8 in CSC.	<i>No personal interviews on organizational level issue</i>	Perceptions Motives Values Attitudes Background Loyalties } All in regards to either collaboration in general or the specific collaborative project
<b>Workshop</b> 40 participants from the focal firms studied. Findings from the studies were presented and all participants commented upon data	Corporate motives for collaboration was presented and discussed. Managers and employee in mixed groups.	Perceptions Motives Values Attitudes } All in regards to collaboration in general and the impact on own organization
<b>Conference</b> Large international partnership conference was held in 2007	Prominent keynote speakers presented key knowledge about partnerships	



The data collection process was initiated shortly before the actual research project was started. In order to write up the project design and project plan I needed to gain insight in the field of study. With this aim in mind a group was put together consisting of people that could inform the project and act as reference group during the project. The group, the Knowledge Incubator, is described below. The members of this incubator has been central to the process of data gathering in this project, still by concentrating the actual interview activities in short time periods in each case (approximately 6 weeks in each company) I have made sure that I was following able to 'step back' from the case and do the analysis without being too attached to the empirical setting.

The main source of empirical knowledge in this study is the interviews done with employees at the case firms. In each case company the interviewees were chosen in accordance with guidelines determined in the research design. First of all, a specific collaborative project was to be chosen in agreement with the member of the knowledge incubator. What I asked for was access to a collaborative research project that had been running for at least half a year and engaged between 5-15 employees of the focal firm. On the basis of formal information about the project I decided on a theme for the case study. This theme was to be examined in addition to the general issues that were studied in all narratives. It could be for example the issue of knowledge sharing which where a core theme in the Novo Nordisk case. Second, expert interviews where done with an employee that played a central role in the establishment of the project in order to get a basic idea of the aim and structure of the project. The expert was asked to generate a list of all relevant interviewees, still I also asked the interviewees to recommend colleagues that I, according to their belief, ought to talk to in order to make sure that no one relevant to the project was left out—a method often referred to as 'snowball sampling'. The interviews with project participants were conducted on the basis of an interview guide structured around themes regarding the specific project, the interviewee's role in the project, their perception of specific project related themes (organizational mechanisms and factors) and additionally they were asked how research collaboration was generally perceived at the company. The interviews lasted for approximately 1½ hour, and they were all recorded and transcribed. When cited in the final case report the interviewees were made anonymous in respect of the sensitive data that some interviews displayed. In the three firms I interviewed 10, 12 and 8 employees respectively. This numbers was the total amount of employees that were engaged in the collaborative projects that was chosen. The interviewees are managers, researchers, or technicians. In addition I talked to a number of employees that were related to the projects in order to make sure that all important information was gathered. In one case I even had a meeting with the core

employee of a partner firm. This was done in the beginning of the study phase where I was investigating the option of doing interviews with the partners as well. This idea was not chosen as the focus of the study was directed towards the firm internal collaborative capabilities of the single case companies.

The case report comprising a case narrative and a brief analysis was sent to the core contact person at each firm in order to get comments on facts, figures and analysis. The comments have been used as guidelines in writing up the final case narratives, and notes are inferred in the final case analysis where the representative's comments were integrated. The process of getting and inferring the comments from the firms have secured reliability of the findings.

**Table 3.3: Description of the Core Firms of the Narratives**

	<b>Narrative 1</b>	<b>Narrative 2</b>	<b>Narrative 3</b>
<b>Company</b>	Novozymes A/S	Novo Nordisk A/S	CSC Denmark A/S
<b>Employees 2007</b>	4.500 50% in Denmark	26.000 49% in Denmark	2.600 All in Denmark (79.000 in CSC worldwide)
<b>Turn over Full year 2007</b>  * Million Danish Kroner	In total 7,438*	In total 41,831*	In total 3,642*
<b>Collaborative experience</b>	High	Medium high, growing	Low, growing
<b>Partnership formalization</b>	Partnering project launched in 2005  Focus on employee training and exchange of experiences from partnering	External knowledge sources seen as highly important in new business units.  No formal training, but experiences scattered in the organization.  Knowledge sharing perceived as core activity	The FESD project initiated as a consortium where CSC was allying with a former supplier SCAN.JOUR  No formal training, but experiences scattered in the organization  What to gain collaborative capabilities
<b>Thematic focus in the case narrative</b>	Creating a partnering mindset	Knowledge sharing procedures	Approaching important customers together with a partner

### *3.4.3 Data Processing*

The process of data collection takes up a lot of time and resources in a case based research project like the present. Further, the collection of data has to be followed by a thorough data analysis and the design and accomplishment of this process is as important as the collection of data itself. Due to the nature of my study that aims at understanding cross level issues, I needed to source data from many sources at different levels (see table 3.2).

The interviews were done for the purpose of 1) gaining knowledge about the overall perception and importance of inter-organizational collaboration in the given firm, 2) gaining knowledge about the mechanisms that was perceived to affect collaborative processes in a positive or negative manner, and 3) to understand the role of the individuals in the overall picture of collaboration in the given firm. The interviews were recorded and transcribed in details. In an exploratory study like the present it is very important to be able to go back and re-read the interviews again and again and thus the transcription process was offered a lot of attention. The data analysis has gone through a number of stages. First, the text was searched for facts about the research projects that were studied in order to write up a detail introduction to the project. Second, I coded the interview texts for information on organizational mechanisms or elements that could lead to the development of collaborative capabilities. This was a tricky process as mechanisms or elements are seldom labeled as such by the interviewees. Thus, for the classification of elements, work processes or mechanisms at stake a template was used. I return to the operationalization of the theoretical constructs in section 3.4.6.

The interviews were transcribed, coded and analyzed right after they were conducted, and I have returned to the transcripts a number of times to check the context or assess the proper meaning of a quotation. I kept working with the original transcript not cutting quotes out of it until I was sure that I got the information right. This strategy was chosen in order to be able to go back and check the context of a given piece of interview text, as ‘having available for any given utterance other utterances around it, is extremely important for determining what was said. If you have available only the snatch of talk that you now transcribing you’re in tough shape for determining what it is’ (Sacks, 1992:729, in Silverman, 2003).

#### *3.4.4 The Knowledge Incubator*

In parallel with the research project a ‘knowledge incubator’ (‘Vidensklubben’ in Danish) was formed. Members of the knowledge incubator are representatives from four Danish knowledge intensive firms that have contributed to the project by making their knowledge and expertise and practical experiences available to the project as well as supporting the project financially throughout the three years. The purpose of gathering a group of people with specific insight in the field of collaboration was both to gain new insight into the empirical field but also to design a forum where results of the project could continually be discussed challenged and—hopefully—validated. Thus the project was strengthened through continuous discussions about relevant themes and findings of the project.

Initially an invitation to join the knowledge incubator was sent to 12 Danish companies and organizations that were alleged to be especially interested in inter-organizational collaboration. The companies were chosen due to variance in their level of experience with developing specific collaborative capabilities. Representatives from four of the firms responded quickly and meetings were held with them in order to assure representativeness in terms of the focal variables. Specifically, it was determined that these four firms differed significantly in terms of level of experiences and corporate attention to development of collaborative capabilities. As such, the firms in the sample represent various degrees of and approaches to collaborative capabilities, which enable a richer investigation of the key phenomenon. Although interviews were made in all four participating firms, one firm (Velux) decided later to drop out of the incubator due to time and resource constraints, yielding three useful case narratives.

Subsequently, expectations were attuned and agreements were signed. The firms participating agreed to support the project in three ways; 1) by participating actively in the four annual knowledge club meeting, 2) by opening their firm to investigations (in the form of in-depth interviews with employees) of a specific research project, and 3) by sponsoring the PhD project with a minor sum during the three years.

The members of the knowledge incubator met for the first time in November 2004, one month before project initiation, and have since been meeting on a regular basis through out the project. At each meeting we have discussed a new theme, such as ‘designing alliance strategies’ or ‘knowledge sharing in collaborative projects’ based on either presentations by external speakers or presentations of project results. General exchange of experiences has been a core part of every meeting as well. Additionally, I have used the meetings in the knowledge incubator and the

continuous communication with the members to verify the findings from the analysis I have undertaken. By presenting the results at meetings and getting both written and oral feedback I have been able to qualify the case narratives and the following analysis.

**Table 3.4: Members of the Knowledge Incubator**

<b>Members of the Knowledge Incubator</b>	<b>Company and Department</b>
Pierre Honoré <i>Vice President</i>	Novo Nordisk, Strategy & Sourcing, Diabetes Research
Niels Espersen <i>HR Manager</i>	Velux, HR and Organization´
Svend Petersen <i>Director/</i> Marianne Weile Nonboe <i>Director</i>	Novozymes, Licensing and Strategy Novozymes, Licensing and Strategy
Fritjof Lind <i>President, public Sector</i>	CSC, Public Sector
Søren Barlebo Rasmussen <i>External Lecturer</i>	CBS, Center for Strategic Management and Globalization
Line Gry Knudsen <i>PhD Fellow</i>	CBS, Center for Strategic Management and Globalization

The members of the knowledge incubator have made their experiences about collaborations available to each other during the meetings and their tremendous knowledge about collaborations has been the foundation for many exciting discussions throughout the years. As the members come from four very different organizations with diverse perspectives on collaboration and general openness towards external partners we have had a huge pool of knowledge to draw from in our debates. The attitude towards collaborations varies in accordance with the policy of the firm, the corporate culture and the ability to protect knowledge and the like; still, they members of the knowledge incubator have all complied with the request to share their experiences and perspectives on collaboration, which has been of inestimable importance to the project.

The kind of knowledge I asked for in the firms is very sensitive and I have realized that collaborating with external partners on core knowledge production is an issue that occupies the minds of many employees. A core dilemma that many employees have mentioned relates to the issues of knowledge protection versus knowledge sharing. The decision on whether to provide the

partner with certain knowledge or to hold one's cards close to one's chest is a dilemma that the employees must deal with on a regular basis. Gaining success in collaborative projects requires a change in attitude and this is a challenge to many employees. Thus, my project has put focus on the central yet difficult issue of partnering, and in this light I am very pleased about how engaged the employees have been in my project and how willingly they have provided me with knowledge about their collaborative projects. Their engagement and interest has been a constant source of motivation.

#### *3.4.5 Partnership Conference and Workshop*

Towards the end of the PhD project a 2 day conference was arranged with the main aim of turning attention towards the field of inter-organizational collaboration and partnerships in general. Preceding the conference a workshop was held with the participation of employees from the firms participating in the knowledge incubator. The aim of the workshop was to disseminate the results of the research project to the participating firms, but also to discuss the findings with the managers and employees in order to test the validity of the findings. Four themes were formulated and groups were formed with the aim of discussing a number of questions related to each theme.

#### *3.4.6 Reliability and Generalization of the Findings*

Validity and reliability are two cornerstones in ensuring objectivity in any given research project (Yin, 1989:40). A case study like the present that is based on in-depth interviews and involves interpretation of the perceptions of a relatively small number of informants, may very easily be a victim of subjectivity and biased conclusions. Thus it is highly important to be explicit about how validity and reliability of the study is ensured.

Reliability is traditionally explained as the degree to which another researcher would be able to repeat the case study over again resulting in similar findings and conclusions (Yin, 1989:45). One important part of ensuring reliability is thus to document the procedures of the research as detailed as possible and by that means make a repetition plausible and easy. In appendix 1 the interview guide is presented. This guide is used at all interviews with as little adjustments as possible. In order to make my own process as routinely as possible I kept a research-log while undertaking the case studies. Here I noted whom I talked to and for how long, both in regards to planned interviews and improvised talks with relevant people I happened to meet while doing my studies at the firms. In this way I made sure that the next case study was also 'repeated' (or at least designed) subsequent to

the log and guidelines of the first case study. Making the studies as transparent as possible (George and Bennett, 2004:106), has been a clear ambition in this study.

It has recently been argued that a reordering of the sequence of generalization, comparison and inference is necessary to provide case studies with the needed rigor (Abell, 2001; 2007). As opposed to classical large-N studies, where the discovery of a given causal explanation is based on preceding comparisons (i.e. comparing units of analysis or many cases) and generalizations, small-N studies must be structured so that comparisons and generalization follow the causal inferences and thus succeed it in time. For example a way to proceed with the issue of generalization could be to inductively assemble cases (if they exist) in order to ask whether or not, known singular causal explanations which has just been inferred, are open to generalization. The issue of generalization of results from a small number of cases is a core challenge to many case study researchers. Generalization—in consonance with the act of aggregation of facts and comparison between instances—is one of the fundamental tenets of science (Maaløe, 2004:17). Generalization is a core part of the test for external validity in all branches of science: it is expected that a researcher can explain the domain to which a study's findings can be generalized in order to test the results. This condition goes for case studies as well as other kind of studies, as the following quote exemplifies. '[Case study research is a] detailed examination of an aspect of a historical episode done to develop or test historical explanations that may be generalizable to other events' (George and Bennett, 2004:5). In the light of this definition it is important to state that in case study research we are dealing with *analytical generalization* as opposed to *statistical generalization* (Yin, 1989; Maaløe, 2004). The difference is significant because analytical generalization dictates that the case results are generalizable or replicable in relation to a given theory *not* that any given sample is generalizable to a larger universe, meaning that a sample/number of respondents can be taken to represent a larger group, as it is interpreted in statistical research (Yin, 1989: 43; Miles and Huberman, 1994:29). Moreover, as case studies are covering both a given phenomenon and its context it would require an extremely large number of potential relevant variables if a case study were to be accomplished based on sampling logic.

In continuation to the above characteristics I establish that the generalizations done in the present thesis will be to the existing theories used to understand the phenomenon of collaborative R&D capabilities; it will not be 'sample-to-population'-generalizations to all collaborative R&D projects. Thus the aim of the narratives studies and the analysis that follows is to inform or even possibly extend the theoretically based framework that I have developed in the theory section based

on prior research. The dynamic processes of this study may thus be described by the following procedures: first I aim to develop a theoretically based framework describing how the corporate aspiration to collaborate impinges on the development of collaborative R&D capabilities. This process is split in three parts following the outline of the Coleman diagram—this is all described in chapter 4. Second, two narratives are done based on information gained mainly by interviews and participatory observations in two firms. The semi-structured interview guide is developed based on the core constructs of the theoretical framework. Finally, the narratives are compared to the theoretical framework, which, as a final point, is revised according to the findings of the narratives. In order to make this dynamic comparison of the theoretical constructs and the elements of the empirical finding possible, the theoretical constructs need to be operationalized. The operationalization is ensured by aligning each theoretical construct with empirical phenomena that is then discussed in the interviews. See questionnaire in appendix 1.

**Table 3.5: Operationalization of Theoretical Constructs**

Core construct	Sub constructs	Elements	Empirical phenomena
Collaborative R&D Capabilities	Corporate Aspiration to Collaborate	Exploration	Wish to engage in knowledge co-creations
		Exploitation	Wish to engage in knowledge sharing
		Designing and implementing a partnering strategy	Creating opportunities to collaborate
	Conditions for individual collaborative behavioral	Willingness	Having a positive mindset towards external knowledge and external partners
		Ability	Possessing the ability to perform task in collaborative projects
	Individual collaborative behavior	Knowledge sharing behavior	Participating in knowledge sharing
		Knowledge co-creation behavior	Participating in co-creation of knowledge

### 3.4.7 Validity

Ensuring validity has to do with how findings are interpreted correctly. The test for validity may relate both to the constructs studied and to the internal and external legitimacy. Construct validity is



said to be one of the hardest parts to cope with, as finding valid measures that are not based on subjective judgments is difficult (Yin, 1989: 41). Yet it may also be stated that it is in the area of validity that case studies have one of their strengths as this research strategy is especially well suited to make a conceptual refinements. This is one of the reasons for many quantitative researchers to do case studies as a preceding task to identify relevant variables and refine concepts (George and Bennett, 2004:19). In the present study this opportunity of doing conceptual refinements is used in relation to qualifying the overall theoretical framework as mentioned above.



## 4. THEORETICAL FRAMEWORK

### The Antecedents of Collaborative R&D Capabilities

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*[Explanatory] gaps related to underlying micro-foundations cannot be bypassed, they need to be explicated, and [...] in addressing these gaps one must involve the level of individual action and interaction.*  
(Abell, Felin and Foss, 2008:3)

#### 4.1 Actions and Interactions: Introducing the Theoretical Framework

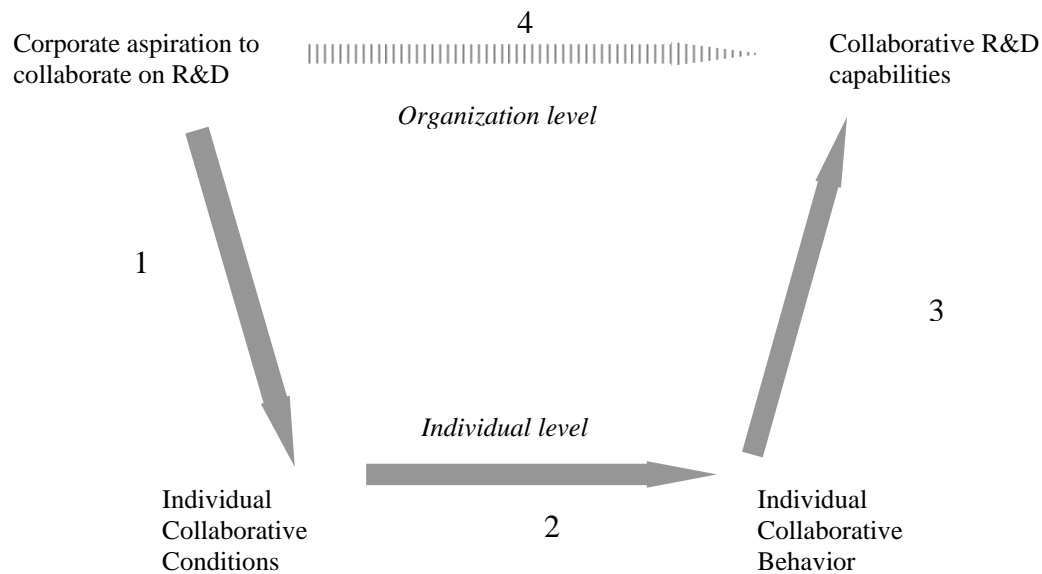
In this chapter I will direct the attention towards the elements that underpin the development of collaborative R&D capabilities. The importance of this search for the micro-foundations of collaborative R&D capabilities was suggested in chapter 1. In chapter 2, I, additionally, summarized how some scholars have started to realize the need for addressing the gaps that stand out in various research fields, due to a predominant focus on macro-level explanations. An emerging interest in micro-level explanations is witnessed in relation to important strategic management issues such as ‘value appropriation’ (Coff, 1999; Lipman and Rumelt, 2003; Barney, 2001), ‘factor market dynamics’ (Makadok and Barney, 2001) and ‘firm-level heterogeneity’ (Felin and Hesterly, 2006; Gavetti, 2005). This has lead Abell, Felin and Foss to the conclusion that “[i]t seems that strategic management is now embarking on a micro-foundations project...” (Abell, Felin and Foss, 2008:2). By searching for micro-foundations of a given phenomenon I mean seeking out explanations of a given phenomenon not at the level of study where the phenomenon (the explanandum) shows, but at the level below. In the present context this means that when searching for micro-foundations we search for patterns of interaction among individuals engaged in the process of developing (organizational) collaborative R&D capabilities in a given firm. I concur with Gavetti 2005 who states that ‘research on capabilities needs microfoundations that capture more fully what we know about cognition and action within organizations’ (Gavetti 2005:599).

This chapter will contribute to this search for micro-level explanations by clarifying and analyzing the antecedents of collaborative R&D capabilities. The orientation is still theoretical as I will deal with theoretical constructs that inform this study and improve on the Coleman diagram put forward in chapter 3. Later I will aim at qualifying this theoretically based model by two rich narratives that will be introduced in the following chapter (chapter 5).

In the present chapter I will discuss, first, how the corporate intention to collaborate that exists in many firms, sets up constraints for actors and orient their actions, next how the employees in the collaborative projects act and interact, and, finally how these actions intervene and affect the development of collaborative R&D capabilities. That is, I will proceed in succession from the properties of the social system studied, to the action of its members, and to the outcome they engender. I argue that the actions and interactions of individuals need to be central to our analysis if we want to give a circumstantial account of how collaborative R&D capabilities are fostered. In this chapter I will qualify the theoretical findings of the previous chapters by applying the learning from the work of James Coleman who, convincingly, argues for a more explicit focus on the individual level issues that underpin given organizational level outcomes. Thus, the model that Coleman advances in his 1990 book (which I have described thoroughly in chapter 3) constitutes the analytical frame in this chapter. The strength of this framework is twofold. First of all, it directs our attention to the fact that individual level traits, values, abilities, motivation and behaviors are important in social studies, as these individual level issues are the foundation for all actions—and following affects the higher level outcome of any social system. Secondly, it provides an advantageous structure for our analysis as it guides our attention to chains of causal actions.

In order to take advantage of the second strength of the framework the sections of this chapter are structured as an exposition of the important ‘states of the world’ (Abell, 1987), illustrated by the corners of the diagram. Yet, these states of the world are not static; the organizational level facts affect the actions and interactions of individuals and these actions combine to produce macro-level outcomes in a number of ways (Coleman, 1990:20). An additional aim of this chapter is thus to outline the factors that act as moderating effects in this diagram and inform the processes of change illustrated by the arrows. By describing both the content of the corners of the diagram and the core factors that lead to changes in the diagram I aim to provide a framework for understanding the micro-foundations of collaborative R&D capabilities.

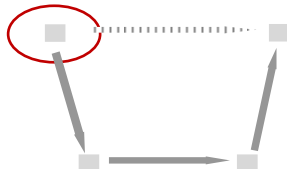
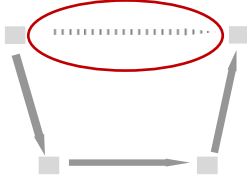
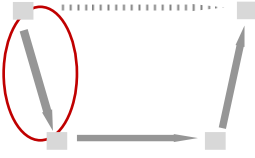
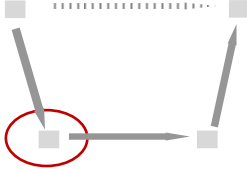
**Model 4.1: Theoretical Framework Model** (see Model 3.2, page 61 for description)

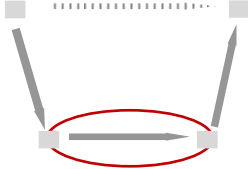
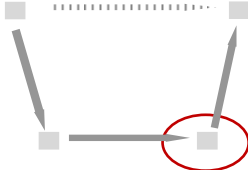
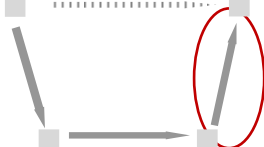
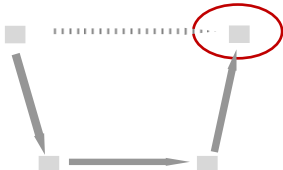


Adapted from Coleman, 1990

The descriptions and discussions of the elements of the framework, the changes, and the moderation effects that cause these changes to happen will constitute the substance of the sections of this chapter. In the table below (table 4.1) I outline the flow of the sections. Each section holds a core theme and can be illustrated by a component of the framework; either a corner or an arrow. This is illustrated in the left column. An extended version of this table describing the element and dynamics of all core themes will be provided at the end of this chapter.

**Table 4.1: The Flow of the Sections and description of core Themes**

Section	Title of Section and Core Theme	Illustrated in the frame-work as:
4.2	<p><b>Corporate aspiration to collaborate on R&amp;D</b></p> <p>Formed by:</p> <ul style="list-style-type: none"> <li>• Exploration</li> <li>• Exploitation</li> </ul>	<p>Upper left corner</p> 
4.2.1	<p>The relation between R&amp;D collaboration and the development of collaborative R&amp;D capabilities</p>	<p>Arrow 4</p> 
4.2.2	<p>How a Corporate aspiration to collaborate Affects Individual Level Conditions</p>	<p>Arrow 1</p> 
4.3	<p><b>Individual Collaborative Conditions</b></p> <p>Comprised by:</p> <ul style="list-style-type: none"> <li>• Willingness to collaborate</li> <li>• Ability to collaborate</li> </ul>	<p>Lower left corner</p> 

Section	Title of Section and Core Theme	Illustrated in the frame-work as:
4.3.1	Collaborative behavior determined by Individual Level Conditions	Arrow 2 
4.4	<b>Individual collaborative behavior</b>  Comprised by: <ul style="list-style-type: none"> <li>• Joint knowledge creation</li> <li>• Knowledge sharing</li> </ul>	Lower right corner 
4.4.1	Joint collaborative Behavior Leading to collaborative R&D capabilities	Arrow 3 
4.5	<b>Collaborative R&amp;D Capabilities</b>	Upper right corner 

#### 4.2 The Corporate Aspiration to Collaborate on R&D—and its Effects

At the upper left corner of the Coleman diagram the ‘macro’ antecedents for the development of capabilities are located. In the context of this study this is a situation where a corporate wish to

collaborate is formulated and thus constitutes a fundamental condition for action in a given firm<sup>7</sup>. This situation where collaboration is asked for may be fostered by conditions such as high competition, technological complexity or need for new knowledge that is not present in the firm. This means that the need for external knowledge that drives firms to ally with external partners is an important factor in this framework, yet the value or strength of this factor is not affected by any of the other factors in the framework.

We have, as stated previously, witnessed a rise in the numbers of partnerships throughout the last decades. This upsurge of interest is reflected in research on strategic alliances in general and on R&D collaboration specifically. Alliances and partnerships are seen as the solution to many of the challenges meeting knowledge intensive firms. The wish to engage in collaboration with external partners are often motivated by a recognized lack of knowledge or other resources that are then searched for externally—or produced at a lower cost and higher speed in collaboration with external partners. The motivation to collaborate can thus be divided into two main groups; the first comprises the search for new or more robust knowledge and can be classified as *exploratory* activities and the second type is associated with the wish for making better use of the knowledge and resources already at hand, namely *exploitation* of existing resources. The concept of knowledge exploration comprises activities such as search, variation, risk taking, experimentation, play, flexibility, discovery and innovation. The core activity of exploration is experimentation with new alternatives (March, 1991:71, Koza and Lewin, 1998:256). Knowledge exploitation, on the other hand, includes refinement, choice, production, efficiency, selection, implementation and execution. Exploitation is about refining and extending the existing competencies, technologies, and paradigms (March, 1991).

These two concepts were thoroughly examined in section 2.2.4. The core issue to emphasize here is that the motivation to collaborate—which is a wish to engage in either exploration or exploitation activities—may very well affect the need for specific capabilities in a given collaboration. Activities related to exploitation, such as the sharing of existing knowledge between partners may for example call for the presence of the ability to codify and communicate complex knowledge to a partner with a different disciplinary background. I will return to the discussion of different individual abilities yet here it is very important to emphasize the need for explicit description of whether a need for exploring new knowledge drives the collaboration or it is motivated by a wish for better exploitation of existing resources. These two different drivers of

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<sup>7</sup> I have previously characterized the situation of the upper left corner as the exogenous variable of the framework as it is a situation formed by factors external to the system we are studying.



collaboration comprise very different kinds of knowledge processes, as just mentioned, and thus they may potentially call for very different capabilities in the firm. Thus, a critical element in the investigation of collaborative capabilities is a precise definition of the kinds of collaborative activities that need to be supported.

In the following I will discuss this link between the aspiration to collaborate and the collaborative R&D capabilities, illustrated by arrow 4 in the diagram. This means that I do accept that a connection exists; still I contend that this link can be understood properly without making some calculations on the way and especially I argue for the need of bringing this process to the level of individual action and interaction.

#### *4.2.1 R&D Collaboration and the Link to Collaborative R&D Capabilities (Arrow 4)*

Even though it is reasonable to say that collaboration as such has a number of salient outcomes, firms still experience a lot of difficulties in connection to their collaborative activities<sup>8</sup>. I argue that difficulties often arise because the processes that go on in firms engaged in collaborative activities are to a considerable extent uncharted. What becomes essential is to search for an understanding of the link between the aspiration to collaborate and the development of collaborative R&D capabilities. As explained in chapter 3, the fourth arrow is best described as an attempt to explain a macro level phenomenon by macro level causes alone. In the context of this study this would imply that enhanced R&D performance of a given firm can be explained solely by a higher prevalence of collaborative activities. Scholarly attention has been devoted to studying the relation between alliance experience and the development of collaborative capabilities (Teece *et al*, 1997; Dyer and Singh, 1998; Heimeriks and Duysters, 2007). These studies do, by and large, view both experience and alliance capabilities as firm level constructs and even though they seem to accept that the actions of individuals play a role in this relation (for example Heimeriks and Duysters (2007) refer to the ‘process wherein individual experience and knowledge ultimately shape the organizational

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<sup>8</sup> High failure rates have made many firms refrain from collaborating. This tendency was described in chapter 2 and I will not here go through the description of reasons for the occasionally high failure rate of collaboration, still, we need to keep this circumstance in mind as it is a core motivation for this study. These concurring circumstances of, on the one hand, a rising corporate interest in collaboration and on the other hand a lack of success in collaboration inspires to more through work on how successful collaborations come about. I expressed this need for further knowledge in chapter 1 and 2 and in the present chapter I will start analyzing the antecedents of the necessary collaborative capabilities.

learning process which impacts capability development), they do not make this an explicit part of their studies.

I have stated previously that it is an invalid assumption that organizational level outcome can be generated by organizational level actions alone (Abell, Felin and Foss, 2008). To fully understand the organizational level outcome we need to turn our attention towards another level of study. We will keep the situation in the upper left corner of the Coleman diagram as our point of departure, as we admit the evidence that there exists a corporate wish to collaborate in many firms. Yet instead of jumping to the conclusion that collaboration will lead to enhanced R&D performance we investigate how this corporate belief in collaboration as a profitable strategic tool affect the situation in the firm. Organizational level changes do not just happen; they must be grounded in the activities of constituent individuals. Thus, explaining how collaboration leads to the development of collaborative capabilities can only be done on the basis of an understanding of what formed the beliefs, values, and behavior of the individuals. These changes for their part can happen in a number of ways and this is what we will investigate in the following.

The arrows illustrating elements of changes are—from a theoretical perspective—somewhat ‘empty’ (Abell, Felin and Foss, 2008). They illustrate a process of change that may be moderated by different mechanisms and it is the aim of the following sections of this chapter to explain the changes that these arrows illustrate by reviewing theoretical concepts and mechanism. It is expected that these different moderating effects may help to explain how R&D collaboration may, or may not, lead to the development of collaborative R&D capabilities.

#### *4.2.2 How a Corporate Aspiration to Collaborate Affects Individual Level Conditions (Arrow 1)*

Arrow 1 leading from the top left corner of the diagram to the lower left corner illustrates how employees are affected by the situation at the corporate level; in this case, the fact that R&D collaboration is asked for. To understand how a corporate ambition to engage in collaborative projects affects the individuals of the firm we need to study a range of factors. Put differently I expect that a number of mechanisms moderate the process of change that the corporate aspiration form. By way of example we have to study how managers or other central employees communicate the decision to collaborate and how the employees receive and react to this message. Further we must enhance the understanding of how the employees are motivated to engage in collaborative projects, and how a positive attitude towards collaboration can be fostered. What is central in this section is to get an understanding of how a positive orientation towards collaboration can be

fostered, and to investigate how and in what manner employees may react to the corporate aspiration to collaborate?

Obviously, the interests of the firm to engage in a given collaborative project may simply be communicated to the employees who are expected to start doing their R&D activities in this new collaborative project. If the project is clearly beneficial to the firm, if it is in line with the research agenda, and has a number of obvious potential gains this managerial task may not be difficult. Yet, motivating employees to share knowledge with external partners is often more complicated. One of the main reasons for employees to be reluctant to share knowledge is that an instruction to undertake research in close collaboration with external partners may seem as a contradiction to the traditional conviction about the R&D activities; that is to say, the conviction that R&D activities and results are seen as being the absolute 'core' of the firm activities and that the activities and results should be protected as such. This means that the doors are *not* to be opened to external people. Accordingly, collaboration seems to raise questions that pertain to the nature of the firm (Caloghirou, Ioannides, Vonortas, 2003) in regards to issues such as protection of core values and therefore the decision to engage in R&D collaboration is often very challenging to communicate. This description of resistance towards knowledge sharing may be overstated as the value of external knowledge seems to have been acknowledged in many firms today. Still, some employees may still find it difficult to engage in inter-organizational knowledge sharing due to a belief in the need for knowledge protection and this uncertainty need to be dealt with properly.

Thus, in the process of communicating the collaborative decision to the employees it is vital that the manager can show clear and unambiguous goals for the collaborative project. Other factors may help to illustrate the pertinent need to collaborate as for example challenges meeting the firm such as apparent resource constraints or a need for a specific type of knowledge that can only be sourced externally.

#### *4.2.3 Factors Moderating Arrow 1*

As indicated a number of factors function as moderators on the relation between the corporate aspiration to collaborate and the elements that constitute the conditions of the actions of individuals. Thus means that they impinge on the direction and/or strength of the relation, and therefore they are vital for understanding the dynamic processes of forming the conditions for individual action.

#### 4.2.3.1 The Process of Socialization

The process of understanding and accepting the need to engage in collaborative projects can be seen as an act of socialization. Socialization is learning and internalizing the rules of proper behavior in a given context as well as understanding the consequences of not following these rules (Oakes and Kaufman, 2006:12). As such it can be juxtaposed with what Coleman calls creating an *internal sanctioning system*, which is “the installation in the individual of something which may be called a conscience or superego” (Coleman, 1990:294). An internal sanctioning system is a form of policing, which again can be seen as means to exercise social control. An internal policing system forms a counterpart of an external policing system which is a more explicit way of exercising social control, for example by regulation and application of a range of punishment instruments. An internal sanctioning system is beneficial as it makes the continual external managerial enforcement unnecessary. This is of course given the condition that the cost of internalizing a given norm does not exceed the cost of external policing.

A core question is, though, when and why it is interesting for a beneficiary of a social norm (for example a R&D manager interested in exercising control over the actions of the employees) to attempt to establish a internal sanctioning system within the target actor instead of merely using external sanctions when necessary. My response is that when dealing with employees that are known to prefer autonomy and are motivated by being involved in the decision processes, such as most researchers are, external sanctions are not a suitable tool. In dealing with how socialization may come about we must accept the idea that some individual preferences are endogenous in nature (Oakes and Kaufman, 2006). This means that preferences can be affected by individual internal responses to the external state of affairs, i.e. the local norms. Endogenous preferences may *inter alia* be affected by the characteristics of the organization which the individual belongs to and they are subject to learning. The term implies that what we like and dislike is partly learned from others and partly from the constraints faced (Bowles, 1998). This account holds ideas that are very beneficial to our further study, and in the next section I will look into how managers can use direct or indirect strategies to make the employees accept and maybe even identify with the goals of the collaborating firm.

Yet, the idea of human preferences being socially shaped does run counter to the idea of individuals as being norm-free and self-interested purposive actors as they are delineated by methodological individualist such as Coleman. A resort can be found by searching for the right balance between a deterministic conviction and a belief in free will. ‘Certainly norms do exist’ as Coleman states, ‘persons do obey them (though not uniformly); and persons do often act in the

interest of others or of a collectivity' (Coleman, 1990:31). On the other hand the preferences of individuals are not only formed by the group they belong to. This would reduce theories and our theoretical discussions to descriptions of automata and not persons engaged in voluntary action. It makes sense to assume a certain level of self-interested purposive action as a starting point. To correspond to critical readings of methodological individualism, Coleman maintains that the fact that persons are not endowed with altruism or unselfishness and lacking a shared normative system does not mean that they at all times are assumed to be without these added components of the self. To the contrary, most parts of the theories that have inspired this study will assume that actors possess some of these components although the assumptions are largely implicit. In general, the more universally held a norm or the more widespread a moral precept the more likely we are to overlook it or take it as given (Coleman, 1990:32).

In sum, the search for the factors that moderate the relation between the corporate aspiration to collaborate and the specific collaborative conditions at the individual level provide us with the following key insight. Employees are (theoretically) self-interest seeking individuals that are to some extent, but in varying degree, affected by the norms of the system they belong to – and most importantly informed by their interaction with others. But especially the fact that individuals are assumed to be responsive to norms in varying degree makes it important to study how these norms are fostered and how they are internalized by the individuals in different ways. In the following we will investigate the role of employee motivation.

#### 4.2.3.2 The Role of Employee Motivation

Many of the advantages of inter-organizational collaborative projects are being dealt with in the literature as firm-level benefits. Yet, as the individuals of a given firm play a central role in inter-organizational relations their willingness to collaborate and share knowledge with external partners is vital to the success of a given collaborative project. Realizing the importance of the individual's knowledge sharing behavior has made scholars study the role of work motivation in connection to work done in R&D environments (Dewett, 2007). In general, work motivation can be defined as the set of psychological processes that initiate work related behavior and determine its form, direction, intensity, arousal, and duration (Latham and Pinder, 2005; Mitchel, 1982). Motivation is an invisible, internal, hypothetical construct (Ambrose and Kulik, 1999) which is affected by external factors such as rewards, punishment, rules, norms etc. and internal factors such as needs, values, cognition etc.

A number of different classifications of motivational mechanisms have been put forward in the literature (Gottschalg and Zollo, 2005), many of which are highly fine-grained. A specific three-category classification is best suited for the purpose of the present study as it captures the fundamental differences between the mechanisms through which organizations can influence motivation. Additionally it remains parsimonious and thus it is better suited for the application to questions of strategic management than some of the more fine-grained taxonomies used in social psychology (Gottschalg and Zollo, 2005:420). This classification deals with motivation as being either extrinsic or intrinsic in nature as originally proposed by Deci (1975). Additionally, it follows a refinement made by Lindenberg (2001) which separates intrinsic motivation into a social component; hedonic intrinsic motivation and a task related component; normative intrinsic motivation. In the following I will discuss these three forms of motivation as I relate the discussion to the specific context of R&D activities done in collaboration.

Individuals are *extrinsically motivated* when they engage in certain behaviors because of the desirable consequences it leads to. They are driven by the goal of obtaining extrinsic work rewards or outcomes such as money, power, and recognition (Gottschalg and Zollo, 2005). When extrinsic motivation is used in organizations it can be in the form of financial compensation given to the individual employee—or group—for their contribution to the performance of the organization. Or it can take the form of explicit recognition of the successful performance of a given employee in a collaborative project. Thus, extrinsic motivation can be used to coordinate the resources by for example linking employees' monetary motive to the goal of the organization (Osterloh and Frey, 2000). The impact of extrinsic motivation depends jointly on the reward system in place (determining the extrinsic work rewards or sanctions that the individual obtains), and the importance of these rewards to the individual.

Individuals are in general *intrinsically motivated* when they undertake an activity because they find it to be interesting, involving, exciting, satisfying or personally challenging (Amabile, 1993). Intrinsically motivated behaviors are ones for which there is no reward except from the activity itself and intrinsic motivated people are ideally motivated by working with processes that are self-defined. Intrinsic incentives are said to originate within the individual or the task, not the environment. The first kind of intrinsic motivation labeled *hedonic intrinsic motivation* refers to the interest of a given individual to be engaged in enjoyable, self-determined, and competence enhancing activities (Lindenberg, 2001; Deci and Ryan, 1985). An employee will be motivated to engage in an activity if it is perceived to meet the above characteristics. The second specific kind of

intrinsic motivation defined as *normative intrinsic motivation* is driven by the goal of engaging in behavior that is compliant with the norms and values of, for example, a firm that the individual works in. The behavior of the individual will, accordingly, depend on how important it is for the employee to comply with the norms of the organization (Gottschalg and Zollo, 2005).

From an organizational point of view intrinsic motivated people also represent a risk, as they are often more inclined to follow their own interest instead of the goals of the organization and of being difficult to collaborate with because they will be governed by personal emotions and they may show extreme belief in own ideas. Organizations will in general not be interested in employees working exclusively in accordance with their own interests not considering the goals of the organization; rather, employees must be motivated to contribute to coordinated and goal-seeking activities. If we apply this to the context of R&D collaboration, we see that a dilemma may occur if employees are more interested in working towards their own research interest than they are in exchanging knowledge with external partners as stipulated by the firm. As pointed to previously the mere act of collaborating may look unwise to an employee who has been trained to hoard and protect the knowledge of the firm. Only if the employees consider the long term objective of building a relation based on mutuality, they may accept to let go of valuable knowledge that is requested by a partner. Reciprocity is not always about giving and getting simultaneously and a long term perspective needs to be applied if the advantages of collaborating shall be obvious.

Carrying this matter to its logical conclusion we see that individuals may sometimes engage in collaborative activities because they comply with the shared value that exists in the firm about the benefits of knowledge sharing, even though it is not in their short-term interest to do so (Uzzi, 1997). Thus, it becomes important to acknowledge that individual behavior may be guided not only by personal motivational orientation, but also by collaborative norms that define what is considered appropriate and inappropriate behavior in regards to, for example, a request for sharing knowledge with partners in a collaborative project. In other words, dealing with how individuals are motivated by normative intrinsic orientation may be very relevant in the present setting. This is in line with the process of socialization which we just touched upon in the previous section.

The importance of intrinsic motivation in contexts like the present has also been established by Dewett (2007) who refers to the specific magnitude of intrinsic motivation for R&D activities. This is due to the positive effect on exploration (Zhou, 1998), persistence (Oldham and Cummings, 1996), flexibility, spontaneity, and ultimately creativity (Amabile, 1983, 1996; Deci and Ryan, 1985; Ryan and Deci, 2000); all activities that may be comprised under the label of R&D activities.

In fact, a range of studies show that R&D workers are often intrinsically motivated. By way of example, Fox (1983) displays studies (for example by Box and Cotgrove, 1968) showing that a higher performance level is witnessed among scientists who are free to select, initiate, and terminate their own research projects, or to influence the process. Other studies show in line, that there exists a high degree of correlation between productivity and organizational freedom, for example freedom to participate in decisions about research projects. This directs the attention to the quest for autonomy in the work processes. In this context, the dilemma of employee autonomy versus management control is often present. Even though it is a dilemma that has been known and dealt with for decades (Zedtwitz, Gassmann and Boutellier, 2004) it is still a prevalent problem. The autonomy/control dilemma may even be more pertinent in the setting of collaborative projects as these projects require a higher degree of control and visibility than internal R&D projects in order for both the focal firm and the partner firm to be able to understand the goals and know what to expect from the partner. Whether this need for control and visibility of shared goals will damage the intrinsic motivation of employees is a core issue in any discussion of incentive structures in a given collaborative projects.

In sum, employees are motivated by intrinsic factors when job satisfaction is attained by engaging in a personally interesting or varied work task (such as venturing into a novel research field in a collaborative project), by gaining new experiences or competences through innovative collaborative projects or aligning to the collaborative goals of the firm. Or they are extrinsically motivated to engage in collaborative projects because they gain rewards in the form of either monetary compensation or verbal acknowledgement or the like. But most often willingness is fostered by a mix of the two forms and this mix may vary from employee to employee and from task to task. This is what makes building the right incentive structures a very complex task. In dealing with work motivation as a 'tool' that managers can use to make employees align to the goal of the firm, e.g. engage in a collaborative project, we revive yet another dilemma (Christiansen, 2007: 49). On the one hand motivation is understood as almost a hypothetical construct (Pinder, 1998) as it is an invisible process that is hard, if not impossible, to measure and evaluate due to its origin in a range of presumption about psychological processes. On the other hand, the task of managing is represented by a belief in high degree of apparent causal links and visibility of the managerial initiatives and the results that emerge from them. It is important to keep in mind that motivation is never an end in it self; it is only valuable if it leads the organizational outcome (for example higher earnings) or change in behavior (for example higher degree of knowledge sharing)



that were the end in the first place. These outcomes are the only part of the process that is likely to be measurable (Christensen, 2007:49-50). This point to the importance of job design and the need to understand the motivational properties of works tasks (Hackman and Oldham, 1975). People that are intrinsically motivated to engage in collaboration (due to e.g. personal beliefs or traits) may be specifically chosen to be a part of a given collaborative project. In this way the manager can design a group of people for a given collaborative project that are especially keen on collaborating. I will conclude this reading of the factors moderating the processes of arrow 1 by stating that even though the issues related to motivation of R&D employees seem very unmanageable, managers do play a key role as they can design job functions in accordance with the above mentioned findings and be instrumental in designating the right direction of the relevant works group. This later issue will be touched upon in a following section.

#### 4.2.3.3 Collaborative Climate

In addition to personal motivation the willingness to engage in collaboration is undoubtedly shaped by the overall collaborative climate in a given firm or research group. Collaborative climate is best defined as the observable behavior in regards to collaboration in a given group; or put more colloquially it can be said to be ‘what people do around here’ (Sveiby and Simons, 2002:421). At the basis of a large scale theoretical study Sveiby and Simons (2002) developed a quartered categorization of how the composition of collaborate climate can be understood. The four components are *employee attitude*, describing an employee’s own attitude towards collaboration; *work group support*, covering the knowledge sharing behavior of the individual’s nearest colleagues, *immediate supervisor*, relating to the actions of the immediate manager; and finally, *organizational culture*, relating to the leadership factors outside the individuals nearest working environment. These four components show that factors at both group and management level can impinge on the conditions at the individual level and as such it makes sense to work on all four components if a positive collaborative culture<sup>9</sup> is to be fostered. I will return to the issue of employee attitude as this factor will be central in transforming a separate employee’s (positive) attitude towards collaboration into a collective approach to collaboration of a given group or organization. What remains is to understand how a manager (or other core employees) can see to that the group climate stimulates the knowledge sharing activities. Sveiby and Simons (2002) show that collaborative climate tends to improve with age (or experience) of the participants, their

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<sup>9</sup> As the word culture is highly contested, Sveiby and Simons choose to deal with specific aspects of culture in their study, being ‘the values, beliefs and assumptions that influence the behaviors and willingness to share knowledge’ (Sveiby and Simons, 2002:421).

educational level and the role that the immediate manager plays (his/her engagement), yet Sveiby and Simons do not find answers as to how employees can be more 'logged into' an organizations knowledge sharing infrastructure, as they put it.

A concurrent study deals, in like manner, with the relation between team climate, innovation and performance of R&D teams (Bain, Mann, and Pirola-Merlo, 2001). This study shows in particular that factors such as *participative safety*, referring to an interpersonally non-threatening atmosphere in the team, and *support for innovation* being articulated and enacted support of attempts to introduce new and improved ways of doing things, will lead to high performance of the R&D team. The study is based on a sample of 193 scientists in 20 research teams and 18 development teams and in comparing the research teams with development teams it is shown that especially *support for innovation* and *task orientation* are crucial factors for high performance of research teams whereas the relations are less obvious for development teams with the main aim of developing new products or processes. In development groups the strongest factor relation to team performance is clear and obtainable *objectives*. This might tell team managers that the more research oriented the team is the more devoted they need to be in articulating and supporting attempts to introduce new and improved ways of doing things in order to be performing better.

#### 4.2.3.4 Designating the Direction

In the previous sections I have dealt with the macro to micro-level transition in our framework as we have examined how a corporate aspiration affects individual level beliefs and values which are examples of individual conditions. To sum up the described processes in a short concluding remark seems to be an impossible task. The factors which are essential to providing an understanding of the process are large in numbers and very diverse in character. We have dealt with the overall possibility of socializing joint (collaborative) norms into a group and the role that the manager may play in this process. Motivating people to collaborate is for sure not as easy as pocketing a ball. Still, our theoretical exercise shows that managers may be able to designate the direction of a given group—for example a group of researchers who are going to collaborate. This process will be eased if the employees are involved in the decision processes that are of importance for the coming collaboration. When employees are consulted and treated with respect for their intelligence they may be more willing to act in accordance with the decision without feeling undermined or alienated from the organization (Deci, 1995; Kim and Mauborgne, 1997). Kim and Mauborgne refer to this proactive perspective as a type of *procedural justice* (Greenberg, 1987) and state that '[p]eople are sensitive to the signals conveyed through a company's decision making processes. Such processes

can reveal a company's willingness to trust people and to seek their ideas—or they can be a signal of the opposite' (Kim and Mauborgne, 1997:69 in Christensen, 2007:83). This perspective leaves room for the manager to motivate the employees by involving them in the decisions process, explaining the goals and reasons to collaborate and making these goals visible to all relevant employees.

It is important to state that fostering a collaborative culture that motivates the employees to engage in a given collaborate project is not a mission for the manager alone, a number of other conditions will affect whether the employees identify with the organizational goals. This could be personal traits or beliefs that are formed by previous work situations or disciplinary background. These are vital in informing willingness to collaborate. Another condition can, however, be shaped by organizational initiatives as well; that is, the ability of the employees to be able to engage in collaborative activities.

One way in which a corporate wish to collaborate can be communicated to the employees is through the formulation of a partnering strategy. Formulating a partnering strategy is a powerful tool that may affect the employee's willingness to collaborate as it makes the benefits and goals of collaborating much more comprehensible. A partnering strategy is a generic tool as it relates to all collaborative activities of a given firm. It may describe the aims and reasons to collaborate but I can also prescribe the processes of partnering by outlining the different stages that a project runs through. Aligning the collaborative strategy with the overall strategy of the firm is a core element of succeeding with the partnering ambition (e.g. Bamford *et al*, 2003; Chesbrough, 2006; Gomes-Casseres, 2006). The partnering strategy needs to mirror the overall ambitions of the firms and fit with the overall culture and perceptions held by the employees in order to be beneficial to the firm. This match will make it easier for employees to make decisions and act when a opportunity to collaborate suddenly emerges and this is why the strategy process need to be highly susceptible to the attitudes, norms and beliefs of the top managers or other employees involved in the strategy formulation.

The concept of strategy has developed in a myriad of ways since Schendel and Hofer (1979) outlined the field of business strategy, based on the work of Ansoff (1965) and Andrews (Learned *et al*, 1965) among others. Traditionally strategy was understood as a conscious plan to align the firm with opportunities and threats posed by the environment. A firm will usually have only one overall corporate strategy, but may wish to incorporate a number of underlying business strategies to direct the actions of various business units. Such a (sub)-strategy may direct the action of the

collaborative R&D activities of the firm. What an alliance strategy can provide is a logic to guide alliance decisions (Bamford *et al*, 2003). Even though a core idea of strategic planning is to foresee the coming challenges and decisions that need to be taken, a strategy can have a more or less emergent nature and it will often be necessary to make room for adoption instead of going for a teleological planning (Mintzberg, 1994).

The concept of strategy being more of an intention to do certain things than an actual plan has been subject to a lot of refinements. A later branch of strategy research has included the notion of cognitive bias into the idea of strategy (Chesbrough and Rosenbloom, 2002) as it is argued that human judgment and decision-making is not based on full rationality. Rather people tend to make decisions using mental short-cuts or heuristics; that is, rules of thumb, educated guesses, intuitive judgments or simply using their common sense. Cognitive biases can arise from the various loyalties that a person may have, or from local risk and attention concerns that are difficult to separate or codify (Tversky and Kahnemann, 1974). Based on this knowledge Prahalad and Bettis (1986) introduced the notion of a dominant logic in strategy development. The argument is that the actions and decisions of managers are often guided by heuristic rules, norms and beliefs; or in other words, a dominant logic that will focus their attention as they seek new opportunities for the firm (Prahalad and Bettis, 1995). This could by way of example be an idea about the strength of partnering which will guide the decisions when new knowledge is searched for. Yet, while such a logic or belief can be useful as it may reduce ambiguity and make sense of complex situations faced by managers, it comes at a cost. The application of a specific dominant logic guiding managers to make certain choices may constrain other choices and filter out certain possibilities (Chesbrough and Rosenbloom, 2002). As shown by Chesbrough and Rosenbloom (2002) decisions made in established companies are more cognitively bounded, as new information is filtered through a heuristic logic that is established from previous successes. This heuristic logic informs the various strategies e.g. the R&D strategies, and may guide the firms towards a more or less open attitude towards external knowledge in the R&D process. What has been emphasized in parts of the alliance literature is the importance of alignment between a given R&D strategy and the overall business strategy of the focal firm. In line with the argued internal portfolio view scholars point to the importance of 'looking beyond the deal' and focus the attention on how the alliance contributes to the company's business strategy (Bamford *et al*, 2003).

### **4.3 Individual Conditions: Willingness and Ability to Collaborate**

At the lower left corner of the diagram the issues that condition an individual collaborative behavior is placed. A core condition in the context of this study is the willingness of the employees to engage in the collaborative activities outlined at the corporate level. Whether employees are willing to engage in collaborative projects is, as just touched upon, an outcome of their motivational orientation; they may be willing to collaborate because they are rewarded for this specific effort or they may collaborate when the opportunity arises because they find collaborative activities more interesting than the ordinary R&D tasks they otherwise would have done—or their willingness may come about as a mix of the two. In addition to willingness the ability of the individuals to perform the collaborative task is also central.

In chapter 2 I outlined the importance of collaborative R&D capabilities to succeed in external collaboration. Until now most studies of capabilities have been done at an organizational level, ignoring the fact that some elements may pertain to the single individuals. The most central abilities that are needed in a given collaborative project are, naturally, the ones related to the research task that is to be carried out in the collaborative project. The extent to which an individual understands a specific domain of knowledge defines whether he is an expert in this area. Individuals with a high level of expertise are better at understanding the laws, logic and rationales underlying the function or processes of a specific knowledge domain. This understanding provides the individual with the ability to identify critical configurations or complexes that contain several pieces of information such as information about the solution in a complex situation (Lofstrom, 2000, Camerer and Johnson, 1991). Individuals who are experts are better at integrating new knowledge in existing domains than individual without expertise, and as a consequence individuals with high level of expertise are more likely to learn from collaborative activities. Thus, by way of example, a project about developing answers to challenges in the field of cancer research will be better off if a number of oncologists are core members of the collaborative group. In staffing collaborative project the manager needs to keep the central knowledge in focus and assign researchers that hold the right expertise. Still, employees with other professional profiles will also be needed. A collaborative project will most often need a legal officer or a patent worker closely connected to the project as well as employees from development department. Even marketing people are often included in various processes of the collaborative project. Most firms have a template that they follow when R&D projects are staffed and this template will most often match

the template of the partner. Following this procedure all employees will be assigned with a counterpart in the partner firm.

Yet, in addition to possessing the proper disciplinary skills employees may benefit from additional abilities that are directed towards the specific challenges that pertain to collaborating as such. An ability to designate and understand the various phases of a collaborative project and to spot the potential problems that may occur at a given time in the project will be beneficial to the employees. Firms that collaborate frequently tend to make this kind of knowledge explicit in manuals or a codex that can guide the employees through the phases of the project. Still, the ability to maneuver skillfully in a collaborative project is often a question of experience and may thus be a personally held ability. Additionally, contributing to a positive collaborate culture of a given project is not something you learn from reading a codex. Abilities that relate to understanding and aligning to the partner's goals or being good at working in trans-disciplinary teams are often gained through experience. This goes for many of the individual abilities, such as communication skills.

As stated previously many of the capabilities that are dealt with theoretically as collaborative capabilities are most often treated solely as organizational level constructs. My response is, that we will get a better understanding of how capabilities are shaped if we are able to tell which are generic and related to the organizational context and which pertains to the single employee. A specific ability that is often mentioned as being highly relevant in R&D activities generally and in R&D collaborations more specifically is the ability to absorb external knowledge. In chapter 2 I showed this ability (in its organizational form) to be central in benefiting from external collaboration. Yet this specific ability does have an individual level dimension as well, and as I argue we will gain better insight in this specific ability if we deal with the organizational and the individual characteristics separately.

#### *4.3.1 Individual Absorptive Capacity*

Since the concept of *absorptive capacity* was coined by Cohen and Levinthal in their influential 1989 and 1990 articles, a large number of scholars<sup>10</sup> have been using and developing this diverse,

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<sup>10</sup> As stated by Lane, Koka and Phatak (2006) the construct of absorptive capacity has been used in more than 900 peer-reviewed academic articles since it was developed. One reason for this popularity is the uniqueness of the perspective in regards to learning and knowledge creation. The fact that it relates to a number of other research areas that were rapidly growing at the same time (such as organizational learning, knowledge management, strategic alliances and resource based view) may have increased its popularity (Lane, Koka and Phatak, 2006). A further reason for its popularity is the fact that the notion directs attention to the mechanisms that lie between external knowledge and firm-level innovation performance (Foss, Laursen and Pedersen, 2007), and as such it helps us theorize upon the fact that firms can benefit from resources produced outside the firm.

significant and complex construct. The construct describes one of the most important learning processes in firms, being the collected process of *recognizing* the value of new, external information, *assimilating* it and *applying* it to commercial ends in the firm. Even though the concept is (at least) three-dimensional, it can be synthesized to be dealing with the ability to appropriating external knowledge and as such it is a central ability for employees engaged in collaborative R&D projects. As stated absorptive capacity can be both a personal held ability located at the employee level and an organizational phenomenon that exists at the firm level. Most of the excitement around the absorptive capacity construct is focused at the firm-level; however, in their 1990 article Cohen and Levinthal did examine the cognitive structures of individual employees specifically (Cohen and Levinthal, 1990). They state that '[t]he concept of absorptive capacity can best be developed through an examination of the cognitive structures that underlie learning' (Cohen and Levinthal, 1990:129). It is worth noticing, though, that despite the fact that Cohen and Levinthal based much of their work on cognitive and behavioral sciences as well as research on memory development, the individual level dimension of absorptive capacity has since been extensively ignored. Especially in their 1990 article in *Administrative Science Quarterly* Cohen and Levinthal relates to research on the cognitive structures of individuals and on problem solving at individual level to study the processes underlying organizational learning. They do this by focusing on the individual-level foundation of the increasingly popular notion of organizational learning and affirm that learning is a cumulative process and that it is greatest when the object of learning is related to what the individual already knows (Bower and Hilgard, 1981; Ellis, 1965; Estes, 1970). The authors suggest that absorptive capacity is actually a by product of prior innovation and problem solving (Allen, 1977). In addition, Cohen and Levinthal point to the fact that the breadth of knowledge already possessed by an individual will aid the process of making sense of and acquiring new knowledge (Bower and Hilgard, 1981).

An additional fact is worth noticing in regards to individual absorptive capacity, namely that essential new knowledge that could be central to a given R&D project might be possessed by someone in the organization already, and the ability to locate knowledge and transfer it inside a group or organization is a core ability as well (Lane, Koka and Phatak, 2002). This relates closely to what Cohen and Levinthal (1990) label *inward-looking* and *outward-looking* absorptive capacity. The former has to do with the ability to absorb knowledge from external sources, while the latter refers to 'the efficiency of internal communication' (Cohen and Levinthal, 1990:133). This characteristic may be very important in the present context as it directs our attention to the

importance of knowledge sharing inside a given collaborative project. Additionally the *inward-looking* absorptive capacity may help to utilize the knowledge that has been accumulated in a given collaborative project by transferring it to the rest of the organization as far as it is relevant and possible. This focus on inward and outward knowledge transfer highlights the role that the employees play in a given collaborative project.

Looking at the employees' part in the process of absorbing external knowledge it becomes clear that some employees are of special importance to the process. They may come to stand in the interface of the firm and the external partners (Cohen and Levinthal, 1990: 132) and act as 'gatekeepers'. In some cases the function of the gatekeeper will be mainly to monitor and build relations to relevant external partners, while it will be necessary to 'translate' the new information to the rest of the group under other circumstances. The gatekeeper will sometimes act as a mediator between the focal firm and a partner and the gatekeeper will most likely contribute significantly to the performance level of a research group (Tushman and Katz, 1980).

Focusing on the process of absorbing knowledge from an external partner it is important to bear in mind that some kind of shared knowledge and expertise is a necessary condition to make communication happen between the gatekeeper(s) and the rest of the group (Cohen and Levinthal, 1990; Borgatti and Cross, 2003). This could be both a basic level of shared language and symbols and of more technical forms of knowledge. Absorbing intra-industry knowledge is shown to be supported by more in-formal contacts between employees. This knowledge can easily be spread between people as this knowledge is easily understood due to the homogeneity of the knowledge from one's own industry. Inter-industry knowledge on the contrary is best shared through formal channels and the employees will need some more general skills in structuring problems and gathering information on previously unknown subjects. If all researchers in a group share the same specialized knowledge, coding scheme or specific expertise they will be good at communicating with each other, they will, however, have a hard time linking up with an external knowledge source (Burt, 2002) as they may not understand the new external knowledge or can not integrate it with the knowledge they already hold. In fact, the process of knowledge sharing often meets certain barriers that make it difficult to attain the objectives. In sum, the development of absorptive capacity is 1) dependent on the prior investment in the absorptive capacity of the employees, 2) happening in a cumulative manner and is thus path dependent, 3) dependent on the ability to share knowledge and communicate internally.



In section 2.3.3 I pointed to the fact that a number of different sub-capabilities are very important for the collaborative capability to develop.

Schreiner *et al* (2009) are showing that collaborative capabilities can be conceptualized as being a multi-dimensional construct consisting of three sub-capabilities, namely; ‘coordination capabilities’, ‘communicative capabilities’, and ‘bonding capabilities’<sup>11</sup>. These capabilities are in the Schreiner *et al* framework all described as organizational level capabilities that the firm needs in order to be a successful collaborator. Still as alliance capabilities are furthermore described as being ‘partly a function of individual skills and capabilities and firm-level attributes that enhance, encourage, and support alliance-like thinking and behavior throughout the firm’ (Spekman *et al*, 2000: viii), it may be hypothesized that the different dimensions of capabilities outlined above exist has individual level elements as well. Individual coordination ability may then be understood as the ability to bring together the different parts of knowledge and technologies that are needed in a give collaborative project. Communicative abilities are necessary for the employees to inform colleagues about the knowledge they hold and, as important, about the knowledge they need from the collaboration. Bonding capabilities are, finally, important in order to foster a trustful relation by expressing attentiveness, consideration, and support for its exchange partner. I will return to the importance of trust in section 4.4, but in regards to the discussion of the abilities of individuals I will summarize that different elements are highly important to fulfill this picture and in addition to the important absorptive capacity also coordination abilities, communicative abilities, and bonding abilities play a vital role.

#### 4.3.2 Collaborative Behavior Determined by Individual-level Conditions (Arrow 2)

The processes matching the next arrow of the analytical diagram, arrow 2, unfold solely at the level of individual action as it leads from the individual conditions to the actual collaborative behavior of the employee. In general, factors may very well affect the individual level conditions (the situation at the lower left corner of the diagram) in ways that either aid or impede them to evolve into the actual collaborative behavior. In this section I will focus the analysis on one specific issue that

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<sup>11</sup> Bonding capability is defined as ‘a firm’s ability to develop and nurture meaningful social exchange by consistently expressing attentiveness, consideration, and support for its exchange partner’ (Schreiner *et al*, 2005:9). ‘Coordination capabilities’ are defined as ‘a firm’s ability to organize interdependence among activities of the exchange parties in an effective and efficient way’ (Schreiner *et al.*, 2005:6), and ‘communicative capabilities’ as ‘a firm’s ability to credibly convey relevant knowledge and information about itself to the partner’ (Schreiner *et al.*, 2005: 8)

moderates this relation; that is, the characteristics of the knowledge at stake in the collaborative projects.

The character of the knowledge at stake in a given collaboration is very influential on the employees' ability to make use of the knowledge (Dyer and Singh, 1998). Knowledge can be characterized by its degree of transferability: explicit knowledge can easily be communicated and hence is easily transferred between individuals, across space, and across time (Grant, 1996: 111). Tacit knowledge on the other hand is not articulated and thus more difficult to transfer. Tacit knowledge transfers more slowly across organizational borders than codified knowledge (Zander and Kogut, 1995). Tacit knowledge can be illustratively explained as follows; 'if someone can do something they must possess the requisite knowledge, but since they can not express it, this knowledge must be tacit, at least at that point, if not generally' (Gourlay, 2004:86). R&D activities comprise a number of different and related knowledge processes, such as: knowledge sharing, knowledge creation or knowledge integration. In R&D collaboration specifically knowledge sharing is essential. Knowledge sharing is defined as a process that results in changes in the knowledge repository of the recipient and/or his or her performance (Argote and Ingram, 2000). Further knowledge transfer<sup>12</sup> is understood as 'a process in which an organization recreates and maintains a complex, causally ambiguous set of routines in a new setting' (Szulanski, 2000:10). According to various scholars knowledge sharing has become a core activity in many firms as it contributes substantially to various desirable organizational outcomes, as for example new product development or dissemination of best practice across business units (Dyer and Singh, 2004; Hansen, 1999; Szulanski, 1996). The ability to share knowledge is said to constitute a source of competitive advantage for organizations compared to markets (Arrow, 1974; Kogut and Zander, 1996). This is due to the fact that organizational identity leads to social knowledge that supports coordination and communication (Kogut and Zander, 1996:502).

By understanding the knowledge sharing activity as a process and not as a single act, we will gain insight into how we can design and apply specific mechanisms that support knowledge sharing (Szulanski, 2000). Yet, initially we need to recognize that knowledge is not 'fluid' and easy to transfer, in fact it is best characterized as being 'sticky' and thus difficult to achieve (Szulanski, 1994). The 'stickiness' has a number of predictors, the majority of which descend from the

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<sup>12</sup> In this article knowledge sharing and knowledge transfer is used interchangeably. The two constructs are often used so in the literature (e.g. see Heiman and Nickerson, 2002), yet sometimes the use of the word 'transfer' highlights a process of 'moving' knowledge from a sender to a recipient; a one way process. In the present context, namely that of R&D collaboration, we assume that knowledge sharing is a two-way activity based on reciprocity.

characteristics of the knowledge transferred. In general, if knowledge is easy to articulate and encode, then it is more likely to be transferred successfully and at a low cost. On the other hand, transferring complex and causal ambiguous knowledge—a characteristic that will fit most R&D knowledge—will require reconstruction and adaptation at the receiving end (Kogut and Zander, 1992). Thus, solving problems that occur while transferring this complex knowledge may involve frequent comparisons of the ‘replica’ being created with the ‘template’ after which it is modeled (Nelson and Winter, 1982). This means that repeated exchange of information between the partners of the collaborative project is needed.

#### 4.3.3 Factors Moderating Arrow 2

Studies show that individuals are more willing to put a serious effort in to sharing knowledge with persons that they have a close personal relationship to (Reagans and McEvily 2003; Hansen 1999; Uzzi 1997). Inter alia, Szulanski states that, ‘...the recipient may be more or less motivated to seek or accept knowledge from the outside. Lack of motivation may result in procrastination, passivity, feigned acceptance, sabotage or outright rejection in the implementation and use of knowledge’ (Szulanski, 2000:12). Behaviors like these will most certainly lead to failures in a collaborative project which, as I have pointed to earlier, is a reality that meets many collaborating firms.

The high failure rate of collaborative projects may stem from a mix of problems, yet for analytical purpose we will benefit from categorizing some barriers as either *behavioral* or *cognitive*. Barriers can be formed by the lack of willingness of the employees to share their knowledge, which is best described as behavioral barriers. Certain individuals are opposed to collaboration for numerous reasons which may give rise to an attitude mirrored in the ‘not invented here’-syndrome (NIH). According to the NIH-syndrome employees traditionally resist accepting knowledge produced externally, and favor internal solutions to a given problem even though external solutions do exist (Katz and Allen, 1982). Various kinds of knowledge hoarding behaviors may lead to rejection of knowledge sharing. The term ‘hoarding’ suggests a premeditated attempt to hide something away for own future use, yet a hoarding behavior may also be the result of an unconscious attitude. Conscious or unconscious, people hold back their knowledge if they anticipate to be punished for sharing it, in one way or another. An employee may, by way of example, fear to be blamed if she shares knowledge with a partner and what is shared is misused by the partner. Additionally she may be anxious about losing her status; if she shares her knowledge there will be no need for her expertise any longer and she may not even be recognized for her contribution. These factors may all lead to behavioral barriers to collaboration.

The cognitive barriers, on the other hand, are related to the absence of ability to share, as for example lack of ability to articulate the required knowledge or incapability of understanding the context in which the knowledge is to be applied. An employee's wide range of abilities is a very important condition for his or her behavior in a collaborative project.

#### **4.4 Individual Collaborative Behavior**

At the lower right corner we arrive at the issue of collaborative behavior. We now need to analyze how individual collaborative behavior is formed on the basis of the conditions that we outlined in the previous section. I have argued that in order to be able to explain how an individual collaborative behavior comes about we need to focus on the willingness and the abilities that are possessed by the single employee. Individual abilities and experiences account for an essential part of the organizational memory and entail a set of repetitive activities ensuring a smooth and effective functioning of organizational operations (Lenox and King, 2004). The individual level factors that contribute to the collaborative capability are related to the acquisition and processing of new knowledge from external sources (Powell *et al.*, 1996; Gulati, 1999; Lane and Lubatkin, 1998). I have highlighted that one of the core abilities that can aid this process is the ability to absorb external knowledge. As we have seen absorptive capacity is formed primarily by educational level and prior experience in collaboration. A fact that attracts attention in the study of individual level abilities is that most of the existing literature on collaborative capabilities is mainly dealing with organizational level capabilities. The capabilities associated with high performance in alliances are typically conceived to be embedded in organizational routines, which are repetitive activities that a firm develops in order to deploy its resources in alliances (Helfat and Peteraf, 2003; Nelson and Winter, 1982; Winter, 2003). Although implicitly accounting for the micro foundational processes of capability building studies by and large neglect to empirically account for the *individual* level attributes that ensure the effective integration of alliance capability. I have dealt with how both disciplinary skills (insight in core knowledge) knowledge related capabilities (such as absorptive capacity) and other collaborative capabilities (such as communication skills) are all important in shaping an actual collaborative behavior at the individual level.

To summarize, in outlining the processes along the Coleman diagram we are, so far, dealing with individuals that—for different reasons—are willing to collaborate and who, due to the possession of various abilities, can engage in a collaborative project. In an attempt to sum up the situation at the lower right corner of our theoretical framework we can state that what is needed is a

collaborative mindset. A mindset is a set of attitudes, thoughts and feelings that influence decisions and actions (Berdrow and Lane, 2003) and a collaborative mindset can thus be defined as a necessary condition for collaborative action to happen. A positive attitude towards current or future partner firms and more generally towards the idea of inter-organizational collaboration is also thought to have a positive effect on a given collaborative action as it impeded the development of mutual trust between project participants. Being open minded towards external partners will ease the process of collaborating and diminish the potential obstacles in the collaboration, such as barriers to knowledge sharing. The existence of a collaborative mindset is a central factor in building and maintaining collaborative capabilities.

#### *4.4.1 Joint Collaborative Behavior leading to Collaborative R&D Capabilities (Arrow 3)*

The processes matching the third arrow of the Coleman diagram deals with the aggregated outcome of the individual level behaviors. The micro to macro transition highlights the crucial role of interdependencies in social phenomena that affect changes or outcomes at the macro level. Yet getting from micro to macro is not merely a question of aggregating the behavior of group of individuals to get the outcome at the organizational level. As individuals tend to react differently to for example two different motivational factors we can not just do a simple aggregation of the actions of the relevant individuals. The way the individuals interact and respond to the organization and the work tasks as such, will inevitably lead to another outcome than if the hypothesized individual outcomes were just added—simply because they interact and affect each other.

The findings from the studies done on collaborate climate supports the learning from research on motivation, namely that we have to do with a number of issues that impinge on the individuals wish to collaborate and that these issues will sometime work together and sometimes be conflicting. In sum, understanding the dynamics of collaborate climate may be one of the most important tasks in setting up collaborations. Working towards a positive climate means fostering a trust-based relation between the collaborating partners and setting the scene for frequent communication and high commitment. A relation characterized by frequent communication and emotional connectedness is in the field of social network theory referred to as characterized by strong ties between participants. People connected through strong ties are shown to be more successful in sharing knowledge (Burt, 2004). The difficulties of sharing idiosyncratic, context bound knowledge between partners in a collaboration are eased in cases where the partners share or have strongly overlapping knowledge bases, strong social relations for example developed through past collaboration and a high level of trust between them. The more complex knowledge the more

advantageous are strong ties for the exchange of knowledge (Hansen, 1999). In line, various scholars have shown that *lack of trust* between partners is one very important barrier to knowledge sharing (Abrams *et al*, 2003; Husted and Michailova, 2002), and that trying to operate in a collaborative setting with low level of trust will almost certainly lead to failure (Creed and Miles, 1996). Trust can be defined as ‘confidence in the goodwill of others not to cause harm to you when you are vulnerable to them’ (Ring and Van de Ven, 1994), and lack of trust between knowledge sharing individuals may for example lead the sender to fear that shared knowledge will be misused or misappropriated (McEvily, Perrone and Zaheer, 2003) which again will damage the motivation to engage in the project. Yet, when a trustful relation exists it may substitute for more formal control systems such as contracts, by relying on less formal norms and sanctions (Ring, 1996). Thus it may even help to resolve the control/autonomy dilemma, as the controlling element can be scaled down in a group characterized by mutual trust.

In other words, trust is an important ingredient in inter-firm collaboration in general (McEvily *et al*, 2003) and especially in research collaboration as it improves and accelerates knowledge exchange (Newell and Swan, 2000; Davenport *et al*, 1999) and in various ways features all phases of a given partnership; being the formation, the implementation and the evolution stages (Nielsen 2004). As highlighted by Ring (1996) a core characteristic of trust is that it is an enabling condition facilitating the formation of ongoing corporate inter-organizational relationships.

Coleman suggests, relying on the work of James Friedman (1977), that the best way to understand this micro-macro transition is to conceptualize it, not with respect to particular persons, but rather as a system of structural interdependent positions. By describing the interdependence as structural, Friedman (1977) recounts actions as being independent of each other. Each actor is deciding on a course of action and takes the environment as fixed rather than reactive. This may make sense in a situation where we study the action of buyers in a market with fixed prices, where the action of the single individual may not affect the overall outcome of a large group of buyers in the market. Yet, when dealing with collaborative research and rich knowledge sharing I would assume another type of interdependence to be a more appropriate description of the actions of individuals. This is what Friedman calls behavioral interdependence being a type of interdependence where actions are conditional on those of others at an earlier point in time<sup>13</sup>. This

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<sup>13</sup> Friedman outlines a third type of interdependence among actors. That is evolutionary interdependence being a behavioural interdependence that over a sufficiently long period of time that, through selective survival, the mix of strategies in a population change towards an equilibrium of strategies (Coleman 1990:30-31). Coleman does only spend a minimum of time on these two types of behavioural interdependence. Still, I recon the behavioural type of interdependence to be relevant for our further studies in the present context.

implies that actors must base their actions on more complex considerations than applied in structural interdependence. In this situation the best choice of action for a given individual will have to depend on information, both about the number and character of future studies and about the kind of strategies that will be pursued by others (Coleman, 1990:30). This reflects the complex situations in collaborations where actions of employees are often very interdependent due to the intense knowledge sharing and an often high degree of shared resources. Yet, the more complex the situation the harder it is to understand the dynamics of the collaborative actions. Still we want to avoid ad-hoc explanation of the micro to macro translation and this leaves us with the question; what kind of rules can we apply in this setting?

#### *4.4.2 Factors Moderating Arrow 3*

Some factors seem to function as moderators on the relation between the behaviors of the individuals and the development of collaborative R&D capabilities and the elements that constitute the conditions of the actions of individuals. This means that they impinge on the direction and/or strength of the relation, and thus they are vital for understanding the dynamic processes of collaborative R&D capabilities.

##### *4.4.2.1 Individual Collaborative Behavior and Group Dynamics*

We have dealt with motivation in regards to the specific research related work tasks in a previous section. In continuation of this discussion it would be relevant to look into how individuals are motivated to engage in inter-organizational collaborative projects. A hypothesis is that collaboration is a behavior that may be more easily induced by some types of rewards instead of others. Extrinsic, more specifically pecuniary, rewards are for example shown to be undermining collaborative behavior whereas rewards given to a group may lead to *free-rider* problems (Cohen and Sauer mann, 2007). An individual may decide to be a free-rider on the beneficial actions of others in a group if the group is rewarded for the collective action and nobody recognizes whether he participated or not. To evade this situation and make the group strive for collective goals and feel some sense of mutual obligation a group is best supported for its teamwork by intrinsic or social rewards (Cohen and Sauer mann, 2007). Social incentives are hardly ever included in the study of work incentives (Sauer mann, 2004), still as this kind of incentives are originating from the individuals perceived social relations, that is, from something else than the work task itself, they are potentially relevant when we study how individuals act in a given collaborative project. People often tend to act in order

to gain social approval or avoid social disapproval (Fehr and Falk, 2002) and as such a wish for peer recognition could lead to certain behaviors of the collaborating employees.

#### 4.4.2.2 Social Capital: Investing in the Relational Structure

In focusing on the transformation from the micro to macro level we start dealing with how people interact as a function of many factors. As shown the macro level outcome is formed by both willingness and personal abilities which again are influenced by the corporate aspiration at the organizational level. Also barriers or carriers that are due to the character of knowledge or the attitude towards collaboration form the collective actions of individuals. All these diverse factors which are displayed in the present chapter inform in various ways the final organization outcome. As stated repeatedly the outcome displayed at the upper right corner of the Coleman Diagram is not just a sum of all the activities of the collaborating employees—this is not a question of simple aggregation. Instead the outcome can be seen as something that is highly dependent on how the relevant employees interact and relate to the strength and capabilities of each other. Our quest to understand and explain how R&D capabilities are fostered by the activities of collaborating employees relates closely to what scholars have labeled social capital, i.e., the idea that the connectedness of individuals may be important sources of power and influence (Portes, 1998), as such, social capital inheres in the structure of relations between actors and among actors. Following social capital can be described as ‘a resource for action’ (Coleman, 1988:95) and scholars point to the importance of understanding how social organization (such as R&D collaboration) affects the function of economic activities. Social capital is best defined by its function; it “is not a single entity but a variety of entities with two elements in common: they all consist of some aspect of social structure, and they facilitate certain actions of actors—whether persons or corporate actors—within the structure’ (Coleman, 1988:98). In Coleman’s conception, social capital is a neutral resource that facilitates action; its neutrality is shown by the fact that a given form of social capital that is beneficial to some specific ends while useless or even damaging to others. By way of example close relatedness in a group may be useful for knowledge sharing in the group but it may harm the search for new external knowledge.

The concept of social capital has gained popularity in numerous social science disciplines (see Adler and Kwon, (2002) for an overview); in organization studies social capital has proved to be a powerful factor in explaining actors relative success in regard to facilitating inter-unit resource exchange and product innovation (Gabbay and Zuckermann, 1998; Hansen, 1998; Tsai and Ghosal, 1998), the creation of intellectual capital (Hargadon and Sutton, 1997; Naphiet and Ghoshal, 1998)

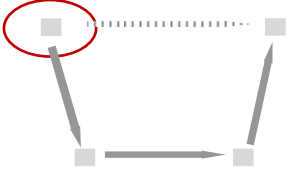
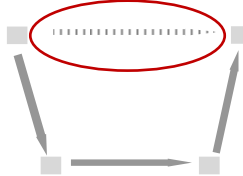
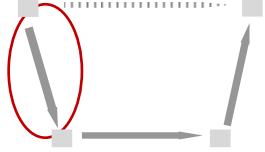


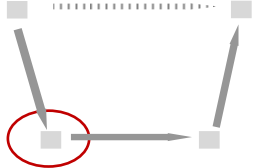
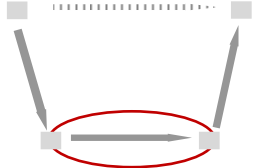
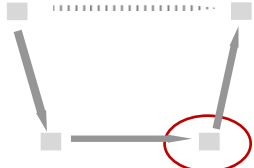
and cross functional team effectiveness just to mention some of the issues that may relate closely to R&D collaboration. The sources leading to social capital lie in the social structure within which the actor is located, and in our present search for factors that determine how the behavior of individuals affect the organizational outcome this is of high importance. The relational position and the ability of the single employee to build relations to others will benefit the firm when this is utilized in connection with a given R&D project. Like other forms of capital social capital is productive as it facilitates the achievements of certain ends that in its absence would not be possible to obtain. Investment in social capital is thus very important. The relational position of a given employee may be a potential source of new information. As information is an important basis for action and can be costly to obtain if the right sources are not known (Coleman, 1998), the position of the employee and the following social capital which can be derived from that is of great value to the collaborating firm. Not only the structure but also the closeness of the relation has a great important for the potential information search and knowledge sharing between employees. Coleman and scholars alike are advocating the benefits of a dense network of relation where as others, especially Burt (1992), has emphasized the benefits of the relative absence of ties, labeled structural holes, between members of a given network. This is so because a dense network will provide only redundant information while weak ties will be sources of new and valuable knowledge as discussed thoroughly in chapter 2.

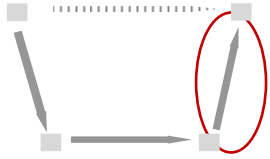
#### **4.5 Conclusion**

I have now outlined the core elements of the dynamic process that links a corporate aspiration to collaborate to the development of collaborative R&D capabilities. In table 4.1 the core elements of these processes inherent to the framework model are described and the aim is now to match these findings with the situation in the three narratives that follows. When beginning the comparison with between the theoretically informed elements of the framework model and the empirical elements of the two case narratives I will deal mainly with the critical elements that belong to the ‘corners’ of my framework model. This focus is chosen due to the fact that I see these events (Abell *et al*, 2008) as the most important building block of this model. The changes that happen, illustrated by the arrows of the model, are essential as well. However, the situations that they inform are used to focus the attention as these events are exactly where we can locate the important attitudes, abilities and behaviors of the employees engaged in collaboration.

**Table 4.2: Searching for the Elements of the Theoretical Framework**

Section	Illustrated in the frame-work as	Moderating effects on the change process (the arrows)	Critical elements of collaborative R&D capabilities
<p><b>4.2</b></p> <p><b>Corporate aspiration to collaborate on R&amp;D</b></p> <p>Formed by:</p> <ul style="list-style-type: none"> <li>• Exploration</li> <li>• Exploitation</li> </ul>	<p>Upper left corner</p> 		<p>Exploration and Exploitation may ask for different capabilities</p> <p>Ensure transparency about drivers of corporate aspiration to collaborate on R&amp;D</p> <p>Creating and elucidate Collaborative opportunities</p>
<p>4.2.1</p> <p>The relation between R&amp;D collaboration and the development of collaborative R&amp;D capabilities</p>	<p>Arrow 4</p> 		
<p>4.2.2</p> <p>How a Corporate aspiration to collaborate Affects Individual Level Conditions</p>	<p>Arrow 1</p> 	<p>The process of socialization</p> <p>Employee motivation</p> <p>Collaborative Climate</p> <p>Designation the direction (signaling)</p>	<p>The internalization of collaborative norms</p> <p>Employees are Intrinsically motivated to engage in R&amp;D activities</p> <p>Trust comes with an collaborative climate</p> <p>Managerial signaling is an important means</p>

Section		Illustrated in the frame-work as	Moderating effects on the change process (the arrows)	Critical elements of collaborative R&D capabilities
4.3	<p><b>Individual collaborative conditions</b></p> <p>Comprised by:</p> <ul style="list-style-type: none"> <li>• Willingness to collaborate</li> <li>• Ability to collaborate</li> </ul>	<p>Lower left corner</p> 		<p>Collaborative mindset (willingness)</p> <p>Absorptive capacity (ability)</p> <p>Coordination ability</p> <p>Communicative ability</p> <p>Bonding ability</p>
4.3.1.	<p>Collaborative behavior determined by Individual Level Conditions</p>	<p>Arrow 2</p> 	<p>Knowledge characteristics</p>	
4.4	<p><b>Individual collaborative behavior</b></p> <p>Comprised by:</p> <ul style="list-style-type: none"> <li>• Joint knowledge creation</li> <li>• Knowledge sharing</li> </ul>	<p>Lower right corner</p> 		<p>Knowledge sharing behavior</p> <p>Level of joint knowledge creation</p>

Section		Illustrated in the frame-work as	Moderating effects on the change process (the arrows)	Critical elements of collaborative R&D capabilities
4.4.1	Joint collaborative Behavior Leading to Enhanced R&D Performance	Arrow 3	Individual collaborative behavior and group dynamics	
4.4.2			Social capital: investing in the relational structure	
4.5	<b>Collaborative R&amp;D capabilities</b>	Upper right corner		Collaborative R&D capability (Organizational)

## 5. INTRODUCING THE FOCAL FIRMS

### Studying the Practice of Collaboration

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*Alliances are key components of many corporations' competitive strategies (Larsson et al, 1998:285)*

In this chapter, three firms that have acknowledged the strategic importance of R&D collaboration will be presented. In each firm, one collaborative project has been chosen as object of study. The three collaborative projects will be described and discussed in the three narratives that follow in chapter 6, 7 and 8. The narratives will illustrate how the existence of a corporate aspiration to collaborate affects the single employees in different ways and how the subsequent actions and interactions of the individuals impinge on the development of collaborative R&D capabilities.

The collaborative R&D projects described in the narratives are characterized by the fact that they transgress organizational borders and bridge gaps between potentially different organizational cultures, opposed strategic intentions, and divergent work habits, as they bring together knowledge from different disciplines. This composes a challenge to the firms engaged in collaboration. Yet, the collaborations are expected to provide new valuable knowledge or technological development at a speed that can not be matched by any internal process in the firms.

In the narratives it is shown how the act of collaboration is perceived in the focal firms and I describe the way in which strategies and structures have been implemented in order to support the utilization of external knowledge. It is expected that a brief introduction of the focal firms will provide a better basis for the understanding of how and why the three collaborative projects developed as they did and how the decisions taken on corporate level affect the actions and interactions of the individuals. Introductions will be provided at the beginning of each narrative.

The assumptions that underlie this study are described in details in the methodology chapter, yet it is important to keep in mind that what I search for in this study are the mechanisms that act as causes of changes in the collaborative project. As stated in the methodology chapter I am especially interested in the mechanisms that transform one situation, or state of the world, into another, and create links between situations or actions. Put differently, I search for causal links that can tell us something about how or why individual act as they do in collaborative projects and thus provide us

with a better understanding of the dynamics of the collaboration and the processes leading to collaborative R&D capabilities.

The three narratives of this thesis portray three separate collaborative projects undertaken by three Danish firms and one of their partners. The collaborative projects are not related to each other. The first one is a relatively new collaborative project between the Danish firm Novozymes and the German partner Solvay. The project started out as a short-term project oriented towards the licensing of a patent held by Novozymes. The relation has developed, though, into a long-term engagement due to the many opportunities that has risen during the first years of collaboration. At present the collaboration is organized in a short-term and a long-term project part, which engages different employees and have very different aims. In the narrative it is described how a more open strategy has been designed and implemented in Novozymes. The unambiguous corporate argumentation about why and how collaboration is vital to the firm make this a constructive starting point for studying the activity of partnering. Taken together, a story is told about how a corporate intention to grow through inter-organizational collaboration challenges the firm in many ways.

The second narrative presents a collaborative relation that was initiated decades ago. The two firms, the Danish Novo Nordisk and the American ZymoGenetics, have a shared history characterized by both close interaction and periods of separation, yet there has throughout the previous 25 years been a continuous exchange of knowledge, employees and managers between the two firms. Recently an agreement has been signed between the two firms prescribing a more structured way of sharing knowledge in relation to a specific R&D project. The construct of knowledge sharing is essential in this project and it refers to more than just sending loads of information back and forth across the Atlantic. In order for knowledge to be truly attained the receiver must be able to communicate with the sender and be acquainted with the context in which this knowledge is produced. In other words, knowledge sharing requires a more integrated interaction between partners for value to be created. This is exactly how sharing of knowledge separates from sharing of information. And this is where this narrative has its strength; in showing how the act of knowledge sharing is formed by the interrelated actions of individuals from the collaborating firms. Additionally the narrative help to clarify how successful knowledge sharing is closely related to the existence of a range of collaborative R&D capabilities.

The third narrative portrays the Danish part of the IT Service Company CSC. CSC Denmark provides consulting, system integration and outsourcing services to both public and private companies and their main focus is to help customers reach their strategic goals through the use of

advanced information technology. The partnership between CSC Denmark and the smaller Danish Company Scan·Jour was initiated when CSC decided to bid on the tender for the national FESD project that aimed to develop a joint electronic case and document management system to apply in public settings. CSC started to look for a potential partner with a product that could match the request of the tender and Scan·Jour was chosen because of their technological platform, Captia. CSC was familiar with Scan·Jour as they had been a preferred supplier to CSC for years. Still, being related in a buyer-supplier relation like the two firms have been before is completely different than working closely on the development of a joint product as they do in the present project. The new collaborative project required a higher degree of interaction between the employees than they were used to. This case is exceptional due to the fact that the two partners, CSC and Scan·Jour, had to agree on a number of core issues in a rather fast manner in order to be able to approach potential costumers as one service provider. A key success factor in this project is that CSC and Scan·Jour appear as one united company when they approach new customers to implement there new jointly developed products and services. Still, this has been a significant challenge to the two independent companies and has made the development of collaborative capabilities in CSC both difficult and even more important.





## 6. NOVOZYMES

### Matching Corporate Strategy and Collaborative Reality

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Partnerships are the Future of Research  
([Novozymes](#), *Annual Report 2007*)

#### 6.1 The Value of Openness: Introducing Novozymes

The Danish Bio-Innovation<sup>14</sup> company Novozymes is a world leader in the field of enzymes and micro-organisms. In large-sized tanks inside the laboratories of Novozymes tiny enzymes are produced using microbiological processes and fermentation technology. The enzymes' unique capacity for catalyzing chemical processes and altering substances is utilized in a number of different industrial processes.

Novozymes was created as the result of a Novo Nordisk de-merger in November 2000, which spun off more than 60 years of enzyme-related research and development. When the company celebrated its 5th anniversary at the end of 2005, it produced more than 600 different kinds of enzymes and micro-organisms, and the company's products were used in 40 different industries in 130 different countries across the world. In large-sized tanks inside the laboratories of Novozymes tiny enzymes are produced using microbiological processes and fermentation technology. The enzymes' unique capacity for catalyzing chemical processes and altering substances is utilized in a number of different industrial processes. The activities are generating a turnover that in 2006 amounted to 6.806 million DKR, with an operation profit margin of 20.2%. 13% of the turnover is invested in new research and development and the company sustains itself by a stream of innovative ideas which are filtered through the different subunits of the organization: 'Idea', 'New Lead', 'Discovery' and then 'Development'. If the first three phases of the Research and Development (R&D) efforts are successful, the innovation has 'Proof of Concept' and it will progress to the Development phase. The goal then is to lift the enzyme out of the laboratories and introduce it to the market. Novozymes protects its new knowledge and inventions through an active patenting strategy. At the end of 2006, Novozymes had more than 5000 patents granted or pending.

R&D activities at Novozymes are performed in close association with the outside world. The R&D projects are often, and increasingly, carried out in collaboration with external partners

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<sup>14</sup> Novozymes is defining itself as a Bio Innovation company. They aim to create more sustainable ways to do business through Bio Innovation; that is, advances based on biotechnology that replace traditional industrial production methods with more sustainable methods.

bringing new knowledge and new competences to the organization. ‘We see no contradiction in being both profitable and transparent’, as it is stated on the company website in a section where potential new partners are invited to join in on the various technological ventures. ‘It is important to us to maintain our reputation as an open and honest collaboration partner’ the invitation proceeds. Novozymes is an example of the growing number of firms that turn to external partners when innovative ideas and new knowledge is needed. Still, the company is more than just an example of a rising trend of inter-firm collaboration. Novozymes expects to grow through partnerships and is actively planning to increase the number of research and development projects carried out in close collaboration with external strategic partners. A recently introduced partnering strategy indicates that the choice of whether or not to take on a collaborative R&D project is undergoing a transformation. Allying with partners in the research process is no longer only a R&D related decision it is just as much a corporate strategic decision.

#### *6.1.1 The Partnering Project: Part of the Corporate Strategy*

With references to the framework of the Open Innovation paradigm, Novozymes can undeniably be categorized as an open organization as knowledge produced by, or in collaboration with, external partners is seen as an important source of innovation. The strategic importance of external knowledge sources has been recognized and there is a growing interest in collaborative research projects throughout the company. A number of initiatives are implemented to ease the access to and use of external knowledge sources and support collaborative activities. Indeed, the positive and proactive attitude towards external knowledge has permeated the organization at both corporate and employee level to a significant extent.

The Novozymes annual report 2007 states that ‘Partnerships are the future of research’<sup>15</sup>. Under this headline the company’s latest conquest in the field of bio-ethanol is presented. But the headline does more than just present a case in point of frontline research and development. It also reflects an important corporate strategy of developing new business areas through collaboration with external partners. As stated on the Novozymes website: ‘Partnerships can help each individual partner reach greater heights than they could alone’. The ambition is unambiguous: 50% of the research and development activities must be undertaken in collaboration with external partners<sup>16</sup>. This strategy was implemented in order to bring in new technological knowledge at a faster pace, to learn about new markets and to share resources. To collaborate closely with external partners is not,

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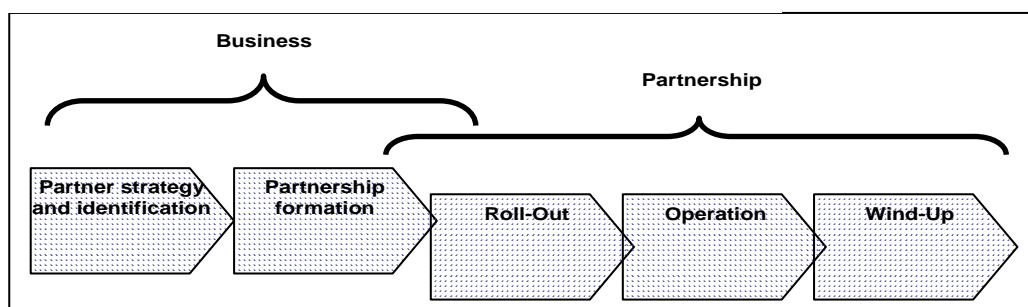
<sup>15</sup> Novozymes annual report 2007, [www.rapport2007.novozymes.com/](http://www.rapport2007.novozymes.com/)

<sup>16</sup> Interview with the manager of the strategy and licensing department, Novozymes

as such, a new phenomenon at Novozymes; however, dealing with partnering in a formal or more strategic way is a new venture for the firm.

In 2005 a partnering project was initiated at Novozymes. The main aim of the partnering project is to strengthen the ability to source knowledge externally and to collaborate with external partners, or as it is stated in the partnering project material, the purpose is ‘to develop a streamlined setup for partnering’. Prior to the initiation of the partnering project a partnering project group found that the internal and external expectations in collaborative projects were not always aligned. In fact feedback from partners indicated ‘that they sometimes view us differently as partners than we do ourselves’. In other words, a need for improving the partnering competences was identified. On the basis of analysis of interviews with both partners and employees, the partnering project group recommended: 1) a stronger strategic anchoring of partnering in the organization; 2) generation of supporting tools and guidelines; and 3) the shaping of a partnering mindset among employees. The different recommendations were implemented by developing, combining and deploying different mechanisms throughout the organization during the subsequent partnering project. One of the central elements of the partnering project is the development of an internal partnering website containing information about the partnering process. A process model is developed, labelled ‘The Partnership Life-Stages’-model, describing the elements of a given partnership. This process model makes up the structure of the website as material can be searched under the different categories of the model.

**Figure 6.1: ‘The Partnership Life-Stages’, Novozymes**

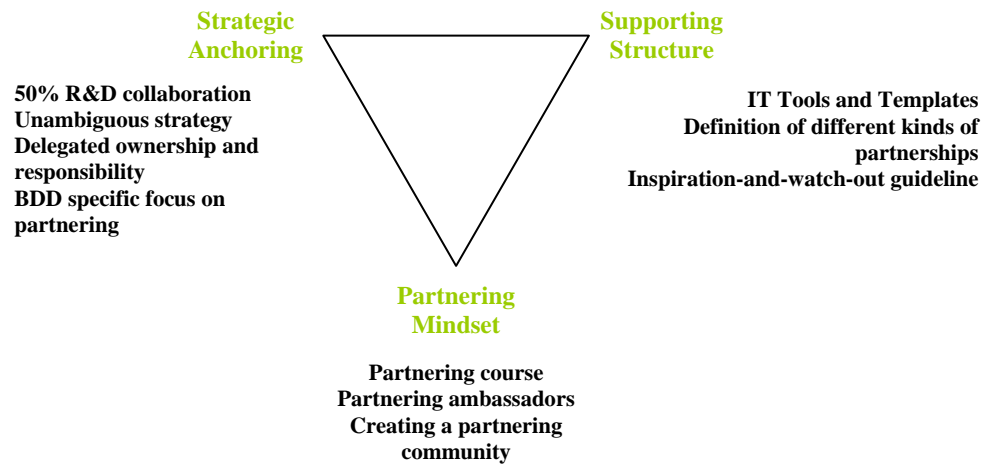


Source: Novozymes, Partnering Project material

Each stage consists of a number of key activities. For instance, the first stage, ‘Partner strategy and identification’, entails description of crucial activities such as mapping ‘Business model options’, ‘Partnering prospect short list’, ‘Internal resource requirements’ etc. Each activity is then matched with a description of practical tools and guidelines as well as a list of inspiration and ‘watch-outs’.

This way the activities along ‘The Partnership Life-Stages’-model integrates strategy, structure and mindset pertaining to collaboration. Figure 2 shows the interaction between these elements in the Partnering Project at Novozymes.

**Figure 6.2: The Elements of the Partnering Project**



Source: Novozymes, Partnering Project material

### 6.1.2 Strategic Anchoring

One of the recommendations from the Partnering Project Group was to develop a strong strategic anchoring of the partnering projects throughout the organization. The strategic anchoring is achieved by developing and communicating a clear partnering strategy along with a well defined policy on how to delegate responsibilities in the partnerships. Attention is devoted to securing that a potential new partnership is in consonance with the existing overall strategy of the specific business area or of the entire organization, and that the new partnership does not collide with existing partnering activities. Thus, when working with partnering as a cornerstone of business development it is important to have a coherent strategy that is communicated in identical terms throughout the organization. At Novozymes, one approach is to write up clear and unambiguous partnership strategies including scope and field limits. This includes clearly delegated ownership and responsibility for each partnership together with cross functional buy-in to strategies. Further, it is a clear strategic objective of partnering to secure market growth and a high level of competitiveness, which by way of example is reflected in the partner-oriented approach in the Biotech Business

Development (BBD) or in New Industries, where partnerships and collaborations are defined as an important means to bringing innovation to Novozymes. The Head of the New Industries department states: 'Creating partnerships is at the heart of the New Industries group and in this respect we see our role as somewhat like that of a matchmaker—to help identify new areas where Novozymes' core technology can be put to work for customers and partners operating in industries that we have not dealt with in a significant way in the past'<sup>17</sup>. As such partnering has become a fruitful way of testing new business areas as a manager state in the following:

In New Industries it is even more urgent that we partner because we might have little or no knowledge about the new market we want to enter and we don't know the customers' demand. When we want to test our enzymes in a new industry it is natural to collaborate; you save time because you don't have to start from scratch, you spare resources and diminish the risk. (#10)<sup>18</sup>

Yet, one thing is to develop a partnering strategy that is convincing and fits the objectives of the strategic business unit in which it is embedded as well as the overall corporate strategy; another is to make this strategy a cause of changed actions in the different business units of the organization. Asking a researcher, who was one of the initiators of a current larger collaborative project, whether the partnering strategy has made a difference in his daily work, he answered:

This (partnering) strategy meant absolutely nothing to me; but it might have made a difference anyway. In this project, I was in contact with the - then - potential partner for a while. Sometimes it starts off as research collaboration where you give away some test material without having a distinct business plan developed. In this case I talked to a number of people at business development [at Novozymes] and they made a note and said that the project was interesting but nothing more happened. Then I meet Marianne from the strategy department and then things started to happen. It could be that the strategy actually made a difference because Silvia was aware of this corporate intention to partner. (#11)

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<sup>17</sup> Interview in BioTimes, an internal Novozymes magazine, December 2004

<sup>18</sup> The figure following each quotation refers to different Novozymes employees. The names of the interviewees are replaced by figures in order to make the employees anonymous. 12 employees have been interviewed during the summer of 2005.

Although the respondent seems to acknowledge that the existence of the partnering strategy makes a difference, it is fairly clear that the quote also reflects that the strategy might not have been diffused to all parts of the organization at the point in time where the interviews were made, which was approximately 6 months after the initiation of the strategy. It further points to the fact that a strategy alone does not suffice. Supporting organizational mechanisms and facilitating tools are other necessary parts of the partnering process.

### *6.1.3 Supporting Structure*

A number of initiatives have been made to ease the partnering activities or help the employees in developing the needed capabilities. An advanced partnering-toolbox is developed as a central part of the partnering project; it is mainly IT based and a part of the partnering website. The toolbox can be searched and used by employees engaged in partnerships throughout the organization. One element of the toolbox is a guideline defining different kinds of partnerships, such as transactional partnerships, tactical partnership, strategic partnership or alliances. Dependent on the characteristics of a given collaborative project it can be categorized and then matched with different objectives or descriptions of supporting routines. For example, a tactical partnership has the basic objective of securing business and it will normally be organized by means of separated work groups in the partnering firms and with limited mutual openness in regards to methods, experiments, sharing of samples and the like. An alliance, on the other hand, has the objective of developing into new business areas and is often designed within a timeframe of 5 to 10 years. The partners are likely to jointly contribute all relevant resources and subsequently split the profit. In this situation, employees may make use of a number of the organizational mechanisms developed in the partnering project in order to secure knowledge transfer and absorption.

Staffing of the workgroups of a given project acts as an organizational procedure developed with the explicit purpose of securing knowledge transfer. A member of Novozymes' Project Management Group (PMG) is always in charge of staffing and developing a convenient meeting structure and communication routines when a development project is launched. When the project is inter-organizational it is even more important to select the right people with an appropriate competence profile, not only in regard to their professional profile but also to their communication and collaboration skills. A project manager from PMG is assigned to help set up the core group of the collaborative project and further assists in staffing a joint steering committee and a joint management committee, typical in larger collaborative projects. Even though the staffing of these groups is partly given by the partnering contract it is important to make sure that the people from

Novozymes matches the people at the partner firm in regards to e.g. level of competence. In collaborative projects it is often important to bring in employees with specific competences at another stage than if it had been an in-house project. Referring to a specific collaborative project, a project manager notes:

When working with a partner it is essential for us in the patent department to get into the project in time to identify the weaknesses that might be in the collaboration agreement. [...] In general we like the collaborative projects because it leaves us with a number of exciting assignments, and we are given a very central role to play due to the unusual allocation of rights. And the decision process is different as well - it is just another culture. Another thing is that there can be a lot of feelings attached to these activities that you often tend to forget. We have to discuss with the researchers whether or not their work can be classified as an invention, and this can be a very hard job in a collaborative project because you have to go through the project manager or whomever. It is just more complex. (#7)

Securing the right mix of people in the core group and bringing them in at the right time is an important part of the success of a collaborative project. As the project manager states it is only when all the competences are combined that valuable knowledge is created. The project manager is designing the communication tools (e.g. setting up tele-conference meetings or an Internet-based partner forum) that can facilitate the interaction in and between the different groups. A meeting structure is agreed upon and the meetings are then facilitated by the project manager. Asked about the competences that are needed when running a collaborative project the project manager answers:

Our core competence is project management: to govern a group of people, and challenge them; question their work and their time schedules. It is even more complex when the project is being done in collaboration. Then we have to make sure that we appear as a professional company and that we stick to the promises we make. [...] My job is to manoeuvre between governing and being service minded, making things happen, and being sufficiently coarse when needed. (#7)

The facilitation of the inter-organizational knowledge sharing is one activity that needs the attention of the project manager. Yet another governance mechanism is being employed in order to facilitate the collection of both technical knowledge and project experiences, and making it assessable to

employees inside Novozymes. This mechanism is called *technology circles*, a project manager describes:

A Technology Circle is not a formal project; it's an opportunity to invite people to share experiences in connection to a specific technology, e.g. pharmaceuticals. Besides sharing experience the members of the technology circle could be offered training courses or invited to visit partner firms that are more experienced in a certain field. (#7)

Many of the initiatives of the partnering project are developed mainly to facilitate the most integrated collaborations namely the strategic partnerships and alliances. Each step of the partnership life-stages model (figure 1) is followed by descriptions of best practice cases and critical success factors. Through these explicit descriptions shared practice is codified and turned into shared routines supporting all parts of the partnering process from partner search to the wind-up-phase. Additionally, each partnership activity is matched with different inspiration and watch-out statements that serve the purpose of making the employees aware of important opportunities or pitfalls. All of the tools and guidelines are available through the partnering website where a number of pre-developed documents guide the employees through the phases of the partnership by help of questions like 'consider why an alliance can fill capability gaps better than in-house development' or 'consider the partnerships from your partners standpoint, given their stakes, ambitions and positions'.

To summarize, numerous efforts have been devoted to designing and implementing organizational mechanisms that, if successfully utilized, can ease the collaborative knowledge production and knowledge sharing at Novozymes. As mentioned earlier, collaborative capability is a dynamic capability that combines organizational level mechanisms with individual competences. At Novozymes, a number of initiatives have been implemented to enhance the collaborative ability of individual employees. This improvement of the collaborate abilities is closely linked to what is referred to as the process 'shaping a partnering mindset' of the employees in Novozymes.

#### *6.1.4 Shaping a Partnering Mindset*

In addition to the strategic and structural mechanisms, a set of initiatives have been designed to enhance the individual employees' ability to collaborate. The overall aim is to foster a partnering mindset or a positive attitude towards partnering and a core part is then the focus on partnering



abilities. In Novozymes a specific *partnering course* is developed and offered to all employees engaged (or expecting to be engaged) in collaboration. It is taught by an external consultant who has designed the course in close collaboration with the partnering project group on the basis of a thorough investigation of the needs of the firm. The course is seen as the best possible way to align the defined principles of how partnerships are to be carried out and managed and the individual abilities to collaborate. In order to attain this link between principles and practice the course addresses real partnership challenges provided by the course participants. In one course session the participants are working with partnership related issues such as the importance of mutual dependence, commitment to the project, and the appropriate behaviours in collaborative projects. In addition topics such as the importance of openness and clear communication procedures, and the possible style differences in management that can be observed in a collaborative project are covered in these courses.

Another initiative is the designation of a number of *partnering ambassadors* throughout the organization. The ambassadors are experienced employees that are able to coach colleagues in a partnering process on the basis of prior knowledge and experience. The ambassadors form a ‘partnering community’, a community with the purpose of ensuring that the partnering experiences are collected and shared throughout the entire organization.

We would like to see a small number of people, maybe 3 or 5, devoting their time to partnerships and being drawn on as a sort of mentor or coach when an Account Manager or somebody else has to begin a partnership. (#10)

Beyond the purpose of ensuring better practice-sharing and implementation of know-how throughout Novozymes, members of the cross-functional partnering community, the ‘ambassadors’, are requested to identify the relevant training needs of the employees. Not all employees need the same amount of supervision and access to tools and guidelines. Thus, in spite of the standardization of the processes everything has to be designed in a way that leaves room for interpretation or, as the project manager puts it:

[We will] have to make it as simple as possible and make a lot of things optional in order to prevent the system from becoming too ponderous. [...] Every employee has their own opinion on formal partnership tools. Some people seem to say, ‘Nothing better than a toolbox,’ and they can hardly get one that is big enough, and

then there are those who get that panicky look in their eyes when they imagine all those huge, bulky processes. (#10)

The individual motivation to engage in a collaborative project is something that affects the collaborative projects and hence needs to be actively managed. When asked about the motivational differences between working in an in-house project and a collaborative project a manager from Development refers to a specific collaborative project and says:

This project is special because we don't always know what to deliver. I can't tell my people what we need to do for the next three months because I actually don't know. Well, I like it. I am very open minded, but not all people of the project group like it, simply because delivery is not well defined. (#2)

The capability of individuals within an organization to collaborate effectively is a function of *ability* and *willingness*. As the above quote shows the single employee's willingness to take part in an often not-well-defined collaborative project is something that the project manager needs to address when assigning employees to collaborative project groups. As illustrated above, Novozymes is actively managing individual partnership ability through a series of training courses combined with the building of a community of partnering practice. In the narrative description following in chapter 6, I will focus on the specific collaborative abilities that are at stake in Novozymes. Willingness, on the other hand, seems somewhat more elusive to manage as it is grounded in individual values, attitudes and motivation. However, without relevant fundamental ability to collaborate the effects of collaborative capability would be discounted even if willingness was present. Moreover, simply gaining ability may sometimes act as motivator for subsequent application of these same abilities. Hence, it seems the decision taken in Novozymes to focus explicitly on developing collaborative abilities among its employees is a valid foundation for fostering willingness to collaborate.

## **6.2 Collaboration is the Key to new Knowledge: the Novozymes Narrative**

The partnering project, described above, aimed at preparing both the Novozymes organization and the employees to the rising number of partnering activities that was planned for the coming years. The ambitious goal is that 50% of the R&D of the company is to be undertaken in collaboration.

A recent manifestation of the partnering strategy in Novozymes is the collaboration with Solvay Pharmaceuticals; a business unit of the Belgian company Solvay S.A. The primary aim of this collaboration is to develop new products for patients unable to produce a sufficient quantity of digestive enzymes<sup>19</sup>. Whereas Novozymes is already operating at the forefront of the field of enzyme production on the basis of biotechnology, applying this knowledge to the pharmaceutical field is a relatively new Endeavour. Solvay is essential to the success of this venture due to its position as a market leader in the treatment of pancreatic exocrine insufficiency. In addition to the immediate economic and research related advantages of this project, collaborating with Solvay is expected to give Novozymes an opportunity to learn more about operating in the field of pharmaceuticals.

With an ambition of doing half of their research and development activities in collaboration with external partners, it becomes crucial for Novozymes to understand how they can be instrumental in designing the required supportive structures and ensuring that the employees are able to participate in the collaborative activities. However, as shown in chapter 4, a number of factors impinge on the development of the collaborative capabilities. Thus the ways in which individuals may act and interact on the basis of the different organizational level initiatives are crucial to take account of when we want to understand the nature of collaborative R&D capabilities. Referring to the framework developed in chapter 4 on the basis of the Coleman diagram I will investigate whether the critical elements of collaborative R&D capabilities are present in Novozymes—and if so; in what form they exist. The first section 6.2.1 (*Why Collaborate?*) analyzes the overall corporate wish to collaborate illustrated by arrow 4 of the framework developed in chapter 4. In section 6.2.2 (*How Corporate Aspiration Impinges on the Individual level Conditions*) deals with the dynamics of arrow 1 that describes how the corporate wish to collaborate impinges on individual level conditions. Part 6.2.3 (*Being willing and able to Engage in Research Collaboration*) matches arrow 2 of the analytical framework as it directs our attention to the processes where the willingness and ability of the individuals lead to collaborative behavior. Finally, part 6.2.4 (*Individual Behavior Impinging on Organizational Capabilities*) investigates the

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<sup>19</sup> Worldwide, around 880.000 people are unable to produce the enzymes that help the body to digest food. Normally the enzymes in the stomach and upper digestive tract ensure that the food is broken down into small pieces, which can be converted into energy for the body. Typically, it is patients with cystic fibrosis or pancreatitis or those who have undergone pancreatic surgery who are the ones deficient in the relevant enzymes ([www.novozymes.com](http://www.novozymes.com)).

dynamic relations of individual level behaviors and organizational level collaborative capabilities, as illustrated by arrow 3.

#### *6.2.1 Why Collaborate? (Arrow 4)*

Even though the benefits of collaboration argued by Novozymes are diverse, one central argumentation runs through all communication on the reasons for engaging in partnering activities. It becomes abundantly clear in the following statement made by a research manager:

There is no philanthropic reasoning here; that 'if we do research together we can save the world'. I think it concerns the fact that it is, economically, the only right thing to do. Then there are a number of reasons as to why it economically is the right thing to do. And it is correct that when two different company cultures meet we will always learn something. We learn from this diversity. But it all boils down to the need for results at the bottom line. I cannot recall that we or other companies would collaborate for any other reason. (#2)

The overall economic purpose of collaboration is both expected and apparent. Still, as we shall see when we direct attention to the specific collaborative project that Novozymes has engaged in with Solvay pharmaceuticals, the reasons for collaboration become more diverse and so do the challenges meeting the collaborating firms. It is important to study the reasons for collaboration closely in order to understand how the new collaborative activities affect the behavior of the employees.

The collaboration between Novozymes and Solvay began in the fall of 2004. Marianne Weile Nonboe from the Licensing and Strategy department had been exploring the possibilities of issuing licenses on different Novozymes patents for some time when she was contacted by Solvay Pharmaceuticals. Solvay was looking for a purer and safer enzyme to improve one of their existing products. At the same time, Novozymes researcher Allan Svendsen learned that Solvay was looking for a new partner and it became apparent that there was an opportunity for more than just issuing a license to Solvay. After thorough negotiations involving a number of persons from both Novozymes and Solvay, an agreement was made to establish a collaborative research project. A contract was signed in November 2004.

The primary purpose of the project was to meet Solvay's need for a fast delivery of enzymes to ameliorate their existing products in a way that could make them cope with the fierce competition. As they informed the employees at Novozymes they had the feeling that they were outstripped by their competitors, one of the reasons being that they had gambled on the wrong partners. They were in need of enzymes they could use right away. This need was complied with in what was labelled the 'short term project', a project with the primary aim of defining an add-on lipase to supplement Solvay's existing product, Creon, which had proved to be inefficient on a number of points.

In Novozymes the collaborative project was considered to have yet another promising benefit in addition to the economic gain they would get from the licensing agreement: Through the close collaboration a scope was offered for learning how to operate in the pharmaceutical field. The pharmaceutical field is seen as a viable area for business expansion and a number of reasons are given as to why the pharmaceutical field is a promising place to make use of the biotech enzymes that Novozymes produces. First of all, enzymes that are produced using biotechnology are purer and safer than enzymes from animals (e.g. pigs) and this is a very important feature if you want to engage in pharmaceutical production. Second, the fact that this production method offers the possibility of tailoring the enzymes to satisfy the varying needs of different patient groups makes it especially interesting. A third advantage pertains to the fact that these enzymes can also be produced in higher concentration resulting in a smaller amount of pills that need to be taken by the patient. Additionally, the fact that these enzymes do not come from pigs could be important when addressing, for example, the kosher market.

Due to the wish for utilizing the potentials in these very diverse fields the project was born with a somewhat two-folded purpose: first, the research was meant to result in the definition of a specific enzyme that could match Solvay's need, and second, Novozymes desired to gain insight in the pharmaceutical field. In order for them to be able to store the knowledge and experience they would potentially gain in this project they needed to organize the project in a way that provided the needed integration and diffusion of knowledge in the company. This venture into new disciplines constituted a learning potential and it was important for Novozymes to ensure that new knowledge was anchored in the company as the project went by. As an employee stresses:

We are entering a new field and some competences will be stored separately in every little business unit. But how are we going to share the knowledge and collect it? That is a challenge. (#7)

The decision about entering into the collaborative project was taken at the corporate level, yet it influences a number of individual level issues as we shall see in the following.

### *6.2.2 How Corporate Aspiration Impinges on the Individual level Conditions (Arrow 1)*

The corporate aspiration in Novozymes to grow through partnering has been a contributory cause to the development of the partnering project and the numerous tools and guidelines that has been designed. At Novozymes, initiatives have been carried out with the purpose of ensuring that knowledge is shared between employees and that experience and best practice are retained, as described in chapter 5 when introducing Novozymes. An example is the partnering community where experienced employees can supervise colleagues that are engaging in collaborative projects for the first time. It is very important that a firm like Novozymes deliberately assesses what kind of knowledge they want to obtain and which relations to build for this purpose. When knowledge about new work processes and radically different areas is asked for it demands tight relations between the participating firms. As is the case with the long term project with Solvay, where the focus, among other things, is on learning to operate in the pharmaceutical business, building and maintaining a tight relation must be in focus.

The different initiatives that have been designed and implemented in Novozymes serve the purpose of both fostering a collaborative mindset of the employees and enabling them to work in close collaborations. A number of organizational mechanisms have been implemented at Novozymes to support the employees engaged in collaborative projects. The course program provides employees with important competences beyond the scope of their professional training. Rules and guidelines have been successfully established to support the employees in creating and maintaining inter-organizational relations. These initiatives have affected the ability to collaborate and they have helped foster willingness towards collaboration; at least that is how the majority of the employees engaged in the Solvay collaboration project describe it. One of the core aims of the partnering project was to foster a positive mindset towards partnering. This is not an easy task and a few quotes indicate that is not always in the interest of the Novozymes researchers to open their processes to partners outside the organizational borders.

### *6.2.3 The Project Design: A Stroke of Genius or a Source of Conflict?*

According to one of the researchers, the idea to launch a long term and more research oriented project parallel with the short term project was fostered by Novozymes, but the people at Solvay



It appears that more persons are allocated to the project in Novozymes than in Solvay. This might be due to the fact that Novozymes plan to learn a lot from participating in this project, thus employees from many different business units are taking part in the project, some of them on an occasional basis. Additionally, Solvay may have people working on the project behind the lines and these people may not show up in the formal list of participants. However, employees of Novozymes have been taking on many of the tasks that could be seen as shared responsibility, such as the project management task including the design of the project web. A rough sketch of the project structure was presented to Solvay at the kick-off meeting, and the project manager at Novozymes has been functioning as a facilitator of the telecom meetings throughout the project. The assistance he is normally offering to the participants of an internal project has in this case been offered to the partner as well.

In a collaborative project you will have to communicate with the partner as well. Take care of the external teleconferences, make sure we are present. There is an extra dimension, it is just more complex. You constantly have to maneuver between governing and being service minded, making things happen, and being sufficiently coarse. (#8)

Talking about which employees are involved in the short term project group, the project manager states that the composition of the core group of the Solvay project is not like an ordinary group. This is due to the fact that the enzymes are going to be utilized in other products than normally and that they for this reason need to fit to new standards.

The composition of the group is unusual because the project is completely different. Normally, we would never need two quality assurance people in our core group, but in this project they are very important (#8)

In comparison to other new projects the collaborative project with Solvay is more integrated in the organization. Often a project as big as the Solvay project is established in a new separate business unit, with loose strings to the main organization, yet this is not the case with the Solvay project. As an employee comments, the Solvay project seems more robust due to the fact that it is organized, managed and staffed more like an internal project. The project is managed by a Joint Steering



Committee (JSC) and a Joint Management Committee (JMC) with members from both companies (see overview of Management Committees, table 6.4). Additionally a number of employees are connected to the project on an ad hoc basis when their specific competences are needed.

**Table 6.4: Managerial Committees**

Body	Novozymes	Solvay	Key Activities and Responsibilities
Joint Steering Committee	2 members	1 members	<ul style="list-style-type: none"> <li>• Monitor performance</li> <li>• Resolve disputes</li> <li>• Meet twice a year</li> </ul>
Joint Management Committee	5 members The sub group leaders	3 members The sub group leaders	<ul style="list-style-type: none"> <li>• Reports to JSC</li> <li>• Meet a couple of times per year</li> <li>• video /teleconferences</li> </ul>

As mentioned, the short and the long term projects were initiated somewhat simultaneously and under the same agreement. Still, the plan was to continuously evaluate the viability of the long term project. Serving as a ‘back up plan’ for the short term project, it became clear that the long term project would lose some of its raison d’être should the short term project succeed. The underlying rationale was that if the attempt to identify existing Novozymes-enzymes matching Solvay’s need for purer and safer enzymes, which was the aim of the short term project, should fail to pass the clinical tests, this goal could then be pursued in the long-term research project. As stated by a researcher:

We are, in fact, never sure about a project. The overwhelming majority of these projects fail in clinical tests and there is also a risk that they are not the most optimal ones seen from a cost perspective. That is what we are trying to address in the long term project, it is simply a matter of spreading the risk; if it fails in the clinical tests we can make yet another attempt. (#4)

While the short term project was fully staffed both in terms of researchers and managers and kicked off immediately, the long term project seems to have had a more loose bearing from the outset. Moreover, no one had fully decided what would happen if both the short term and the long term

project should be successful, and exactly how success was defined in the case of the long term project.

[Solvay] did actually not make any guidelines for what the long term product is supposed to be capable of, like: "What would it be really great if we could produce in ten years time?" ...It is a discussion that will be going on for some time: who is going to decide the strategy for the long term project? I was in on it from the beginning, but at the moment I don't know what is happening ... the long term project is in need of some overall strategic planning. (#5)

What looked like a very efficient project design at the outset could turn out to be a source of internal conflict as some employees might have an interest in the endurance of the short term project while others were more interested in securing the survival of the long term project. Still the project has weathered the storm and the organizational design could even facilitate the integration of the new knowledge in Novozymes as the members of the two project groups, the short and the long term, keeps communicating and make sure that knowledge is both extracted from the shared project with Solvay, and, even more importantly, distributed to all relevant departments and employees at Novozymes.

Another important theme that has been brought up for discussion relates to the question of where the enzymes should be produced if the project succeeds. At the outset Solvay wanted Novozymes to take care of the production issue, and as Novozymes had just previously bought a small laboratory with production facilities in Sweden, BioPharma, it suddenly seemed feasible. Even though the Swedish company BioPharma is owned by Novozymes it is referred to as a 'third party' in relation to this collaborative project, as it is economically and legally independent. Still, whether this factory could be optimized to meet the pharmaceutical standard, the cGMP, or Novozymes were to build a new large scale production facility, or even outsource the production to a third party, has been a subject to ongoing discussions, in which a number of partners have been participating. A primary issue has centered on the need for Novozymes to know a lot about the quality standards in order to be able to come to a decision on the production issue. As stated by the BioPharma manager:

When you participate in a collaborative project like this, where in this case Solvay needs to deliver the knowledge we request, it becomes a huge issue to the project

group. We have to challenge Solvay and say, “We really do need to know this now.” We need to know about the claims and about the regulatory issues. We want a pharmaceutical that is valid with bagpipes and marching drums, because we want to be sure that the medicines agency will validate it. (#9)

In sum, a number of issues have been discussed from the outset of the project pertaining to how the project was best organized and especially how the strategic aims of both profiting economically and gaining new knowledge were met. In many ways this collaborative project was seen as an option to learn—both in regards to this specific research field and in regards to the act of collaborations as such. As described in the previous chapter a number of initiatives have been taken in Novozymes in order to prepare the employees to the collaborative projects they were to engage in. Especially the fact that the completely new knowledge to be produced in this project was a challenge that was to be handled. The project was organized in a more integrated manner than a large new project normally would be. It is not unusual that larger collaborative projects are given a separate business unit but not in the case of the Solvay collaboration.

In general, the organizing of the collaborative endeavor with Solvay bears witness of the concurrent aims of both exploiting existing enzymes and exploring new knowledge on enzymes needed for the next generations of products to help out patients unable to produce the sufficient amount of digestive enzymes. Some of the ongoing discussions may express the difficulties in balancing the short run and long run goals in the project. Still, it is important to keep in mind that both projects may be vital to Novozymes and the best solution may be to aim for a certain degree of cross-fertilization of the projects. In order for the collective collaborative project to become a success a good relation between all involved employees must be created. In general the employees refer to the project as characterized by openness and trust between the participants. Asked how this trustful environment has been established an employee refers to the effort that has been put into the first phases of project creation:

It is important that the thorough talk that preceded the project was taken with some senior persons at Solvay. Often when it [the wish for collaboration, red.] comes from the researchers, you meet with people involved in research, but not involved in managerial decisions. And then when you start the project it might happen that some new people are involved and they set limits to the project and by that the tone gets too rigorous. (#11)

The initial effort that was made to create a good atmosphere in the project is noted by more than one employee. Especially, the early and continuous contact between Solvay and both researchers and people from the Strategy and Licensing department of Novozymes seems to have been creating a prolific foundation for the succeeding project activities.

When we started communicating with Solvay about the project it became clear that this was not an inferior piece of work. It demanded a relationship of trust. I am talking about the period before we started the actual relationship, where Marianne (from the License and Strategy department, red.) and others had spent a long period of time talking to Solvay. (#8)

According to the employees at Novozymes the project has to some degree been dependent upon the effort done by exactly this centrally placed person from the Licensing and Strategy department. In the following quotation, a researcher describes how he tried to get different persons interested in building up a relation to Solvay. Still, nothing happened until he contacted Marianne Weile Nonboe:

In the passing year I asked a number of people from Business Development, who are responsible for initiating new projects... they thought it was an interesting project, yet nothing more happened. I was trying to catch up with someone in the organization, but nothing happened until I met Marianne. (#11)

It is quite conventional to have a person from the Strategy and Licensing department playing a central part in the beginning of a project where the contact is made with the partner and the contract is drawn up. Yet, what is unusual in this project is that the central person from the Licensing and Strategy department, Marianne Weile Nonboe, is still participating in the important meetings and keeping her seat at the Joint Management Committee. What could explain this is that a number of central issues still have to be resolved throughout the project, e.g. which production plant to use. While being responsible for the different agreement and contracts, Marianne Weile Nonboe needs to maintain her insight in the project to be able to know what kind of activities that will be going on in the future. Further, it seems that this project has benefited from having one single person following it from its initiation and all the way through. Even when the contract is agreed upon and

the goals and milestones are settled, the success of the project still depends on whether a trustful relation is created and maintained. Having a knowledge broker maintaining the relation between the two partner firms as well as the two project parts has been highly beneficial to Novozymes, - and expectedly also to their partner.

Many of the initiatives at Novozymes have spurred a wish at the employee level to collaborate closely and thus the initiatives in general can be said to be causing a positive collaborative behavior. As touched upon in chapter 4, some employees will be of special importance to the process of collaborating. They will act as *gatekeepers* as they stand in the interface of the firm and the external partners (Cohen and Levinthal, 1990) and their attitude towards partnering will be especially important. In some cases the function of the gatekeeper will be mainly to monitor and build relations to relevant external partners, whereas under other circumstances it will be necessary that they 'translate' the new information to the rest of the group, or act as mediators between the partner and the relevant employees of the focal firm. In the Novozymes-Solvay collaboration it is apparent that especially one person fill the post of the gatekeeper, namely Marianne Weile Nonboe from the licensing department, who has been instrumental in fostering the relation to Solvay in the first place as well as playing a key part in maintaining a good relation between the two partners throughout the project. A number of the characteristics applied to the role of the gatekeeper can be witnessed when studying the role that she has played, as well in the initiation of the collaboration with Solvay as throughout the project. As mentioned in the employee interviews, Weile Nonboe's participation in the project is generally seen as essential to its success. She played an important part in building up a trustful relation, and she has created the necessary links between employees at both Novozymes and Solvay.

#### *6.2.4 Being willing and able to Engage in Research Collaboration (arrow 2)*

Fundamental to the R&D process is the creation and use of knowledge. Choosing to open up to external sources of knowledge in the R&D process serves the purpose of accessing complementary knowledge, that is knowledge that adds to and matches the knowledge already at hand. The advantages of gaining access to new and complementary knowledge held by a partner seem to be widely acknowledged throughout Novozymes. Still, collaboration is not only a question of getting access to new knowledge faster, it is also seen as profitable way of obtaining synergistic effects when knowledge from different firms is used in the process of reaching common goals. Hence, the fact that the result of combined actions is greater than the sum of its parts is referred to a number of times in the interviews.

Fundamentally, partnering is the only right thing to do. As I see it, doing everything alone is a very old-fashioned way of doing business. Ideally, one plus one should make three and that happens if you bring in something different. (#2)

Even though Novozymes is engaged in a number of partnerships, the collaboration with Solvay is unlike the typical collaboration Novozymes usually is engaged in. The unusual organizational anchoring has been touched upon, but yet another difference compared to other collaborative projects lies in the fact that this collaborative project is done at an unusually early stage of the R&D process. Novozymes is used to collaboration in close manners with users of their enzymes, which are often large companies such as Chr. Hansen<sup>20</sup> with whom they do a number of projects. Yet the long-term part of the collaboration with Solvay is taking place at the other end of the R&D process. A researcher involved in the long-term project explains:

Normally we are doing it [the R&D] ourselves because we see a business potential, and we pay for the R&D expenses, expecting that somebody will buy it when we reach the target. But Solvay is a different kind of collaboration, because it is at an earlier stage, we get paid for the R&D and they want to buy the end product as well. (#11)

The unusual focus on the early R&D phases in this project calls for other employees to be engaged in the project than the ones who are normally involved in collaborative projects. This is a challenge to some employees who are not familiar with the uncertain nature of a collaborative project. A research manager states:

This project is special because we don't always know what to deliver. I can't tell my people what we need to do for the next three months because I actually don't know. Well, I like it. I am very open minded, but not all people of the project group like it, simply because delivery is not well defined. (#2)

The individual motivation to engage in a collaborative project is something that affects the collaborative projects and hence needs to be actively managed. The capability of individuals within

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<sup>20</sup> The Danish company Chr. Hansen develops natural ingredient solutions such as cultures, enzymes, colours and functional blends. The ingredients are used in the food, pharmaceutical, nutritional and agricultural industries.

an organization to collaborate effectively is a function of ability and willingness. As the above quote shows the single employee's willingness to take part in an often not-well-defined collaborative project is something that the project manager needs to address when assigning employees to collaborative project groups. As illustrated in chapter 5, Novozymes is actively supporting the development of the collaborative ability through a series of training courses combined with the building of a community of partnering practice. Willingness, on the other hand, seems somewhat more elusive to manage as it is grounded in individual values, attitudes and motivation. However, without relevant fundamental ability to collaborate the effects of collaborative capability would be discounted even if willingness was present. Moreover, gaining ability may sometimes act as motivator for subsequent application of these same abilities. Hence, it seems Novozymes decision to focus explicitly on developing collaborative abilities among its employees is a valid foundation for fostering willingness to collaborate; a precondition for collaborative capability.

Talking about what motivates the employees to make an effort in a project like this, a researcher mentions the fact that the Solvay project is done in new and different research areas, which can be a motivational factor in itself:

Some of the enthusiasm [in the Solvay project] is owed to the fact that it is a new area [...]. We have already been producing many enzymes for detergents, now we might be getting something really different. And then it is great fun to work with others, getting a sparring partner and being exposed to some different demands. (#12)

Another manager puts it like this:

There is a little hype about it; 'Wauv, we have got a big agreement and we are going to make a difference by helping out people with scleroses and not just making enzymes for detergents'. Don't get me wrong; we know that it is a sound business to make enzymes, but there is certainly some additional hype around this project. (#2)

The Solvay project is characterized by a high degree of openness between the two firms, a fact that might help improve the desired knowledge sharing. As stated by an employee:

The characteristic feature of the Solvay project is that it is extremely open. I have never been involved in a collaboration that has been that open. They know everything we are doing – everything. This morning I sent some internal documents, which I would otherwise never have handed out, but they asked for them yesterday, so... (#2)

A relation like the one with Solvay where very sensitive information is shared and new core knowledge is produced needs to build on mutual trust. Even though a number of key issues are described in the underlying contract a collaborative project must be based on the members' reciprocated confidence.

You need to put trust in that they are serious people and that they have the same goals as you. These things cannot be booked in a contract. (#8)

#### *6.2.5 Individual Behavior Impinging on Organizational Capabilities (arrow3)*

As stated in the beginning of the chapter, the partnering project at Novozymes aimed at preparing the employees and thereby the organization to gain the most of the rising number of collaborative projects that is expected to be initiated over the coming years. A core focus has been to provide the employees with the capabilities needed to secure a successful outcome of the many collaborative activities. A general tendency of openness towards external knowledge sources in the innovation process is unquestionably gaining ground, and this makes it even more relevant to secure the development of the specific capabilities that support the inter-firm processes. In Novozymes, the overall label of collaborative capabilities covers the ability to communicate with external partners. This means that you have to know exactly how to disseminate the knowledge you hold and make it useful to the partners. For this to happen, the researchers must be more precise in the codification of their knowledge as also knowledge that is normally more tacit in character needs to be articulated to be transferred to an external partner. Besides the focus on the ability to communicate and transfer the relevant knowledge, a general ability to understand partners need is vital. By managing the expectations of the partners focus is put on the incremental value of the partnership as well. Expectation management is important in this context. It relates very closely to what the partnering group at Novozymes calls cultural compatibility. Cultural compatibility has to do with having an



open mind towards partners, wishing to build a close relationships and understanding the importance of personal chemistry.

An additional issue that must be handled carefully by Novozymes in this project is to overcome some of the communicative barriers that potentially exist between sub units inside Novozymes. A trustful relation between the Novozymes employees that are engaged in the two parts of the collaborative project is essential to the processes of the internalization and diffusion of new knowledge in Novozymes. Thus, the ability to communicate inwardly in the group may even enhance the ability to communicate with external partners, and in this way there may be a trade-off between the internal absorptive capacity and external absorptive capacity of the collaborative group. While both internal and external absorptive capacities are important components of a firm's organizational learning, excessive dominance by one or the other will be dysfunctional. If all researchers in a group share the same specialized knowledge, coding scheme or specific expertise they will be good at communicating with each other but they may have a hard time relating to an external knowledge source.

### **6.3 Analysis and Conclusion**

The focus on access and utilization of this new knowledge leads to a different way of organizing the project than normal. The Novozymes-Solvay collaboration has its roots in both a wish to exploit and explore resources and knowledge. This has been apparent through the design of both a short term and a long term project part, and this twofold aim has called for the utilization of a range of different abilities. The project is not just about agreeing on a given division of labour in a resource intensive project; rather, it is a project where a groups formed by employees from the two partnering firms are working closely together with the aim of sharing knowledge and expertise while providing the research results that are asked for. In the short-term project in particular an effort has been made to establish trustful relations, achieved for example by very frequent interactions in the beginning of the project. Many resources have been devoted to organize meetings and joint project activities. By creating an environment based on mutual trust the managers hope to smooth communication and ease knowledge sharing between the two firms. As the short term project was the first to be carried out, this has also been where a special effort has been made to build a close relation between participants.

In spite of the two somewhat different aims of the collaborative project, represented by the short term and the long term projects, the management team at Novozymes has decided that the

Novozymes employees that are members of the two projects have to interact and share relevant information. Focusing specifically on the goal of assimilating new knowledge, this way of organizing the project seems very productive, as new knowledge and results are shared easily. More importantly perhaps, it is not only R&D related technical knowledge but also knowledge about the different work processes related to different business areas that is shared. By collaborating on a project in a new field of business, in this case the pharmaceutical field, it is likely that new knowledge find easier means of being transferred. In addition to creating good relations to the partner firm, Novozymes has chosen to organize the project internally in a way that may have yet another advantage. Securing the internal knowledge sharing and diffusion of knowledge produced in the collaboration is a big challenge. The organizational set-up of the collaborative project could meet this challenge because the employees participating in the collaborative project are neither removed from their daily workplace nor organized into anything like a separate business unit. Instead, they meet for project meetings frequently. This is done in order to ease the diffusion of knowledge as the employees return to their colleagues and report on the improvements of the Solvay collaboration.

Novozymes can without doubt be categorized as an organization marked by the open innovation paradigm that was described in chapter 3. A number of initiatives have been taken to ease the use of external knowledge sources. Indeed, the open innovation perspective seems to have permeated the organization at both corporate and employee level to a significant extent. The strategic importance of external knowledge sources has been recognized and there is a growing interest in collaborative research projects throughout the company. Initiatives, such as the Partnering Project, seek to foster a positive mindset towards collaborations that reach outside the organization. We have studied the collaboration with Solvay as an example of a collaborative project at Novozymes. It has been noted in the interviews that the Solvay project differs from how a collaborative project is normally organized. Still, due to the ambitions of turning the collaboration with Solvay into a fruitful and long-lasting relationship, there is a lot to learn from this case as it will be shown in the following.

There is no doubt that, in addition to the core areas of doing forefront enzyme related research, Novozymes will gain from the work they have already done on developing the collaborative competences and tools to support the employees in their interaction with external partners. As the many mechanisms that have been described in the Novozymes case are developed and implemented throughout the organization, the employees at Novozymes possess a very valuable

competence that is likely to give the firm a competitive advantage. Thus, building and maintaining collaborative capabilities constitutes an important potential competitive advantage for Novozymes.

**Table 6.5 Collaborative R&D Capability Elements at Novozymes**

<b>Core theme from the framework</b>	<b>Practical examples observed at Novozymes</b>	<b>Comments from Novozymes context</b>	<b>Challenges to analytical Framework</b>
Arrow 4: <b>The relation between a corporate wish to collaborate and the development of collaborative capabilities</b>	The partnering strategy  The partnering project	Partnering strategy is a tool to explicating the goals of collaboration	
Arrow 1: <b>Corporate aspiration to collaborate impinge on individual collaborative conditions</b>	Creating opportunities to collaborate and making them visible. Explicating the goals of collaboration  Short term project is mainly about exploitation—long term project is exploratory in nature. Exploration /exploitation may require different abilities	IT based structures like communication tools and process guidelines have supported both internal and external communication	Exploration and exploitation activities are not necessarily either-or. The two project parts have benefitted from a certain degree of overlap of participants.  Some employees may engage in collaborative project just because they find the research topic interesting, not because they are motivated to collaborate. This suggests a link from the upper left corner of the framework to lower right corner
Arrow 2: <b>Individual collaborative conditions affect the collaborative behavior</b>	Willingness and ability to collaborate is vital  Partnering course and partnering ambassadors are increasing ability and willingness	Large difference in motivation schemes. Some employees have been reluctant to participate in collaboration because of indistinct aims  Others are motivated by the fact that collaborative projects are opening the doors to new research fields or because the results will potentially be used to produce medicine	Organization of project may hamper motivation  Arrow 2 is not always a positive relation; differences in personal motivation schemes may work against a collaborative behavior
Arrow 3: <b>Individual collaborative behavior leading to corporate collaborative capabilities</b>	Knowledge sharing behavior  Knowledge Co-creation	Ambassadors are guiding colleagues  Collaborative behavior is aligned through training	



## 7. NOVO NORDISK

### Knowledge Sharing Practice at Novo Nordisk

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*When the project changed its status  
from being 'just another project'  
to being a serious collaborative project,  
every body changed their perception of it.  
(employee Novo Nordisk)*

#### **7.1 Acknowledging the Value of External Knowledge: Introducing Novo Nordisk**

The firm playing the focal part in the second narrative is the Danish pharmaceutical company Novo Nordisk A/S, a world leader in the field of diabetes care. Novo Nordisk is a case in point of the numerous R&D intensive companies that has acknowledged the importance of external knowledge sources. In Novo Nordisk R&D collaboration has been strategically accepted as a desired way of acquiring new knowledge and recently knowledge sharing has been acknowledged as a core activity in collaborative projects. This seems both theoretically and practically to be an appealing decision. Previous research has strongly established that knowledge sharing is imperative for gaining advantage from R&D collaboration, regardless of whether the motive for entering into a collaborative project is cost related, based on a wish for sharing resources, a need to learn new competences, or a combination. A successful outcome of collaboration relies on the ability to share knowledge across borders and contribute to new either local or joint knowledge production. And this has been acknowledged in Novo Nordisk as well. Still challenges do come about and as we shall see in this narrative knowledge sharing is by no means as straightforward as it may sound.

When venturing into the field of biopharmaceuticals in 2005, Novo Nordisk decided to build parts of this new business area on knowledge sourced externally. This strategy is opposed to the earlier dominant logic of the firm which implied that research must be done on the basis of internally developed knowledge and technologies. This open strategy exposes a company that expects to gain competitive advantage and become even more innovative by interacting with external partners on projects of vital importance to the company. A number of asymmetries may exist in R&D collaboration that might create barriers for knowledge sharing between firms. To understand the asymmetries, how they affect knowledge sharing and how they may be mitigated is the aim of this narrative that offers an insight into the organizational practices and individual competences that are needed to overcome these challenges. The narrative has its strength in

showing how the individual level factors work together with corporate initiatives in facilitating inter-organizational knowledge sharing.

### *7.1.1 Knowledge Sharing Practice*

A specific focus is put on a single collaborative project between Novo Nordisk and the American Biotech firm ZymoGenetics. The collaboration is unique because it is based, not on a standard collaborative research and development (R&D) agreement, but on a specific ‘Knowledge Sharing Agreement’. As knowledge sharing is pivotal in this collaborative project it is particularly well suited for examining 1) the disposition of knowledge sharing, and 2) the factors affecting the outcome of knowledge sharing in a collaborative R&D project. The project studied is labelled the ‘IL21’ project. It belongs to the field of cancer research and it is part of the newly launched business unit, *Novo Nordisk Biopharmaceuticals*. The new business unit is, as mentioned above, built upon different principles than the classical business unit *Novo Nordisk Diabetes Care*. The new Biopharmaceutical unit will for instance be more internationally anchored and will rely more on in-licensing of promising new candidates. In other words, the new unit builds on the idea that the basic research does not have to be of ones own making to be a good foundation for further development. The following quote of a manager in Novo Nordisk exemplifies this:

We are completely dependent on small biotech companies that come up with good ideas. We do not come up with them ourselves. It is apparent that we do have some very excellent people, yet it is hard to keep on fostering new ideas. We do try, but we look for other projects as well. Thus, collaboration will become the thing to do (#3).

The research done in the new business unit belongs to a very immature research field compared to diabetes; namely, the field of therapeutic proteins. Not only is this field less developed it is also a high risk area. All in all, the research of the business unit will rely much more on integration of external knowledge incorporated through collaborations and the like. A research manager emphasizes that in his perception there exists a notable difference between the two ‘parts’ of Novo Nordisk which pertains to the experience and collaborative capability:

The employees at Diabetes Care have lived a much more quiet life because of their ability to be self-sufficient in their area—and they do think that they are the best in

the world. But they have been lulled into illusions due to the lack of interaction with others. They have had nothing to strive for, as long as they did well in the insulin field. These people; and it is actually half of those who work at Novo Nordisk, do not know what it means to collaborate with other companies because they were never forced to do so. They had to protect their data until it was publishable. Our response, in contrast, is to talk to people, because that will bring you further on. It is perceptible inside Novo Nordisk that we are in fact two companies; Bio Pharmaceuticals and Diabetes. (#3)<sup>21</sup>

Even though this perception might be on the managers own account it signals a development that is visible both in Novo Nordisk and other knowledge intensive firms, namely that collaboration is vital and that it necessitates the acquiring of a new set of competences to be handled successfully. These collaborative R&D capabilities will play a core part in the narrative as I search for the factors that either stimulate or hinder these capabilities. Due to the focus on capability development the study will deal specifically with the focal firm, Novo Nordisk, and not much with the partner. Even though R&D partnerships are shaped by all parties involved I focus explicitly on the initiatives that can be taken in the focal firm to enhance and ensure the vital knowledge sharing processes and development of the needed capabilities. Relational issues are discussed when they impinge on the process of knowledge sharing or other interactions or behaviors.

## **7.2 Knowledge Sharing across the Atlantic: the Novo Nordisk Narrative**

One example of a research and development project that has been grounded on close collaboration is the so called ‘IL21’ project where Novo Nordisk has worked with the Seattle based biotechnology company ZymoGenetics Inc. As the following narrative will show the relation between Novo Nordisk and ZymoGenetics has lasted for more that 25 years and has resulted in many smaller or larger collaborative projects. The narrative is illustrative in the way that it visualizes the dynamic processes and mechanisms that impinge on the vital assimilation of new knowledge. Still as we will see a number of barriers for fast and effective knowledge sharing does exist, even though the two firms have a long history together. The narrative shows, that if failing to direct attention to the important micro processes of collaborative projects companies will not be able to utilize the high potential of linking to external knowledge sources.

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<sup>21</sup> When the findings were validated by the contact person in Novo Nordisk it was indicated that this quote is probably not representative but ought to be seen as the respondents own perception of the situation.

The framework developed in chapter 4 will again order the search for the important underlying dynamics and mechanisms that facilitates the development of collaborative capabilities. The framework directs our attention towards the relations between the organizational level aspiration to collaborate and the individual level attitudes and behavior. In part 7.2.1 (*Bridging the Atlantic in search for Knowledge*), 7.2.2, 7.2.3, and 7.2.4 the overall wish to collaborate will be described. This part matches arrow 4 of the analytical framework. This and the following 3 chapters will also describe the historical back ground of the relation between the two firms. In part 7.2.5 (*Affecting Willingness and Ability to Share Knowledge*) and 7.2.6 (*organizational mechanisms facilitating knowledge sharing processes*) the analysis will match arrow 1 of the framework as we see how the corporate wish to collaborate affects the individual level willingness and ability. In part 7.2.7 (*Individual Conditions Leading to Collaborative Behavior*) we focus on the dynamics of arrow 2 as the study concentrate on how willingness and ability affect individual collaborative behavior. In part 7.2.8 (*Collaborative Behavior leading to a Positive Corporate Outcome*) we will see how the collaborative behavior affects the corporate collaborative capabilities, as illustrated by arrow 3.

In this narrative the historical dimension is important. As we know from studies of knowledge sharing, previous contact between partners is often said to facilitate a faster and better absorption of new knowledge. However, this narrative shows that it can be much more complicated as previous experiences may also have a negative affect on new endeavors as old stories and previous troubles may be transfer to the new project.

#### *7.2.1 Bridging the Atlantic in the Search for Knowledge (arrow 4)*

The distance between Copenhagen and Seattle is extensive; 15.000 kilometers in direct line and almost a day of travel. Yet, it is a distance that many employees of the Danish pharmaceutical company Novo Nordisk have covered repeatedly throughout the last 25 years. In this period of time, Novo Nordisk has been engaged in a number of collaborative research projects with the Seattle based biotechnology company ZymoGenetics Inc. For a period of time Novo Nordisk even owned the small biotech company, yet since the turn of the millennium ZymoGenetics has been an independent company and the relation between the two firms is now shaped by partial ownership and collaborative activities. The latest collaborative endeavor, a project of great promise in the field of cancer treatment, was commenced in 2001.



Just about 25 years ago, in 1982, Novo Nordisk was originally attracted by ZymoGenetics' expertise in expression systems for proteins, and the first collaborative research project was established on the production of recombinant human insulin in yeast. Few years later, in 1988, Novo Nordisk acquired ZymoGenetics and for the next twelve years ZymoGenetics functioned as the U.S. research arm of Novo Nordisk. The work done at ZymoGenetics has contributed to the development of several of Novo Nordisk's current products among others the successful product NovoSeven®, used for the treatment of bleeding disorders (i.e. hemophilia).

From the mid 1990s ZymoGenetics altered their line of research towards a clear focus on protein research based on bioinformatics and gene data base mining. This made ZymoGenetics more independent of Novo Nordisk as the change in research focus moved them away from Novo Nordisk interest in research on small molecules. At the end of the 1990s Bruce Carter who was both the CEO of ZymoGenetics and Chief Science Officer at Novo Nordisk in Denmark, moved back to Seattle and a separation of the two firms was initiated. At the turn of the millennium, ZymoGenetics was restored as an independent biotechnology company. \$150 million was raised through private placement financing and ZymoGenetics completed an initial public offering (IPO) in 2002. Following the IPO Novo Nordisk owned 40% of the shares, a share capital that has since decreased to 30%. ZymoGenetics left Novo Nordisk with the patents on human insulin and factor VIIa the active principle of NovoSeven®. This has resulted in large amounts of royalties flowing from Novo Nordisk to ZymoGenetics in the course of time.

As part of the spin out, the parties entered into an Option and License Agreement under which Novo Nordisk had the rights to license a number of proteins per year for a four-year period. The agreement was structured so that ZymoGenetics maintained the right to North America and Novo Nordisk the right to the rest of World.

Already in the fall of 2001, Novo Nordisk was informed that ZymoGenetics' efforts had led to the identification of a number of novel cytokines and cytokine receptors that could be used to regulate a variety of cell types involved in the body's ability to fight diseases. One of these cytokines, 'Interleukin 21' or IL-21 as it was called, was of special interest to Novo Nordisk due to its potent regulatory effect on cells of the immune system that can destroy malignant or infected cells, including certain cancers. The immune system is known to have an enormous power to fight cancers and infectious diseases and for decades scientists have been searching for factors that can help initiate, sustain and enhance an immune response, in order to find ways to use the immune system itself as a tool to treat diseases. The quest has led to the identification of several dozen

cytokines, that is, proteins that serve as the communication network among cells of the immune system. Understanding immunology and cytokine biology are key areas of research and development at ZymoGenetics. By the use of for instance computer algorithms to screen DNA sequence databases for novel cytokine receptors, ZymoGenetics has successfully identified novel cytokines<sup>22</sup>.

After being offered the option of IL-21 an assessment was made by a group of internal and external experts at Novo Nordisk. On the basis of their evaluation Novo Nordisk decided to in-license the IL-21 project along with another protein project. At this early stage, nobody could tell whether the IL-21 project would lead to the development of new pharmaceutical products, but features of the project looked very promising. It was established as an ordinary research project at Novo Nordisk and researchers at ZymoGenetics carried on with the project as well, that is, in the two companies two parallel project groups worked on the project. Suddenly, in the fall of 2002, it became clear that ZymoGenetics had upgraded their work on the project. The sudden leap forward in research motivated Novo Nordisk to work towards a closer integration of the two parallel projects in order to achieve deeper insight into the knowledge being produced by the American biotech company. To initiate this integration of the somewhat parallel projects a meeting was set up at ZymoGenetics' headquarter in 2002.

### *7.2.2 Visiting old Friends*

In late November 2002, 12 employees from Novo Nordisk arrived at the location of ZymoGenetics Inc. The meeting was going to take place at the head-quarter of ZymoGenetics, which is located in an imposing building on the southern shore of Lake Union, Seattle. The building was originally created to house a steam plant that supplied the city of Seattle with electrical power. Back then, when the large-scale distribution of electricity was in its infancy, the visionary businessmen of the city built the impressing plant to 'furnish an abundance of power at the lowest rates in order [to] bring new industries, both large and small, to Seattle' (City Light Superintendent, J. D. Ross, 1905). Now the towering windows of the old steam plant allow visitors a glimpse into the laboratories and offices of one of the largest biotechnology companies in Washington State. ZymoGenetics Inc. was founded in 1981 by three renowned university professors: Earl W. Davie, Professor of Biochemistry at the University of Washington; Benjamin D. Hall, Professor of Genetics at the University of Washington; and the late Michael Smith, Professor of Biochemistry

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<sup>22</sup> Source: [www.zymogenetics.com](http://www.zymogenetics.com)

at the University of British Columbia and 1993 Nobel Laureate in Chemistry. For the past twenty-five years, the work of ZymoGenetics has been focused on the discovery, development, and commercialization of therapeutic proteins.

The aim of the meeting between ZymoGenetics and Novo Nordisk was to agree upon a shared plan that could lead to an 'Investigational New Drug'-application, the so-called IND-filing for IL21 that allowed for testing the drug in humans. Due to their initial advantage in research on the IL21 protein ZymoGenetics had already planned the IND-filing process and the two firms needed to come to an understanding of how Novo Nordisk could participate and contribute to this plan. Further ZymoGenetics was to document their results in order to convince Novo Nordisk that a future collaboration was possible and productive.

The meeting resulted in a proposal for proceeding together on the IL21 project. Yet, the group of researchers from Novo Nordisk suffered a great disappointment as the management of ZymoGenetics did not comply with the proposal for a more integrated R&D project. One of the key drivers for this decision was the lack of cost savings from having a joint plan with two partners. In the following years, the intensity of the relation between the big pharmaceutical company and the smaller biotech firm was constantly changing, depending on both external circumstances and internal challenges. In order to allow for collaboration on specific issues, the two companies established a number of agreements in this period. However, a broad collaboration was not established and exchange of information was difficult as the parties needed to protect their own intellectual property and know-how.

### *7.2.3 Starting at Unequal Terms*

When returning from Seattle in 2002, the employees at Novo Nordisk had a feeling that ZymoGenetics had been hoping for quite another outcome of the meeting. While Novo Nordisk is an important player in the pharmaceutical field, they had no prior experience in cytokine biology or the field of oncology. They were in other words moving into an unfamiliar terrain whereas ZymoGenetics had hoped for an experienced partner that could bring their research further on. Thus, even though a preliminary agreement about future collaboration was made the two companies did not start out on common ground. As an employee states:

ZymoGenetics showed absolutely no confidence in us, which I found quite understandable since Novo Nordisk had no expertise in this field. At that time ZymoGenetics had probably hoped that if anybody was going to run off with their

project it would be a powerful company who really had the know-how and knew how they should do it. And then Novo takes it on because we think it fits well with our strategy. We needed something new and we wanted to move into oncology (#3).

Further, as employees at Novo Nordisk describe below, the details of their shared history did not rouse a wish for working closely together either. As positive prior relations may ease collaborative activities, negative experiences can on the other hand hamper future collaboration as the following quotes show:

A gap had been created between the two companies because ZymoGenetics belonged to Novo for several years. (#3)

If you go back and listen to what people have to tell from that period [when Novo owned ZymoGenetics] you will know that wide gaps were created between the two firms. To me it is all about the human factor and then a management board that did not handle the problems properly. (#7)

While Bruce was a manager in ZymoGenetics and here at Novo Nordisk at the same time something happened. Basically I don't think they understood the cultural differences between an American biotech firm and a big pharmaceutical with Danish values and big systems that was to be implemented in a place where they did not belong. The conflicts following led to a number of changes in top management. (#7)

An additional factor that has contributed to the asymmetry between the firms is the difference in the conditions faced by Danish and American companies. Even though external in character these factors do impinge on the project. They relate to legal matters, market conditions as well as general personnel policy. As a manager stresses in the following:

It is hard to become equal when there is such a big difference between the companies. Take as an example cost sharing; it is actually hard to calculate the exact expenses in the projects. There is the external cost and then there is the expense for a full time employee, yet an American full time employee is not always the same as a Danish full time employee. (#5)

Whether this reflects a true disproportion may be debated as another manager point to the fact that all cost differences were equalized, but never the less it shows a perception of inequality that did exist among Novo Nordisk employees. The differences relating to national conditions are numerous, and many of them will have to be dealt with throughout a given collaborative project as for example the differences in the demands of the regulatory authorities. By way of example Novo Nordisk has to follow the rules of the *European Medicines Agency* (EMA) while ZymoGenetics is subject to the American *Food and Drug Administration* (FDA). This means that even though it research-wise might seem sensible to create a shared protocol for the clinical tests it is not always an optimal solution due to the differences that can be found in the two different regulatory authorities.

Yet another source of potential conflict has been the discussions related to the intensity of data sharing. According to Novo Nordisk all clinical data and results ought to be shared between the partners especially due to ethical considerations. As the employees of Novo Nordisk believed it to be unethical to make the same test in two different groups of patients, due to the risk this could entail for the test persons, they wanted to share the data of the clinical studies. By this procedure they could limit the total number of clinical tests and thereby the risk that is always connected to this kind of tests. However, even though it seemed obvious to Novo Nordisk that the two companies working on the development of the same product ought to share this data their partner didn't agree and the subject had to go all the way to the Joint Steering Committee. Further it is worth mentioning that ZymoGenetics felt the need to demonstrate independence from Novo Nordisk. It was important for ZymoGenetics to establish a new corporate identity.

The first part of the data sharing agreement only concerned the clinical data, not the preclinical data describing the results of the tests done on animal models. As the present agreement was signed in 2005 the companies agreed to share all data as well as results in a way that was easily understandable for the receiver. A researcher refers to this agreement as 'a true historical development', as it bridges the gap that has been witnessed between the two companies.

ZymoGenetics were from the beginning afraid that Novo Nordisk would prolong the process when they entered the project. The plans which Novo Nordisk had made for the project, was perceived by ZymoGenetics to be too ambitious and thereby too slow. They had to stick to their milestones and deadlines and were eager to get the processes up and running. Novo Nordisk, on the other hand, was afraid that ZymoGenetics would make too many short-cuts to reach the objectives

and that they thus would have to go back and recreate matters later on. A clear difference in risk tolerance between the two companies was witnessed. A manager summarizes:

It has been very frustrating that questions have popped up all the time; why couldn't we come to an agreement; why couldn't we put an end to these matters? I think it has to do with the trustful relation we needed to build up; this is one part of it. The second part is that good personal relations are indispensable. A third issue is that the management at both firms did not sell this project well enough to the employees. (#7)

Asking whether the shared history and the relation of long standing between the two companies had made it easier to formulate an agreement on the present collaboration a manager refers to the fact that Novo Nordisk ones owned the American company and states that in this relation this has almost been an disadvantage to the firms. Opposed to what could have been expected namely that the prior relation made it easier for the partners to come to terms on an agreement he states that all shareholders have been very keen on ensuring that no agreements were made that did not comply with the rules. This may have been another reason as to why it was so difficult to come to terms on an agreement. No details were to be missed. He states:

The conditions that Novo Nordisk has been given is in compliance with the standards, it has truly been what we call arms-length negotiations. Thus, nobody could say that Novo Nordisk has had any advantages that would have made it unacceptable to the shareholders. In my point of view, this has almost made it more difficult for us than it would have been for another part because everybody has been on their toes. (#7)

In sum a number of asymmetries have challenges the project and can be summarized as follows:

**Table 7.1: The Asymmetries of the Collaborative Project**

Asymmetries	Barriers Created by Asymmetry in the NN-ZG collaboration	Mitigating factor
Knowledge asymmetry	<p>Problems for NN to integrate new knowledge due to lack of competent employees.</p> <p>Unwillingness from ZG to share knowledge to a partner that was not able to provide knowledge yet.</p> <p>Securing IP rights by each Party</p>	<ul style="list-style-type: none"> <li>- Focus on educating and/or employing employees in the new field.</li> <li>- Clearly defined objectives as they reduce the risk of mutual misinterpretation and wrong or unrealistic expectations to the outcome of the knowledge sharing process</li> <li>- Progress monitoring</li> <li>- Cross-licensing of IP</li> </ul>
Geographical asymmetries	<p>Difficult to set up tele-conference with nine ours time difference.</p> <p>A days work is spent on travelling when employees have to work together</p>	<ul style="list-style-type: none"> <li>- Meet on the go, e.g. on conferences around the world</li> <li>- Create good IT facilities for communication</li> <li>- Adjust work schedules (ZGI employees come in early, NN employees stay late)</li> </ul>
Institutional asymmetries	<p>Different organizational cultures, viz. ownership structures, level of empowerment</p>	<ul style="list-style-type: none"> <li>- Effective communication</li> <li>- Clear objectives and how the two firms contribute, due to their differences</li> <li>- Skilled project managers</li> </ul>
Contextual asymmetries	<p>Different legal rules and procedures (FDA/EMEA)</p> <p>Different business structures</p> <p>Differences in strategic objectives</p>	<ul style="list-style-type: none"> <li>- Split protocol development</li> <li>- Split marked</li> <li>- Share data and knowledge along the way</li> </ul>

The asymmetries between the partners and the inequality in the relationship are evident, still, the wish to collaborate has survived and the common project has in ways gained by the discussions and disagreements. An employee states:

The cultural diversity can be seen as both a positive and a negative challenge. The fact that we do not agree on how things are to be done, do foster new ways of looking upon things that can be very valuable. (#2)

A number of the employees that are currently taking part in the collaborative project are convinced that working towards a shared project was the right thing to do—in spite of all the obstacles on the way. The distrust is vanishing and the employees at Novo Nordisk has finally seen that the small Seattle based biotech firm was on the right track. When reflecting upon the process and the status of the current relation a manager evaluates the situation like this:

It has become apparent that ZymoGenetics did the right thing. And I think it has been an eye opener for our people. It has increased the respect for ZymoGenetic's people; that a small firm can do it. And this knowledge has shaped the basis for the current project. We have learned the lesson, even though the price was a little high. (#3)

The IL-21 project was up against some serious challenges as it got off the ground. Yet, what started out as a somewhat unequal relation due to the gap in the companies' level of competences in the area of immunology and cytokine biology has over time become a more equal. Novo Nordisk started with very little knowledge in the area, but has now established a solid research platform in their company as well. According to the involved employees it took quite a while to convince ZymoGenetics that Novo Nordisk would become a good partner in this project, but the hard work is beginning to pay off:

In the beginning they [ZymoGenetics] felt that we, the big cumbersome company, had taken their research project which had been such a pleasure to work on, and they didn't like that. It is getting better and better because both parties produce many data and ZymoGenetics has now learned that Novo Nordisk can be very useful to them as well. (#3)



[By now] it has become apparent to ZymoGenetics and to ourselves as well as we have gained more self-esteem, that we fully match ZymoGenetics. We started out almost from scratch but have now become an equal partner and both companies put in a great deal of work. (#6)

Finally, in 2005 the current agreement was signed. It is referred to as the ‘IL-21 Knowledge Sharing Agreement’ and it is in different ways the most extensive agreement in the project so far. Table 7.2 shows an overview of the different agreements of the project.

**Table 7.2:**  
**Overview of agreements related to IL-21 between Novo Nordisk and ZymoGenetics.**

Name	Date	Key issues
License agreement	August 21, 2001	<ul style="list-style-type: none"> <li>• Territorial split of rights ( ZGI North America, NN Rest of World )</li> <li>• Each party responsible for further research, development and commercialization in their respective territories</li> <li>• No obligations to share results and improvements</li> </ul>
Collaborative agreement for IL-21	December 14, 2002	<ul style="list-style-type: none"> <li>• NN obtains rights to ZGEN results and improvements generated since August 21, 2001</li> <li>• NN and ZGEN to collaborate on generation of data to support the first clinical trial</li> </ul>
Agreement to share costs of IL-21 joint Asset Exploration Studies	October 20, 2003	<ul style="list-style-type: none"> <li>• A 50:50 sharing of costs for the mutually agreed Asset Exploration studies</li> <li>• Relates to the above Collaborative Agreement for IL-21 cont.</li> </ul>
Agreement to exchange Process Development Data for IL-21 Protein	March 3, 2004	<ul style="list-style-type: none"> <li>• The parties agree to jointly work on the development of a method to manufacture IL-21</li> <li>• All IP generated as part of the agreement will be shared</li> </ul>
Agreement to Exchange Clinical Data for IL-21 Protein	March 3, 2004	<ul style="list-style-type: none"> <li>• The parties agree to share clinical data generated by each party</li> <li>• All IP generated as part of the agreement will be shared</li> </ul>

Collaborative Data Sharing and Cross-License Agreement for IL-21 Protein	August 11, 2005	<ul style="list-style-type: none"> <li>• All data and IP generated by each party will be shared</li> <li>• Equal contribution by each party</li> <li>• Establishment of a Global plan for IL-21 Protein</li> </ul>
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A strong supporter for establishing this agreement was the recently hired CSO of ZymoGenetics realizing the significant benefits and needs for sharing data for a new products being developed world wide. The major challenge in establishing the agreement was on one side the wish for setting up a structure which allowed for an optimized used of each party's resources and on the other side recognizing the significant differences in treatment practices of the cancer forms (the primary indication for IL-21 Protein) pursued between the parties' territories. In comparison with the original license agreement, this agreement allowed for full collaborative efforts on all aspects of the IL-21 protein and a full sharing of all IP and know-how. Especially the latter did remove the barrier for early exchange of information between the parties.

#### *7.2.4 Coming to Terms: Agreeing on Extensive Knowledge Sharing*

The main aim of the current 'IL-21 Knowledge Sharing agreement' is to optimize the use of the parties' knowledge and resources to develop the IL-21 protein. Besides stipulating that the companies will proceed with their research, development and marketing in their respective territories, the agreement prescribes that the companies shall share all the data of the respective projects including, but not limited to, efficacy and safety data generated by each party as well as all intellectual property. Further the parties have decided to share the costs of mutually agreed activities supporting both parties' programs.

The knowledge sharing agreement also stipulates that the parties are allowed to challenge each other's plans and to ask for in-depth knowledge of the partner's project plan, including the work and comments of the key opinion leaders, who are invited into the respective companies to qualify the projects. The project is developed with a 'one product strategy' based on the active agent, the IL-21 protein, which was originally discovered and patented by ZymoGenetics. This means that both companies work on the development of one common product that is later to be marketed in the companies' respective territories with no changes to the territorial rights of each company. Following, each company will operate separately in its own home market when the final product has been developed. As two employees state in the following this is seen as a good way of

handling the potential conflicts that could arise when to firms that operate globally develop a product together:

The issue about the divided territories removes at least one of the elements of competition from the equation. (#6)

They have the American market and we have the rest. When divided like that we are just two companies working well together. It is worth its weight in gold—and we save money. (#3)

Even though the data sharing-agreement might not be as far-reaching as full scale collaboration could have been, the present agreement has opened up the prospect of getting immediate access to all activities and results of each partner with the IL-21 protein.

In agreements like this, I believe that focusing on knowledge sharing is what gives the best level of flexibility. We don't have to strap each other very tight in a marriage-like relationship. That was what we wanted in the beginning, we wanted to agree on every little detail ... but is that really necessary? They look at the American market and we do everything else. That gives natural reasons for wanting to do things a little differently in the project. (#2)

As it is stated the present agreement is unique as it prescribes the sharing of knowledge and research results, and does not call for a very integrated research process. Still, as it becomes apparent in the following knowledge sharing is not just sending lots of printed results back and forth between Novo Nordisk and ZymoGenetics; but what is knowledge sharing then?

#### *7.2.5 Affecting Willingness and Ability to Share Knowledge (arrow 1)*

The corporate wish to collaborate with external partners when new knowledge is needed is especially apparent in Novo Nordisk. It is clear from the efforts put into the collaboration with ZymoGenetics and it is patent from the way that the new business unit has been organized. Yet as stated in chapter 4, employees are sometimes expected to engage in a process of knowledge sharing that might seem unfortunate to them in the short run because they fear to loose valuable knowledge. This illustrates that the management of collaborative processes can be a complicated matter. When

dealing with inter-organizational R&D collaboration special managerial efforts are needed to bridge the diversified backgrounds, norms and objectives of the participants (Hagedoorn, 2002). Clearly defined objectives are essential as they might help reduce the risk of mutual misinterpretation and wrong or unrealistic expectations to the outcome of the knowledge sharing process, also progress monitoring, effective communication and a specific focus on deploying skilled project managers will facilitate collaborative processes (Barnes, Pashby and Gibbons, 2002). The shared objectives should, however, allow for some flexibility in order to make room for the unpredictability in science.

Hierarchical coordination of knowledge sharing between for example two firms working together is often pointed out as an unproductive approach. This is due to situations like the one we have seen in the Novo Nordisk narrative where knowledge, at least at the beginning of the project, is asymmetrically distributed between the partners. This situation, combined with the fact that the tacitness of knowledge prevents other individuals than those who possess the knowledge from taking part in the exchange, make it hard for the managers to design and coordinate the knowledge sharing process on their own. This means that the manager who might have limited acquaintance with the knowledge that is to be shared between the firms must rely on core employees to inform him of the needs for knowledge. Additionally, if told when to share knowledge employees may lose their intrinsic motivation to share knowledge with others and will, as a consequence, only provide knowledge to other units when a higher authority demands it. These issues taken together make it clear that the coordination of knowledge sharing must be based on a common vision or a shared mindset directing the employees' attention towards the benefits of sharing. The manager may in practice seldom be given the option to interfere in the specific sharing of knowledge and need—as a consequence—to trust the judgment of both own employees and the people at the collaborating firm. Following it seems like a wise decision to make the collaborative agreement between the two firms in this narrative rest on the idea of knowledge sharing. This way it is signaled that this project is contingent on the sharing of knowledge between the firms; it is not just about the division of labor and the exchange of research results. The fact that the employees refer to the project as a 'knowledge sharing project' may direct their orientation towards the shared goal.

#### *7.2.6 Organizational Mechanisms that Facilitates Knowledge Sharing processes*

To build a relation on knowledge sharing as it is done in this project with ZymoGenetics is not the same as doing a project in close collaboration. As described the knowledge sharing agreement has

been seen as the second best way of collaborating as parts of the project is done by the two separate firms in accordance with a joint agreed plan and only the results are shared. A *Global Plan* has been developed describing the combined IL-21 activities that is to be undertaken either by Novo Nordisk, ZymoGenetics or their affiliates in order to achieve product approval of the common product. Both the global plan and the individual work plans are designed and agreed upon by both parties. The plans comprise all activities in research and development, including process development, manufacturing and pursuing regulatory approvals. Thus the present agreement between Novo Nordisk and ZymoGenetics is unique in the sense that it deals with knowledge sharing in particular. In order to reach the goals of the IL21 project it is important for the managerial teams to ensure that the important knowledge that is produced in the two partner companies will benefit both partners. Dependent on what kinds of knowledge that is at stake the knowledge sharing procedures can vary a lot. Knowledge sharing as such holds many different dimensions and understanding what knowledge sharing actually is, how it is carried out and who are involved is important foundation for creating a good knowledge sharing practice.

The agreement addresses the sharing procedures by specifying that both parties are to establish procedures to ensure exchange on a timely basis of all necessary information. Research activities such as research updates, delivery of raw data and final research reports are given special priority. Further, both non-clinical development activities (such as quarterly reports, final study reports and post study delivery of raw data) and clinical development activities (such as quarterly clinical reports, clinical trial reports, post delivery of raw data, and reports and data from Sponsored Clinical Trials) are mentioned as being of special importance. Other issues in focus are reports and products that are not common products, public disclosure strategies, joint publications as well as data sharing under third party agreements.

In the beginning the project participants witnessed some difficulties in defining the proper way to share the results of the respective research projects. A Novo Nordisk researcher describes how she ended up with folders stuffed with endless files of papers after printing all the results that was emailed from ZymoGenetics every third month. Even though the sharing seemed to be taking place in regard to quantity, it took hours to make sense of the results presented.

There was a lot of exchange of information; still it was all electronic transfers. What was missing was ... that we deliver something that they can use immediately and that they deliver something we can use immediately. (#2)

Previously there was no evaluation, we just receive all data. And it took me about two hours just to print the data. Yet, what is important is that we talk about the data in order to get the optimal out of the situation. There is a big difference between sharing data and sharing knowledge... (#3)

This experience made it very clear to the involved parties that sending results across the Atlantic did not provide them with much value. The results had to be accompanied with some kind of interpretation of the results by the researcher who had supplied them.

Since cancer research is a new research area in Novo Nordisk a number of new competences and new knowledge has to be gained in this field. This is one of the reasons why the IL-21 project is organized as a collaborative project in this very early phase of the research process. It is unlike other collaborative projects in Novo Nordisk which are mainly based on the company's prior research. Working on a project that to Novo Nordisk is a venture into uncharted waters in many ways (new therapeutic area, new profile of the diseases that are going to be treated) is a challenge.

One of the challenges in this project is that we go new ways in a number of areas. When writing up the preclinical program for a project like this we are very dependent upon what kind of disease we are going to treat in the end. Cancer is a completely new venture in Novo Nordisk. It suddenly becomes much more elastic because the patients might have everything to gain by trying this medicine. The picture is different and there are a number of areas where we have had to proceed by the method of trial and error. (#4)

Two different managerial teams are responsible for the project: a Joint Project Team and a Joint steering Committee. *The Joint Steering Committee (JSC)* is the highest managerial authority of the shared project and consists of three members from each of the two companies. The JSC is responsible for monitoring the performance of the IL-21 global plan and in the JSC changes or additions to common products is discussed and recommendations to the senior management of the two companies are made. A further task of the committee is to approve the annual evaluation by which the parties' overall contribution to the collaboration is assessed. Any dispute that may arise in the collaborative project with respect to shared activities or joint publications is to be resolved by the JSC and they are responsible for enforcing a timely data exchange as well. The committee

will meet at least twice a year and it will get input from the project managers through the Joint Project Team.

*The Joint Project Team (JPT)* is led by a project director from each party and consists of members of the different sub teams of each company. The JPT meets at least three times a year and is responsible for the coordination of activities under the global plan, that is activities taking place in both ZymoGenetics, Novo Nordisk and jointly. The managerial tasks of the JPT are in general of coordinating and monitoring character and the project managers review joint publications and establish operating procedures for the different sub teams. Joint activities are identified and proposed to the Joint Steering Committee by the project managers.

Two *Global Project Teams* comprise representatives from each technical sub unit in the two companies. Members of the different sub units communicate with each other on a daily basis and discuss issues relevant to the daily tasks.

**Table 7.3: Governance Structure of the Collaboration**

Body	Novo Nordisk	ZymoGenetics	Key issues
<b>Joint IL-21 Steering Committee</b>	3 members	3 members	<ul style="list-style-type: none"> <li>• Operate by consensus with one vote to each party</li> <li>• Monitor performance</li> <li>• Resolve disputes</li> <li>• Meet twice a year</li> </ul>
<b>Joint Project Team</b>	Project Director (PD) Plus “core” members of the party’s project group (head of sub teams)	Project Director Plus a project leader and “core” members of the party’s project group (~ head of subteams)	<ul style="list-style-type: none"> <li>• Reports to JSC via PD</li> <li>• Operates by consensus with one vote to each party</li> <li>• Review and discuss all activities of the global plan</li> <li>• Monitor tasks and time lines</li> <li>• Review publications</li> <li>• Meet three times per year plus video /teleconferences</li> </ul>

The role of the project manager at Novo Nordisk does not match in complete the role of the project manager at ZymoGenetics. At ZymoGenetics, the project manager works with the project leader to ensure that the project plans are implemented, that meetings are documented, that the project progresses in accordance with goals, etc. At Novo Nordisk the Project Managers role at NN is more a mix of the two roles at ZymoGenetics, together with other duties as well.

All planned development activities within the project are presented to the JPT for comments or input along the way. The project leaders then communicate with the JPT about progress or planning of new activities, which then again run through JSC. This circular flow is designed to make sure that information is shared and that all participants know about the plans and progress of the common project.

According to a project manager at Novo Nordisk a number of issues must be considered in order to create a good foundation for a knowledge sharing in collaborative project, like the IL-21 project. Building on own experience on the subject, as well as that of his colleagues, he mentions the fact that the time it takes to carry out collaborative projects is almost always underestimated. To do a successful collaborative project is very time consuming and companies tend to forget that when planning a new project. This relates to the managerial issues as well, which are often taken



too lightly, however, it takes time to create good managerial foundation for a successful collaboration.

It is a necessity to have a number of competent project leaders who are good at forming high performance teams and making it run smoothly between the two companies in spite of the different company cultures that exist. So, some strong alliance managers who are good at creating an internal culture in the project or the team, that's important. (#4)

In reality it is very simple. You add up the work of two groups and then you have more than the double. But this requires that the two groups work well together (#6)

It is also important for both the ZymoGenetics and the Novo Nordisk teams to have common goals for the project. Otherwise there is a risk of two strong teams going in two different directions. This is another important task of the project leaders; to ensure alignments of goal and frequent communication between the two companies.

In sum, the managers can and ought to set the scene for knowledge sharing in a number of ways. In the quotations of this study much focus has been put on the ability of the managers to design, to staff, and to lead the shared project groups professionally. This includes setting up the best communication infrastructure and making sure that what is shared is usable and not just batches of bulky information. This ought to be founded in a clear strategy not only in the unique project but also in the focal firms in general. If a clear strategic focus is put on partnering with descriptions of how decisions are to be taken and to what extent decisions can be made by employees in the collaborative projects, this will ease the collaborative processes and make sure that the single employees know to act in different situations that may occur throughout the collaborative project.

#### *7.2.7 Individual Conditions Leading to Collaborative Behavior (arrow 2)*

Even though the wish for knowledge sharing between the two firms exists it is not an easy task to create an organizational framework that can support the knowledge sharing practice. As mentioned above the two companies have faced a number of challenges in their efforts to collaborate. These barriers, such as differences in regulations, prior disagreements, cultural issues or differences in

knowledge level must be carefully studied and understood in order to make the companies able to cope with them.

An important theme when dealing with knowledge sharing is the focal individual's abilities to integrate and utilize the knowledge of the partner. From the scholarly work on absorptive capacity we know that a firm's ability to absorb external knowledge is dependent on, among other things, the firm's prior collaborative experience in general and prior relation to the partner specifically. Thus we would expect the existence of a prior relation between Novo Nordisk and ZymoGenetics to be a facilitative factor in the present process of sharing knowledge. As illustrated by findings of social network scholars' complex knowledge is transferred more easily when the tie between the 'sender' and the 'recipient' is strong. A tie is strong when the partners are having strongly overlapping knowledge bases, strong social relations for example developed through past collaboration, and a high level of mutual trust. At a first glimpse the relation between Novo Nordisk and ZymoGenetics seems to be very strong due to the long lasting relationship. The fact that Novo Nordisk owned ZymoGenetics could be expected to provide breeding ground for the creation of a somewhat shared culture, a good communication practice and thus valuable knowledge sharing. Yet, the interviews tell a different story. It becomes clear that in order to have an affirmative effect a prior relation need to be of positive character. This has not been the case all the way through the relationship described in this case. The very integrated organizational model did not fit the purpose when the partners first started collaborating decades ago, and following the relationship was transformed into more ad hoc based relations. In the perspective of Novo Nordisk it is much more beneficial to let the partner operate as an independent unit, especially when dealing with a small innovative biotech company. In this way the partner company may be much more motivated to pursue their research goal and stay alert, and thus provide new valuable knowledge in a partnership.

Due to prior disagreements trust has been damaged between Novo Nordisk and ZymoGenetics and a trustful relation was to be re-established before the new IL-21 project was launched. This seems previously to have been ignored by the management of the collaborative project, yet the employees and managers working on the IL21 project today have by means of hard work and confidence in the value of the project slowly re-created a trustful relation. Time has been spent on social events and on communicating the means and ends of the project, and additionally Novo Nordisk has gained knowledge in the field. And this time the relation is not based on complete integration of project groups, but on a careful and focused sharing of relevant

knowledge. Thus the best possible level of interaction has been outlined and the actions of the individual are now aligned to the purpose of the project.

In order to build a trustful relation managers have stipulating the importance of a common vision. And they have strived towards the development of clear individual and shared goals. As show in the case social events bringing together employees on a regular basis has foster a trustful environment. Additionally it has been of importance that the strategic goal of the project (sharing knowledge on cancer research) fits well with the overall objectives of the firm (moving into cancer research). The findings of this narrative suggest that a number of individual level factors affect inter-organizational knowledge sharing. Especially the employees' willingness to collaborate and their ability to do are important factors. A specific focus has been devoted to the ability to find the right level of codification of the knowledge. As shown, trust is a central issue in collaborative projects as it may substitute for more formal control systems such as contracts, because trust ensures that the partners can rely on less formal norms and sanctions.

The present narrative describes a collaborative project characterized by years of collaboration between the two partner firms. A number of factors have affected the relation between the firms. The willingness of the employees to keep up the good work even in periods where controversies at the management level were threatening the project's survival has been essential. Some Novo Nordisk employees have referred to the existence of positive personal relations to employees at the partner firm as the reason why the good working relation was kept and others refer to the joy of working in a new research field as a motivational factor. The willingness is often dependent on the individual's ability to collaborate. In the present collaborative project the issue of abilities has been of special importance. At the beginning of the collaboration it was difficult for the employees at Novo Nordisk to engage in the project due to the knowledge asymmetries described earlier. First of all it was hard for the employees at Novo Nordisk to know what knowledge to ask for as they didn't know exactly what knowledge they needed and secondly they new they were not able to contribute to the project immediately which was a source of frustration for them as well. This difficult situation shows clearly that some level of shared knowledge is necessary. As a manager puts it, 'to be a good receiver you have to be a generator yourself'. Knowledge has been acquired both by training and by hiring a number of oncologists in Novo Nordisk and connecting them to the project. The constant communication and joint projects meetings have improved the level of shared knowledge as well. Still, the disciplinary skills are not the only relevant ones. Also communication and bonding abilities are important to make the employees able to engage in

constructive knowledge sharing. Designing structures for communication between the partners has been a central part of the new knowledge sharing agreement and the attention devoted to the knowledge sharing processes seems to be of huge benefit to the project. Many of the difficulties adhering to different communication or work cultures are mitigated by the development of IT systems to facilitate good interaction. Still at the individual level it is an ongoing challenge to make sure that the mutual expectations are met and that knowledge is shared in accordance with the schedule. As the project is based on knowledge sharing and not co-creation as such, the communication abilities become even more central than they would otherwise have been. Being able to explicate the knowledge at hand and describe the knowledge needed is vital.

A manager points to a central issue in the process of doing collaborative research, viz. the importance of identifying with the agenda of the partner. When taking part in a collaboration you might, according to the manager, be misled into thinking that the partner is opposed to the needs and wants of your company. Yet, this is most likely not the case. Instead conflicts that may arise could just be an indication of dissimilar ways of working. A constructive way of handling this perceived opposition is to search for the reason for the conflict instead of focusing on the disagreement as such. According to the manager good communication between the partners and especially a wish for comprehending the agenda of the partner is essential.

Referring to this issue of openness and honesty in the relation, a researcher gives an example of a situation in the IL-21 collaboration where an emerging conflict was handled by thorough communication. When collaborating with a smaller biotech company, as it is the case in the IL-21 project, situations can occur where the partners disagree on the way the project is run. ZymoGenetics has throughout the project been very much focused on meeting the different milestones and deadlines in the project. As the researcher expresses:

They have promised their investors certain things and then they just have to meet the deadlines. (#2)

Yet in the situation referred to, Novo Nordisk was interested in running a trial that involved the risk of delaying the process if new side-effects were observed even though the study itself might have resulted in interesting new knowledge for both of the companies, ZymoGenetics opposed to the idea in order not to jeopardize the overall program. The researcher concludes:

It took us quite a while to understand it. Then, at a meeting, one of their top managers said: 'You just have to understand that it is not out of bad will, but this is how we need to think and that is why we react the way we do'. I think this is fair; you might as well put the cards on the table, so that everybody is familiar with the mechanisms at stake. (#2)

To eliminate the possibility of emerging conflicts it is important to meet very often in order to create a trustful relation that motivates the employees and stimulates them to discuss the different research issues or emerging difficulties. The issue of meeting intervals has been very important in the IL-21 project as well. Since the knowledge sharing agreement was effectuated, the managers from the two companies have been conferring at least once every two weeks. While the project rises in degree of commitment it changes its status in the focal organization. Employees refer to that fact that they would never risk to attend a collaborative meeting without being very well prepared and ready to deal with any kind of questions. A manager signals that no pains are spared at the managerial level either.

The project workers make an extra effort in order to be ahead of time at the collaborative meetings and the same goes for the managers. When a decision is made to extend a given collaborative project, an excessive risk assessment is made which in this case has come out in favor of the project. When the project changes its status from being 'just another project' to being a serious collaborative project, every body changed their perception of it. (#6)

Dealing with the employees' perception of the project has been important in the IL21 project. The motivation of the employees to keep up the good work even in periods where it seemed like controversies at the management level was threatening the projects survival has been a challenge. Keeping the creative milieu alive when the most important part of the research was being done at the partner firm was a challenge at moments, according to a manager.

It is not that we have stopped being a research organization, but at stages we were more like a receiving unit than a generating unit. But to become a relevant and a good receptor you need to be a generator yourself, so we have to keep doing the creative work ourselves as well. You know, creative people will only stay if there are other creative persons around them; that is what motivates them. (#5)

### *7.2.8 Collaborative Behavior leading to a Positive Corporate Outcome (arrow 3)*

At Novo Nordisk a huge effort has been put into fostering a collaborative behavior among the employees. The previous experiences with external collaboration have made it clear that this can not be done in any easy way. Still putting an effort into investing in social capital by building up in the relational structures has prepared the employees of Novo Nordisk to engage in new collaborative ventures with ZymoGenetics had a positive effect. What has become clear in this narrative is the nature of the relation to the partner plays an important role in the process of creation of social capital. ZymoGenetics is not just another company that Novo Nordisk has linked to in order to optimize their research process. The previous relation to ZymoGenetics does impinge on the corporate outcome at Novo Nordisk. In other words; when a company decides to ally with an external partner the dynamic processes inside the focal firm will be affected by the relation to the partner as well as it will be affected by the internal processes, the employees' willingness and ability to collaborate.

Thus, group dynamics and external relation can play a central role in shaping the corporate collaborative capabilities of a given firm as we have seen it in Novo Nordisk. This follows the theory of social capital which point to the fact that it is exactly the employee's position in a given group or network that compose the value of this relation ship. And not only the structure but also the strength of this relationship impinge on the value of the relationship. This support a need for some alterations of the analytical framework as illustrated in table 7.4.

## **7.3 Analysis and Conclusion**

A notable characteristic of the relation between Novo Nordisk and ZymoGenetics is the asymmetries of the relation. The asymmetries are at the same time the impetus and the impediment of the collaborative project. A first example of asymmetry can be witnessed in relation to the level of knowledge the two firms hold in the research area where they are collaborating. ZymoGenetics was seen as an attractive partner by Novo Nordisk due to their valuable knowledge in the field of immunology, in other words there was a learning potential for Novo Nordisk in working with ZymoGenetics. Still, as the case describes the employees of Novo Nordisk had initially a hard time in convincing ZymoGenetics people that they were able to contribute to the shared project. The novelty of the knowledge was the reason for Novo Nordisk to engage in the project, but it was also an impediment as the ignorance made it hard for Novo Nordisk to get of the ground.

A further gap was created by the different cultures of the two firms. While Novo Nordisk wanted to share all possible knowledge in an integrated manner by working on the shared project simultaneously, ZymoGenetics often worked on parallel projects and were thus suddenly able to deliver results in an unexpected pace. Further ZymoGenetics signaled that they were focused on sticking to the agreed upon milestones in order to satisfy their stakeholders, and not as Novo Nordisk was inclined to, follow new and interesting traces and to undertake more activities than a minimum required to achieve a certain milestone. Novo Nordisk was afraid that ZymoGenetics would make too many short cuts and which could result in ambiguous results requiring additional studies and thereby a risk for time delays. Thus the different cultures were a teaser to many employees, yet at a researcher states in an interview it was also a source of inspiration as working in a cultural diverse group may open one's eye to the fact that things can be done in another way than usually done, and even with a valuable outcome. A point is made by one of the managers in the project that to overcome these differences in a given project the employees have to meet at a regular basis, to create mutual understanding and trust. Yet, this becomes very hard with a time distance of 9 hours. The geographical distance is a notable challenge in the IL21 project as well.

Not only did the project participants witness a gap between the corporate cultures of the two firms, they were also subject to very dissimilar legal rules and regulatory authorities. This situation has made the firms work towards a divided-market model where ZymoGenetics operate at the American market and Novo Nordisk service the rest of the world. As an employee states this division has one positive side effect namely that it erases one element of competition from the equation. Yet, coping with differences in the demand of the legal authorities is not just a question of splitting up at the end of the project when the product is to be launched. The differences impinge on the entire project as for example the way the test protocols are being made is subject to national legal rules as well. For this reason it has not been possible for the two collaborating firms to develop their tests in an integrated manner. Thus, even external factors like legal rules in the partners' country that are not for the two firms to change, are impinging on the shared project and must be handled by the managerial teams.

The many asymmetries of the project (see table 7.1 for an overview) can be said to have both a negative and a positive side, and for sure a project with completely equal partners would not provide much new knowledge. Yet the asymmetric relationship like the one described in this narrative study calls for a very decisive management approach. Table 7.4 provides an overview of how the findings of the case support or alter the arrows of the analytical framework.

**Table 7.4 Collaborative R&D Capability Elements at Novo Nordisk**

<b>Core theme from the framework</b>	<b>Practical issues observed at Novo Nordisk</b>	<b>Comments from Novo Nordisk context</b>	<b>Change of framework</b>
Arrow 4: <b>Corporate wish to source knowledge externally as cornerstone of new business unit</b>	Drawing from experience with previous collaborations  Collaborating with know partners to gain faster results	Previous experiences have both positive and negative effects	
Arrow 1: <b>Corporate aspiration to collaborate impinge on collaborative conditions</b>	The importance of signaling that knowledge sharing is wanted from a strategic level  Time and resource allocation  Defining and communicating shared goals  Aligning the project strategies with corporate strategies  Communication culture and work culture aligned with partner  Learning through diversity and disputes	The change from an ‘data exchange’-agreement to a ‘knowledge sharing’-agreement made a huge difference to the employees  Structures for knowledge sharing are designed in the agreement	Disagreements between partners firms lead to re-organization of the collaborative project (from close collaboration to knowledge sharing agreement). Feedback along arrow 2
Arrow 2: <b>Individual collaborative conditions affect the collaborative behavior</b>	Ability gained through experience  Knowledge sharing capabilities are essential	Explication of knowledge at hand and of knowledge needed is vital	Willingness harmed by pervious unsettled controversies
Arrow 3: <b>Individual collaborative behavior leading to corporate collaborative capabilities</b>	Knowledge sharing behaviour has to be based on a trustful relation.  Structures and aims of knowledge sharing need to be formulated	The character of the relation has an impact on the corporate collaborative capabilities.	The relation to the partner has a an impact on the dynamic formation of corporate collaborative capabilities



## 8. CSC

### External Knowledge - Internal Innovation

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Our partnership with Scan·Jour  
is build on the right values and common sense.  
*(Project Manager, CSC)*

#### **8.1 Innovation through Partners and Customers: Introducing CSC**

The third narrative presents the IT service company Computer Science Corporation (CSC). CSC was founded in 1959 and today it employs 77,000 people worldwide of which 2700 are working in CSC Denmark. The Danish unit of CSC was established in 1996 when CSC bought Datacentralen from the Danish government; an acquisition through which CSC got access to a huge portfolio of Danish customers in the public sector. CSC Denmark has grown steadily through the acquisitions of companies such as Scandihealth, Dansk Datalab, E-huset, Mynd and Scandinavia IT Group. The many strategic acquisitions have made CSC Denmark the second largest provider of IT service solutions to the Danish market today, and recently a new strategy has seen the light of day. To stay innovative and continuously being a preferred IT solution provider CSC has started to ally with external partners in a number of core development projects. In this chapter we shall see how partnering is chosen as the best way to innovate the core business processes, still the narrative will also illustrate how working in close collaboration with an external partner is a challenge to employees as well as managers. An employee states:

We need to focus on building the right competences in connection to partnering. We are focusing a lot on the technical parts and on brand value and on the economic dimensions of this collaboration, but we have ignored all the soft parts of partnering. Still, these parts are very important and they will support alt other parameters. (#4)

CSC Denmark provides consulting, system integration and outsourcing services to both public and private companies and their main focus is to help customers reach their strategic goals through the use of advanced information technology. As mentioned, acquisitions have been the preferred way to growth throughout the years, as acquiring is regarded the best way to gain new competences through the employees of the acquired company. A specific focus has been on acquiring companies

with a customer portfolio of small and medium sized companies; a strategy that has made CSC move into new areas and markets in times where the number of new customers from the public sector was stagnating. Yet, as it will be described in the following, CSC has recently been engaged in a partnering project where there has been no plan to buy the partner firm. Instead, partnering was chosen because CSC was in need of a new version of the partner's core product, and they needed the partner to stay an independent company and keep working on the development of the product. The aim of the partnership has been to develop a product which can be adapted to the customers need in a process where both CSC and the partner, Scan-Jour, work in close collaboration with the customer. As stated by both employees and managers, the biggest difference in this project compared to ordinary work processes in CSC has been that they have had to work closely with a partner and with the clients simultaneously. This has made the work process much more complex than if CSC had just developed a product with a supplier and sold it to a customer as they are used to.

A specific initiative at CSC is designed to provide the best physical surroundings for the kinds of processes where CSC is working with partners and customers in a more integrated manner. This initiative is called the I:LAB and functions as a playground for new ideas and solutions to customers who wants to optimize their business processes. But I:LAB is not only about setting the scene for new technological conquests that can be sold to customers. It is as much about facilitating work processes where partners as well as customers are invited to contribute with their ideas, skills, and knowledge.

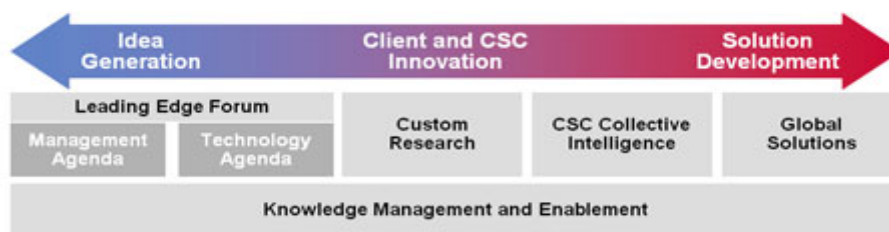
### *8.1.1 The I:LAB*

In the innovation centre, I:LAB, CSC offers a number of services to customers who want to innovate on their business processes. I:LAB is physically located in the heart of the company's headquarters in Valby (Copenhagen) and is equipped with all the technology needed to facilitate various innovation processes, including proof-of-concept projects on technological solutions in which a situation that bear a resemblance to the reality the IT will be applied to is simulated. Through the integrated screens on every wall and other visible or non-visible technologies users and employees can get access to innovation seminars or activities in other parts of the CSC Corporation, or they can access the other virtual innovation centers of CSC. IT plays a key role in the projects done in the I:LAB, yet the innovation processes taking place here are not about developing the newest technological devices; rather it is about creating innovative solutions that will enhance the practices and processes in the customers' organizations—with technology being a means to this end.

Together, CSC and their alliance partners deliver innovative solutions that enable the clients to anticipate and lead technology change. The fusion of CSC’s industry experience and world-class consulting, systems integration, and outsourcing expertise with the advanced proven technology solutions of their alliance partners’ results in what in CSC terms is labeled the “Best Total Solution” - a uniquely integrated, customized approach tailored to achieve the specific business goals of each of the clients.

Partnering is a cornerstone in this innovation process and is seen as a very important organizational tool that is applied throughout the global CSC Corporation. The aim is to become more innovative in the process of servicing customers. A Global Alliance Group has been set up at CSC headquarters to facilitate collaborative processes with external businesses and technology labs. The CSC Global Alliances Program acts as a focal point for the business and technology partnerships by providing a single channel to foster innovation within CSC. The program promotes the continuous infusion of the latest technology and best practices from the alliance partners into CSC-developed solutions worldwide. The idea of working closely with partners is mirrored in the CSC “collective intelligence” which reflects the work processes where CSC make use of external knowledge sources in their innovation processes.

**Figure 8.1: parts of the innovation process at CSC**



Having explored an innovative idea against the backdrop of market and client concerns, CSC then focuses on the idea using what they call Collective Intelligence, which is knowledge coming from both internal sources and partners. CSC can thus sustain and intensify innovation both internally and externally with partners. This general focus on the value of external knowledge has been transferred to the Danish part of CSC and as the following narrative shows, the idea of working closely with partners has inspired to a valuable relationship with a core supplier off CSC.

### *8.1.2 e-Government: A Rising Challenge*

CSC Denmark works with a number of public customers, e.g. The Danish police, the taxation authorities, Denmark's Road Safety and Transport Agency, The Central Office of Civil Registration, and various ministries. In the last decades a very central challenge in many public and governmental organizations has been the implementation and use of IT to facilitate the process of providing the best service to citizens.

The government's use of information and communication technology (ICT) to exchange information and services with citizens, businesses, and other arms of the government is referred to as e-Government; short for electronic government. The most important anticipated benefits of e-government include improved efficiency, convenience, and better accessibility of public services. e-Government has established itself around Europe throughout the last decade. In Denmark, September the 1<sup>st</sup> 2003 was declared e-Day. From that day and onward all governmental departments had the right to send all letters and documents electronically to each other. And in many cases citizens are receiving requested information only in an electronic version.

In order to promote the use of electronic data management throughout the public sector, a joint project was established in august 2002 with the participation of representatives from five Danish Ministries, The Association of Country Councils Denmark, Local Government Denmark, and the municipals of Copenhagen and Frederiksberg. The project was named FESD, a Danish acronym for Joint Electronic Case and Document Management<sup>23</sup> and, in continuation of the strategy for Project e-Government, the overall scope was to provide for efficient penetration and use of electronic case and document management. The aim of the FESD project is to create benefits for the individual organization as well as the public sector as a whole, and to minimize the collected public expenses, e.g. by offering a higher probability for a successful implementation of IT systems through common models and standards.

### *8.1.3 The FESD Tender*

Following the rules for EU-tenders the FESD-project had an initial prequalification run in March 2003 resulting in 17 requests for participation. From those 17 requests 8 vendors were chosen to bid in the following project competition. The project competition resulted in 3 winners and a new phase

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23 In Danish: Fællesoffentlig Elektronisk Sags- og Dokumenthåndtering

was initiated when the project entered a tender with negotiations with the 3 winners. All through the autumn of 2003 the negotiations went on with 4 rounds of negotiations each beginning with a more refined offer from the consortiums. Finally, on January 27th, 2004 the framework contracts with the 3 consortiums were signed.

Through the framework contract all public organizations in Denmark are able to enter into a contract with one of the 3 consortia for a delivery of an EDM-solution (electronic data management) and technical and organizational consulting on the terms and prices negotiated in the framework contract. The 3 consortia are a mixture of large international companies and smaller Danish companies. Besides the consortia in which CSC allies with the Danish company Scan·Jour, and has Rambøll Management as a subcontractor, these are Accenture with Traen Information Systems with Rambøll Informatics as sub contractors, and Software Innovation with Rambøll Management as subcontractor. The contracts also include special deliveries to the organizations participating in the FESD-project. Furthermore, the contracts include optional possibilities to buy services like running of the daily operations, further development, support, education and extra modules for specific work areas.

The partnership between CSC Denmark and the smaller Danish Company Scan·Jour was initiated when CSC decided to bid on the tender and started looking for a supplier with a product that could match the request of the tender. Scan·Jour was chosen because of their technological platform, Captia. Employees from CSC and Scan·Jour have been working together for a number of years and the fact that the two companies are familiar with each others products and work processes played an important role in the decision to ally in the FESD project. Still, being related in a buyer-supplier relation like the two firms have been before is different than working closely on the development of a joint product as they do in the present project. The higher degree of interaction between the employees that is needed in order to fulfill the specifications of the project has made tensions clear that have never been visible before. Both companies had to alter their understanding of own strategies and competencies and thus this collaborative project has been a process of learning and adaption to an external partner. What has made this case additionally exceptional is the fact that the two partners, CSC and Scan·Jour, had to agree on a number of core issues in a rather fast manner in order to be able to approach potential costumers as one service provider. A key success factor in this project is that CSC and Scan·Jour appear as one united company when they approach new customers to implement there new jointly developed products and services. Still, as

obvious as this may seem, it has presented significant challenges to the two independent companies. The close collaboration has highlighted the fact that the corporate wish to enter collaborative project need to be followed by a focus on the differences in organizational routines, the corporate strategies and work cultures.

## **8.2 Collaborating for innovation: the CSC Narrative**

The Danish unit of the IT service company CSC entered a new area when they signed the FESD contract with the Danish Government together with Scan·Jour in 2004. Not only did the partnership signal a new area as CSC was going to work on a completely new technological platform; the project was also going to be undertaken in close collaboration with an external partner, Scan·Jour. Subsequent to the decision to enter into a consortium and hand in a bid for the tender of the FESD project, the responsible CSC managers went through a number of considerations. Being partner in a collaborative project has a number of positive effects. First of all, collaboration shortens the time to market for the solutions that are developed. Additionally collaborate makes it easier for CSC to get access to the ideas and knowledge of a smaller and more innovative firm characterized by organizational agility and the ability to adapt to new technological opportunities and needs. Still, as this narrative will highlight, the positive outcome come at a cost. And at CSC the biggest challenge was to align the corporate aspiration to engage in external collaborate with the employees' motives and understanding of how and why collaboration was necessary. Fostering a collaborative behavior does not come easy; still it is achievable if attention is offered to the dynamic interaction of corporate strategies and individual behaviors. To understand how these dynamic processes have formed collaborative projects at CSC, the Coleman framework is applied to structure the narrative and underline important actions and change in behaviors.

As described in the introduction in chapter 5, CSC is engaged in the collaboration with Scan·Jour because Scan·Jour can provide the product and the capabilities that CSC needs to fulfill the tasks in the FESD tender. In the following, we will examine this collaborative project, which is argued to be of great benefit to CSC, and study the factors that influence the development of collaborative capabilities in the firm. As in the previous two narratives the present analysis will be organized in accordance with the framework developed in chapter 4 on the basis of the work of James Coleman. The chapter will be structured as follows. Part 8.2.1 (*Learning to Collaborate: the Organizational Aspiration*) will illustrate how a corporate wish to gain knowledge through external sources is visible at CSC. This part match arrow 4 of the framework developed in chapter 4. In Part

8.2.2 (*How the Corporate wish to Collaborate affects the Individual Level Conditions*) we will analyze how this corporate wish to collaborate affects the conditions at the individual level, illustrated as arrow 1 in the framework. In part 8.2.5 (*The act of collaboartion*) we will look at the dynamics that form an individual willingness and ability to collaborate into an actual collaborative behavior, illustrated by arrow 2. Finally part 8.2.6 (*How Individual Behavior Affects Collective Outcome*) the processes that lead from individual behavior to the existence of collaborative behavior will be studied in accordance with the third arrow of the framework of chapter 4.

#### 8.2.1 *Learning to Collaborate: the Organizational Aspiration (arrow 4)*

In CSC, collaboration has become a preferred strategy for gaining new knowledge, accessing new resources in a faster manner, or simply profiting from synergetic effects of working closely with external partners who posses other competences. As in many other companies the decision to collaborate is strategically motivated and taken by managers who base their decision on an evaluation of the corporate benefits of collaborating. In addition to providing access to a new technological product as CSC taps into the knowledge and competencies of the partner firm, the collaboration is seen as providing CSC with a higher degree of flexibility and inspiration. Due to its size and geographical scope CSC has the power and resources to solve most customer needs, still the size of the organization may be a challenge when fast changes and swift adaptations are needed. When asked about why collaboration is preferred, a project manager refers specifically to the flexibility and dynamics of smaller firms compared to CSC, and argues that the need for flexibility is exactly why larger companies like CSC engage in collaborative processes with smaller firms:

I have been working at a small company ... and there was lots of renewal and we were all very dedicated. We worked all day and it was our whole life. But when the consolidation happened it was all gone and you need to find this energy in other ways because you cannot do without. Then every thing comes to a stand still. (#2)

The managers of CSC believe that they may benefit from this high degree of flexibility when allying with smaller companies, like the partner Scan-Jour, and it is exactly because of the consolidation that has characterized the whole IT service industry for the last decade that a need has emerged in firms like CSC to ally with smaller and more innovative firms. A number of large corporations have captured the marked but in spite of their strength and market position, they are

not always very innovative or good at bringing products and services to market. Thus, the rising need to collaborate across firms is as much a consequence of the development in the IT service industry in general as it is a solution to the need of the individual firms. This shows that collaboration can be an organizational tool chosen simply to cope with a development of the field of business as such. Still, even though this argument may be true, it does not explain *how* collaborating will lead to more innovations and better performance in CSC. There is, so to speak, only alleged for the link between external collaboration and enhanced performance, illustrated by arrow 4 in the Coleman framework, while the underlying dynamics are not always clear to the employees as illustrated in the following:

It seems very simple when we make up the contract. Yet what is difficult is what follows: when we have made the deal and we are to demonstrate how to collaborate in practice. (#4)

Another example that illustrates the shortcuts that are made in the argumentations about the benefits of collaboration relates to the idea that collaboration is the best answer to the need for new knowledge or competences in the focal firm, as competencies may be complied with at a faster pace when collaborating than if the knowledge had to be acquired internally through education or hiring of new employees. A manager points to the fact that the collaboration builds on the technological platform that Scan-Jour provides and that it would have taken much longer time if CSC should have created the solutions by themselves. CSC did not in this point of time have any market ready product in this field. Scan-Jour had the best product for this aim at the moment and entering into a partnership thus enabled a much shorter 'time to market'. Compared to either buying up a partner firm or hiring new people with the profile needed, collaborating simply is superior.

Still, what is needed if knowledge is to be gained from collaborative experiences like the CSC/Scan-Jour collaboration, is to study and understand how the corporate aspiration to collaborate affects the different work processes and especially how it influences the individual level values and behaviors of the focal firm. This means that in order to get a better understanding of the macro-level processes illustrated by arrow 4 of the Coleman framework we need to direct the attention to the micro level phenomenon and the interaction between the levels. This will be the aim of the remaining narrative that intends to illustrate how collaborative values and behaviors are fostered.



### 8.2.2 *How the Corporate wish to Collaborate affects the Individual Level Conditions (arrow 1)*

A number of good reasons for collaborating are argued by the managers and referred to by the affected employees, and it makes it important to ensure that the new knowledge is stored in CSC along the way. For example it is vital that all employees that are engaged in the partnership can follow the work processes and understand what exactly is complied with in the collaborative project. A manager provides this reflection:

[In the beginning] we were way too busy to stop up and evaluate what we have learned. ... I believe that we are ready to stop up and define what we can do different in the future, what we have learned from this process (#2)

There is a lot to learn from the collaborative processes and in the beginning the learning curve seemed very steep. It is important to focus on how the employees, the norms that they comply with and their level of competence are affected by the corporate decision to collaborate. The learning perspective is very important. Thus this is where we will direct our attention in this chapter that highlights the dynamic interaction of corporate level decisions and individual level collaborative conditions.

### 8.2.3 *Formal Structures that guide Actions*

To guide the actions that are to be taken in the collaborative project and ensure that the goal of the project is fulfilled, the partnership between CSC and Scan·Jour is formally described in a number of contracts. This means that all details about deliveries, milestones and formal obligations are thoroughly described. First of all, CSC and Scan·Jour have entered into a *Partner-contract*, describing in general terms the division of labor and the different task responsibilities of the firms. This contract is related to a specific FESD contract and matches its various specifications. Additionally, every project initiated will have its own customer specific *Supplier Agreement*, describing the products, deliveries, and services that are to be implemented by either CSC or Scan·Jour. The collected amount of agreements and contracts illustrate that formal structures are needed at many levels of the collaborative project; one single all-inclusive contract is not sufficient as the project operates at many different organizational levels and links many different functional units.

A manager states that the process of designing the different contracts and agreements can have an additional positive outcome as this is the first time where the employees work together:

In designing the collaborative contract we learned a lot about working together. This is the first time that you see whether there is a good chemistry between the employees in the two firms. If there is a good relation between the managers it will affect the employees throughout the entire organization. (#7)

Still, when asked how the contracts direct the day to day actions of the collaborative project, the same manager responds:

The first thing we focus on when a partnership is being planned is the legal issues; designing the contracts and eliminating the risks. But this focus on the contract does not always create the best foundation for the relationship you are trying to build. Aiming to describe everything in details is not the best way of starting a partnership and sometimes it becomes so detailed that you are not able to maneuver. (#7)

Another project manager states:

In spite of the contracts a lot of things have to be handled along the way. An example is the issue of lack of quality in the products. We do not deal with that in the contract where the standard quality is described, but what happens if it does not match the prescripts? Who is going to pay for the time and resources spend on taking care of that? We had no routines for that in the beginning. (#6)

And the manager continues by pointing to how such critical situations can be handled. First of all CSC need to gain better knowledge about the partners product in order to be able to know when to take exception in the contractual phase. Second they need to build up good relation between the employees in order to be able to engage in a good communication along the way. She continues:

The social part is import in a project like this. I imagine that some people at Scan·Jour once in a while have been thinking that 'the employees at CSC are quite foolish, they really don't understand this'. But the better the relation the less we will see of this kind of attitude (#6)

At the outset of the collaboration with Scan·Jour a number of work groups were designed to take care of all the different issues. Many issues had to be dealt with and unforeseen issues could turn up both in regards to the internal relation between CSC and Scan·Jour, in relation to the authorities behind the FESD project, and in relation to future customers. The project was characterized by having myriad of stakeholders and it got off the ground with a large number of meetings and steering committees. When asked whether an internal project could have been organized in the same way with this amount of agreements, contracts and committees a manager answers:

Well, it has run wild; all these meetings and steering committees - I think we have fifteen at the moment - and it is completely crazy. We would never do it the same way in an internal project at the same size – but this project is not seen as one project. Every technical detail or problem that occurs in the delivery group is treated like one specific project. But this has just been changed. We learn. (#2)

When asked what it means to a project that it is based on this collection of contracts, a manager refers to the mutual dependency that the two firms feel when they are tightly linked through all the different contracts. CSC might compensate for missing details in the partners product or cover up problems that arise instead of just referring to Scan·Jour as the responsible partner. If the project was just another CSC project they would just refer to the subcontractor if anything went wrong when implementing the product at a customer. But in a partnership they aim to cover each others backs.

The meeting structure has been redesigned after the first year, on the basis of an evaluation of the groups, their responsibilities and the schedules of the meetings. As this program manager says:

Earlier on we had a few large meetings, where people were attending meetings that had no relevance to them. That was not very motivating. Now we have designed a number of meetings that run on a regular basis but with fewer participants. Additionally, we have gathered every thing in a regular FESD unit here at CSC. We have been very keen on designing an escalation opportunity meaning that if problems arise in any of the groups the employees know exactly how to take it to the next managerial level. On top of this, the groups have been

designed with some overlap in staffing so that one manager may attend two groups and can be responsible for bringing important issues further on. (#4)

One of the core aims that the project manager had in mind when designing the new meeting structure was to make sure that CSC was well represented on the teams that worked on the demands for the next versions of the data management platform. In working closely together, CSC would not only get to know the partner better but would also have the opportunity to formulate the demands for the next versions of the shared product. Thus, all groups from the top management teams to the ones responsible for customer service and future developments were staffed with both CSC and Scan-Jour employees.

**Table 8.2: The project group structure of the collaborative project.**

Body	CSC	SCAN•JOUR	Meeting interval	Issues
<b>FESD partner meeting</b>	3 persons	3 persons	Monthly at CSC, first Tuesday, 9-11	<ul style="list-style-type: none"> <li>• Customers</li> <li>• Deliveries</li> <li>• Sales</li> </ul>
<b>Delivery steering committee</b>	3 persons	3 persons + project leaders of large cases	Monthly at SCAN•JOUR, third Tuesday, 13-16	<ul style="list-style-type: none"> <li>• Status on large cases</li> <li>• Other cases</li> <li>• Sales</li> <li>• Action list</li> <li>• Theme of the month</li> </ul>
<b>RCB Meeting</b>	3 persons	3 persons	Monthly, second Tuesday, 14-16	<ul style="list-style-type: none"> <li>• Product strategy</li> <li>• Standard product</li> <li>• Release plan, content and time</li> <li>• New integrations</li> <li>• User feedback</li> </ul>
<b>Support group meeting</b>	3 persons	2 persons	Monthly, fourth Tuesday, 14-16	<ul style="list-style-type: none"> <li>• Status on running issues</li> <li>• Escalated cases or customer issues</li> <li>• Future upgrading</li> </ul>
<b>Resource coordination</b>	2 persons	4 persons	Monthly, third Thursday, 14-16	<ul style="list-style-type: none"> <li>• Mutual orientation on resource issues</li> <li>• Resource need for future projects</li> <li>• Competence need in regards to technical issues and business processes</li> </ul>

#### 8.2.4 Shared Norms and Values in the Collaboration

In spite of the many contracts and the clarity of the meeting structure, challenges became clear as soon as the employees started to collaborate. What looked like the perfect project outline at the drawing board met some challenges when the individual project participants started to collaborate. In other words, even though the managers had done a lot to make the employees ready and capable of collaboration the process of linking the conditions at the individual level to the actual collaborative behavior proved to be problematic. Implementing the right model of collaboration and adjusting the two organizations in order to make them contribute with the needed technologies and competences has somewhat challenged the traditional self-perception in the two firms. In agreeing on how to allocate the different tasks to the firms, it has appeared that the internal strategies of the firms had to be altered. As a CSC manager states:

Throughout the project, Scan·Jour has changed their strategy. They have gone from being a product *and* solution provider toward being a product provider only... it is their new strategy. And we, then, are responsible for implementing the solutions. This is one of the strategic changes that have been hardest to incorporate in Scan·Jour; at least this is CSC's point of view. Meaning that the single employees at least in the beginning questioned the role of CSC and asked: "Why do we need CSC, we are capable of both developing and implementing". So even though the task allocation is right, it has led to a good deal of friction. Basically, it is a question of what the management decides and then what feels right further down in the organization. (#2)

Referring to 'what feels right further down in the organization' among the employees when they start to work on the collaborative project, the manager points to something that has been very important in the project; namely the ability of the project leaders to include all employees and make them realize why it is important to work in a new and more interactive way with the partner. As an employee states:

When we started, it was 'them and us' and we felt that they were the ones who had to learn from us. But we have later realized that we can learn a lot too and that we have to work closely to gain that knowledge. (#3)

And she continues:

It feels like every thing is set up the right way at the managerial level but now we have to make it work at the employee level; that is not always easy. (#3)

To ensure a good relation between the employees in the two firms a number of social events have been set up to create an trustful atmosphere and to make sure that employees know who they are working with and are familiar with the managers in both firms.

We have taken the initiative to start a number of social events; enjoying a glass of red wine and hosting shared meetings. And we, the managers, have taken action as soon as we hear about any problems. I have often called my counterpart at Scan·Jour and said like: Listen, you have to back us up on this. As recently as last week we had an incident in one of the municipalities, where an employee from Scan·Jour enters a steering board meeting with the customer and states that: ‘well, CSC and Scan·Jour do not even agree on this’. When I heard that, I simply grabbed the phone and called my counterpart at Scan·Jour and asked if we could agree that this was never to happen again. (#2)

Conflicts may occur in any project and is very harmful to the process of fostering a good relation. A manager state:

The worst thing we can experience in a partnership is if we have to send an invoice to our partner and demand payment due to an error on the product that we have had to deal with. That is really not a trust building action. (#7)

When asked how this situation can be mitigated the manager responds:

We have to be tolerant in regard to such mistakes and think that it might be us next time. Now we have set up a routine where we kind of tally the mistakes or errors once a month. (#7)

In the following we shall study how the collaborative conditions fostered at the individual level in the collaboration has influenced the collaborative behavior of the employees.

### 8.2.5 *The Act of Collaboration (arrow 2)*

One thing that became clear when the two firms started to collaborate was that the employees in CSC were not all familiar with the details of the contracts and agreements that was the foundation for the collaboration. A project manager explains:

For one thing, we discovered that almost none of the employees new what we had agreed on with Scan·Jour and what was actually outlined in the agreement. Thus, they just started doing business as we are used to and it suddenly became routines. But in some cases this was not desirable because we ended up doing more than was actually agreed upon. Now we have made sure that all employees with project responsibilities are included in the process of writing up agreements and they are asked to review the contract on a regular basis (#4)

This quote illustrates that organizational routines might be developed even though they are not in consonance with the corporate goals. This finding may be very central as it directs attention to the importance of how routines and norms are created in a partnership. Even though the overall aim of the project seems apparent to managers it may be less clear to all employees how activities are to be done. It is essential to be aware of whether the employees are sufficiently informed and thus both able and willing to engage in the activities of the project as it is the basis for the inclusive act of collaboration. A project manager states:

We have to work very close together at all levels, and we have to do that until they understand that it is a benefit to have us in the project. We need to get some joint experiences of success. And then I think that when the orders start to come in that will show the way as well. Then Scan·Jour will know that they could not have done this alone. (#4)

A new initiative has been implemented at the employee level in CSC. It is called “knowledge sessions” and in these sessions the employees from both firms are meeting to create new knowledge jointly. The idea is that when the employees gain new knowledge together they learn at a faster speed than they would have if they were just to go through the knowledge creation or education process alone. Additionally, they might learn from the way the partners approach the new knowledge as they might ask different questions. As a manager state:

We want to learn all that Scan·Jour knows about this platform. (#4)

Thus there is also an aspect of acquiring the knowledge and competencies of the partner through these sessions.

#### *8.2.6 How Individual Behavior Affects Collective Outcome and the moderating effect of Customer Relations (arrow 3)*

One of the most important issues in a collaborative project like the one described is that the potential customers have to experience Scan·Jour and CSC as one a united partnership. This is a challenging situation as the partners does not only have to handle there internal relations, as they would have had to if it was an ordinary buyer supplier relation. Now they have to face a potential customer together with employees from the partners firm.

The collaboration has been characterized by a high level of integration between the two partner firms and a mutual understanding of the need to share resources and knowledge in order to succeed in the collaboration. Still, both partners have to take into account that in spite of the repeated collaborative projects they will eventually proceed alone. When that day comes, they will both need as many solid relations to customers as possible. Thus, building and maintain the customer portfolio has been a subject of considerations throughout the project. For this purpose, it is very important to be the ‘face’ that the customers meet when they choose the CSC/Scan·Jour-consortium as their FESD provider. As CSC is the larger of the two partners and is the main contractor in the consortium as well, they are always involved in the communication with and delivery to the customers.

Asked how they deal with the fact that they need to act at one company when they approach a new customer even though they might not agree on all details of the project, a manager explains:

In general we (the two project managers from each company) make sure that we often meet customers together. [In the beginning] we had an unsatisfied customer who felt that the new system we had launched affected their productivity in a negative way. They went from a client based system to a web based system and that does not work as fast. She wrote to the Ministry of Finance and the FESD project group that this system was useless for this and that purpose and that,



additionally, CSC and Scan-Jour were not able to collaborate. We called the customer right away and said that we would come by, together... We acted in a fast manner. We do a lot to make sure that we appear as a couple. (#2)

The danger of exposing an eventual lack of collaborative ability that is mentioned in this quote is something that is essential to handle. This goes especially for a collaborative project where the relation to a given customer is as vital as it is in this project. It is a challenge to cope with the fact that all employees may not be equally good at collaborating from the beginning. As we will see in the following the individual behavior will affect the collaborative outcome in different ways.

A solution to the problems with lack of interaction is suggested by an employee that has many years of experience with setting up partnerships in different companies:

What concerns me the most in partnerships like this is how to make two firms interact while they are still two independent companies? What I have suggested is to set up an independent virtual unit that deals with all the deliveries and contacts to the customers. This unit needs to consist of people from both companies but they need not be located in the same physicality. All deliveries have to go through this unit and there must be only one manager who is responsible for the prioritization of cases. This will ensure that there is no discussion between managers of the two firms on which cases and which customers are the most important. This is not how it works yet, but hopefully that is one thing we have learned and will take with us to the next project; that the day to day operations has to be done in even closer collaborations. (#5)

To CSC, the overall aim of the collaborative project has been to enter the field of electronic data management as a strong player surrounded by good partners and sub contractors. Being part of the FESD project was from the beginning seen as an opportunity to approach both new and previous customers. The partnership with Scan-Jour was an ideal tool to reach this goal as the close collaboration would provide CSC with both an electronic platform to work with and develop new knowledge in this specific discipline, as well as a much faster entrance to the field that would have been impossible if they should have entered it on their own.

An important step toward fulfilling the main aim of the project has been to learn to collaborate with an external partner on a more integrated basis than CSC usually does. To provide own employees with the right tools and mindsets towards the partner has been a huge challenge to the responsible managers and it has taken even more time than they thought from the beginning. Speaking about partnering, a manager says:

It's a special professional discipline and we have had to upgrade on this. But I think we have reached a position where we know what additional stuff we can learn from the partner. Until now, we have been so busy and we have had more troubles on the way than expected so we have not been able to approach our new customers and say that 'well now we have implemented phase 1; now we would like to invite you into our I:LAB and innovate on your flow of work'. We might be able to improve the product they bought or add features or do some web services or add an internet portal or whatever – in short; utilize some of the potentials of this new product we have provided them with. (#2)

However, as a manager states in the following, partnerships with small and innovative companies have come to stay.

We are supposed to be innovative but if the truth must be told we are not always flying high. We can easily build I:LABs and do things like that but if we strive for new ideas and new technology, we have to search in other settings. These things are born in these small start-up companies where they are up front on the new technologies. These guys have black nails and they have some cutting edge competencies. I am convinced that there will be more partnerships. I have heard IBM say the same. But we need to be more comfortable with entering a partnership like this. (#4)

The clash of different work cultures and the disagreements on the prioritization of the customers has been obstacles on the way. These controversies have been solved by developing new meeting structures and by the fast action of the managers. The processes have showed that organizational learning is possible if the employees know exactly how and why things are done in new ways. While looking back on the last three years, a manager concludes:

It is a very successful collaboration; we have used each other a lot. Everybody knows that we are in this together, and that the success of one partner is dependent on the success of the other. Of course there have been issues that we have had to deal with, but if I turn back time and look at the past three years; I had not imagined that it would be so successful. And we even started out with a really tight business case with too narrow prices. The trend of prices has not been what we expected and this could have caused problems like, ‘who is going to pay?’ or ‘if things don’t work who is going to fix it’, but it has been a tremendous success. (#2)

### 8.3 Analysis and Conclusion

In this narrative the process of learning from the partnership experience is a core issue. Partnering has not been the preferred way of doing business in CSC but it has been a natural choice in the present project described as the project was designed to be completed by a consortium of partners. The project has learned CSC a lot about how to collaborate closely with an external partner. Even though the partner was known as a preferred supplier from previous projects they have never been working as close as this before. This has challenged both employees and managers at CSC because the corporate cultures were hard to align in different ways. Still the two firms seemed to have managed this alignment process well. Following, another challenge occurred. This was the challenge of facing a third party, the customer as one joint alliance. The presence of the customer has in many ways been a very specific characteristic to the project. It has been the core challenge of this partnership as it has illuminated the asymmetries and differences between CSC and the partner. As asymmetries between partners can be beneficial when new knowledge and inspiration is asked for, it can be damaging when a customer is a part of the process and are expecting agreement between the two partners. In table 8.3 the findings of the narrative is applied to the analytical framework.

**Table 8.3 Collaborative R&D Capability Elements at CSC**

Core theme from the framework	Practical examples observed at CSC	Comments from CSC	Change of framework
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<p>Arrow 4: <b>Corporate aspiration to collaborate leading to collaborative capabilities</b></p>	<p>A wish to ally with external partners instead of buying capabilities in.</p> <p>The consolidation in the IT service industry has formed a wish to collaborate with smaller innovative firms</p>	<p>Capabilities are hard to gain when partnering is a new activity</p>	
<p>Arrow 1: <b>Corporate aspiration to collaborate impinge on collaborative conditions</b></p>	<p>Creating opportunities to collaborate and making them visible.</p>	<p>The size of the partner compared to CSC may constitute both a challenge and an advantage</p>	
<p>Arrow 2: <b>Individual collaborative conditions affect the collaborative behavior</b></p>	<p>Not all employees knew how to act in collaborative projects</p>	<p>Some routines were implemented even though they were not in accordance with the project goals. They performed more tasks that expected</p>	<p>Even though the employees are willing to collaborate they might engage in risky routines</p>
<p>Arrow 3: <b>Individual collaborative behavior leading to corporate collaborative capabilities</b></p>	<p>Collaborative capabilities are also the ability to act as 'one company' together with the partner. This is judged by the third party, namely the customer</p>	<p>The relation to the customer affect behaviour of the employees and thus the development of corporate capabilities</p>	<p>The relation to customers has an huge impact on how collaborative capabilities are developed</p>

## 9. Discussion and Conclusion

### *Understanding the Micro-foundation of Collaborative R&D Capabilities*

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Capabilities are clearly an  
'intermediate transformation ability'  
between resources and objectives  
(Dutta, Narasimhan and Rajiv, 2004:278)

#### 9.1 Introduction

The search for micro-foundations can be described as an attempt to understand an aggregate phenomenon in terms of the behavior, interaction and motivation of individual entities of this phenomenon (Janssen, 2006). In the context of the present study this means, that examining the motives, abilities, actions and interactions of single employee engaged in collaboration has played the lead in the quest for providing a better understanding of the nature of collaborative R&D capabilities. This chapter contains of brief summaries of the three case narratives, a cross case analysis and discussion and conclusion section. Finally the chapter ends with managerial recommendations and a section on limitations of the present study and directions for future research.

The cross case analysis is founded on the within-case analyses which conclude the three narratives of the thesis. The findings from the within-case analyses are reported in matrices at the end of each narrative. These matrices direct our attention towards issues that support or confront the theoretical framework developed in chapter 4 of this thesis. The aim of this two-step process of analysis is to let the unique patterns of each narrative emerge before I compare patterns across the case narratives. Conducting a cross case analysis forces the researcher to look beyond initial impressions through the use of structured yet diverse lenses on the data (Eisenhardt, 1989) and consequently it aims to build a logical chain of evidence for the relationships among the key variables studied.

Exploring collaborative R&D capabilities is a complex task that involves the analysis of numerous factors at different levels of study. The framework (Model 3.2) developed in this thesis helps to structure the flow of the analysis and directs the attention towards factors that support or confront the argued process of the development of collaborative capabilities. The framework consists of four 'states of the worlds' located at each corner of the framework model and of four

arrows illustrating the transformation that occurs between the corners. The transformational processes are mediated or moderated by different mechanisms and as these mechanisms are the most central elements of this study this will be where I focus my attention in the following cross case analysis. Thus, the analysis will focus on the arrows (1-4) and I will refer to the states of the world that are either starting or ending the transformational process when this is essential for the understanding of the change processes. Before turning to the cross case analysis I will provide a brief resume of each cases narrative.

## **9.2 Résumé of the Narratives**

### *9.2.1 Novozymes*

The Danish Bio-Innovation company Novozymes is a world leader in the field of enzymes and micro-organisms. In 2005 a partnering project was initiated at Novozymes with the aim of facilitating a more professional approach to partnering. With the aim of doing 50% of their R&D activities in collaboration with external partners Novozymes needed a strong focus on and support for the collaborative activities. The narrative provided insight into a collaborative project between Novozymes and the German partner Solvay. The project started out as a short-term project oriented towards the licensing of a patent held by Novozymes. The relation has developed into a long-term engagement due to the many opportunities that has risen during the first years of collaboration. At present the collaboration is organized in a short-term and a long-term project part, which engages different employees and have very different aims. In the narrative it is described how the trade-off between exploration and exploitation activities plays a central role in the firm. The very different motivational orientations of the employees are also described. Finally the narrative provides an insight into the importance of core employees playing a central role in connecting relevant employees both internally and externally.

### *9.2.2 Novo Nordisk*

The second narrative presents The Danish pharmaceutical company Novo Nordisk and the collaborative project they are engaged in together with their partner ZymoGenetics. The two firms have a shared history characterized by both close interaction and periods of separation, yet there has throughout the previous 25 years been a continuous exchange of knowledge, employees and managers between the two firms. The narrative describes how an agreement has recently been signed between the two firms prescribing a more structured way of sharing knowledge in relation to

a specific R&D project. The construct of knowledge sharing is essential as it refers to more than just sending loads of information back and forth across the Atlantic. In order for knowledge to be attained the receiver must be able to communicate with the sender and be acquainted with the context in which this knowledge is produced. In other words, knowledge sharing requires a more integrated interaction between partners for value to be created. This is exactly how sharing of knowledge separates from sharing of information. And this is where this narrative has its strength; in showing how the act of knowledge sharing is formed by the interrelated actions of individuals from the collaborating firms. Additionally the narrative helps to clarify how successful knowledge sharing is closely related to the existence of a range of collaborative R&D capabilities. The narrative highlights how the fact that employees asked for a more flexible agreement and a more loose link between the firms made the top managers decide on a re-organization of the project. Instead of engaging in a process of co-creation of knowledge the firms agreed on extensive knowledge sharing.

### 9.2.3. CSC

The third narrative portrays the Danish part of the IT Service Company CSC. CSC Denmark provides consulting, system integration and outsourcing services to both public and private companies and their main focus is to help customers reach their strategic goals through the use of advanced information technology. The partnership between CSC Denmark and the smaller Danish Company Scan·Jour was initiated when CSC decided to bid on the tender for the national FESD project that aimed to develop a joint electronic case and document management system to apply in public settings. CSC started to look for a potential partner with a product that could match the request of the tender and Scan·Jour was chosen because of their technological platform, Captia. CSC was familiar with Scan·Jour as they had been a preferred supplier to CSC for years. Still, being related in a buyer-supplier relation like the two firms have been previously is completely different than working closely on the development of a joint technology platform as they do in the present project. The new collaborative project required a higher degree of interaction between the employees than they were used to. This case is exceptional due to the fact that the two partners, CSC and Scan·Jour, had to agree on a number of core issues in a rather fast manner in order to be able to approach potential costumers as one joint service provider. A key success factor in this project is that CSC and Scan·Jour appear as one united company when they approach new customers to implement there new jointly developed products and services. Still, this has been a

significant challenge to the two independent companies and has made the development of collaborative capabilities in CSC both difficult and even more important.

### **9.3 Cross Case Analysis**

The present chapter aims to describe the micro-foundations of collaborative R&D capabilities. This will be done by bringing together the results of each of the three narrative analyses. In table 9.1 I summarize the key findings of the three narratives. The results will be applied to the theoretical framework of the thesis in model 9.1, as this model illustrates a number of dynamic factors impinging on the development of collaborative R&D capabilities in a strategic alliance setting. These factors are, however, not all internal to the model as it was designed by Coleman. Consequently, I argue that the main weakness of the framework is that it does not leave room for the fact that factors external to the framework may have a substantial impact on the development of collaborative capabilities.



**Table 9.1 Elements of Collaborative R&D Capabilities – adjusted**

Core issues of the framework and the moderators or mediators	Comments or Adjustment from empirical setting			Empirically identified collaborative capability elements
	Novozymes  (Highly experienced + strategic focus)	Novo Nordisk  (medium experienced + new strategic focus )	CSC  Little experience, a nascent strategic focus)	
<p>Arrow 4: <b>Corporate aspiration to collaborate on R&amp;D Lead to collaborative capability development</b></p> <p><i>Aspiration is formed by: Exploration aims Exploitation aims</i></p>	<p>The short term project is mainly about exploitation, the long term project is exploratory in nature</p>	<p>Partnering is the cornerstone in a new business unit; arrow four is confirmed.</p> <p>Previous relations are explored as they are sought to support collaboration, <b>they may, however, also hamper a good project</b></p>	<p>Collaborative capabilities do not come easy</p>	<p>Arrow four exists: partnering is believed to provide new knowledge in a faster and better manner in all three narratives. However;</p> <p><b>It is important whether knowledge exploration or exploitation is asked for. A focal firm may benefit from interaction between project parts with different aims. Exploration and exploitation require different capabilities</b></p> <p><b>Collaborative capabilities are needed and a strategic focus must be devoted to ensure their development</b></p>
<p>Arrow 1: <b>Corporate aspiration to collaborate on R&amp;D affect the individual collaborative conditions</b></p> <p><i>Conditions are mediated or moderated by:  Socialization Motivation Collaborative climate Designation of direction</i></p>	<p>Initiatives to collaborate come from employees as well. Employee initiatives need to be supported by organizational initiatives.</p> <p>IT based structures like communication tools and process guidelines support communication and interaction</p> <p>Partnering strategy as tool to explicate the goals of collaboration; searching externally for new know-</p>	<p>Designing agreements that fit the aim of the project: neither to extensive nor to narrow.</p> <p>Important to adjust facilitation structures to those of the partner. Must be continuously attuned.</p> <p>Meet often to create a good social relation</p>	<p>The size and experience of the partners are vital</p>	<p><b>Organizing the search for collaborative opportunities among employees as well as at the strategic level</b></p> <p><b>Group dynamics across collaborating organizations are important</b></p> <p>Structures to facilitate communication and interactions are essential</p>

	ledge in a faster manner			
<p>Arrow 2: <b>Individual conditions lead to Individual behavior</b></p> <p><i>Mediated by: Willingness and ability Absorptive capacity</i></p>	<p>A partnering mindset has a positive effect on collaborative behavior</p> <p>Employees have different motivations schemes. Some are hesitant to collaborate and ask for lot of support, others collaborate because it is inspiring in it self</p> <p>In collaborative projects the codification of knowledge is more important yet often difficult</p>	<p>Need to have expertise to understand and assimilate knowledge. It is as much a question of coping with absorption in side the focal firm/ the project group</p> <p>Need to ask the partners for detailed descriptions of the knowledge to be provided e.g. to match the request from authorities</p> <p>Align expectations on the kind of information or knowledge that is shared</p>	<p>When collaboration is a new endeavor, routines that are not aligned with the strategic aim may be developed</p>	<p>Even though willingness exist, damaging behavior (e.g. collaborative routines) may be developed</p> <p>A positive mindset the a sum of prior experiences, training, information and culture in regards to collaboration</p> <p><i>Attitudes are also formed by non-organizational issues such as the individuals type of job, prior experiences or education</i></p> <p><i>A number of abilities are needed:</i></p> <ul style="list-style-type: none"> <li>▪ The ability to search for, assimilate and utilize external knowledge is vital</li> <li>▪ Absorptive capacity is a resource demanding ability</li> <li>▪ Ability to spot patterns in knowledge and technologies in a collaborative project, and to secure the match of mutually beneficial parts of knowledge</li> <li>▪ Ability to inform the partner about the knowledge needed to proceed with the collaboration</li> <li>▪ Ability to be attentive towards the partners needs for knowledge and support. Relates to having a partnering mindset</li> </ul>
<p>Arrow 3: <b>Individual collaborative behavior affecting corporate collaborative capabilities</b></p> <p><i>Comprised by: Individual behavior and group dynamics</i></p>	<p>When learning about a new field, physical interaction and communication between employees is important</p>	<p>Knowledge co-creation does not need to be an aim of collaboration. Sometimes sharing is more suitable than co-creation</p> <p>Important to provide the partner with knowledge that is relevant and in a</p>		<p>Share knowledge in a way that makes is applicable to the new context yet detailed enough to be valuable</p> <p>Ensure transparency and mutuality.</p> <p>Collaborate to ensure inter-organizational learning</p>

<p><i>Social capital/relational structures</i></p>		<p>form that can be used</p> <p>The sharing behavior will affect the group dynamics and affect the development of social capital in the group</p>	<p>The relation to a third party (e.g. customer) may be of importance even though they are not, as such, part of the collaboration</p>	<p>Third parties (e.g. customers) may be important in the collaborative project and they affect the outcome of the project</p>
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### 9.3.1 Findings Supporting or Altering Arrow 4

The macro level arrow of the framework, arrow 4, illustrates the somewhat invalid assumption that organizational level outcomes can be generated organizational level actions alone (Abell, Felin and Foss, 2008). As this link is perceived to be an inadequate explanation of how capabilities come about the aim of this study has been to search for the micro foundations of collaborative R&D capabilities by splitting arrow 4 into three pieces: arrow 1, 2, and 3. The main focus has been devoted to search for moderating and mediating factors to the following three arrows, not to search for elements that operate solely at the macro level. A few macro level issues have, however, showed to be important for the understanding of the macro level elements of the framework. Especially in the first narrative portraying the collaboration between Novozymes and Solvay it became clear that the elements that formed the corporate aspiration to collaborate had an important influence on the following processes in the firm. In brief it was important whether the aspiration to collaborate was formed by a need to exploit existing resources or explore new knowledge together with the partner. The two different forms of activities ask for different organizational structures and different capabilities and thus it is vital to deal with the matter from the beginning of a project.

A similar finding was done in the CSC narrative where the collaborative project was initiated with a company, Scan-Jour, which had earlier been a supplier to CSC. The partners had a previous relationship, still, working as equal partners in a developmental project where new technology and new services was to be developed necessitated a much closer relation than needed when the relation was just a supplier-buyer-relation. The need for co-exploration of new technologies called for new ways of organizing. To really understand how the differences in the knowledge activities, referred to as exploration and exploitation-activities, affect a focal firm we need to study how it affects the individual level factors as well and thus we need to focus on the dynamic processes of arrow 1.

### 9.3.2 Findings Supporting or Altering Arrow 1

The factors that motivate a given firm to start collaborating can, as mentioned above, be characterized as either exploitative or explorative in nature. This means that the aim of the collaboration is to explore already existing resources held by either the focal firm or its partners or the aim can be more *exploratory* in character as the firm seeks to explore new knowledge together. These drivers of collaboration and their implications were reviewed in chapter 2 (section 2.2.5) and, in sum, the analyses showed that it is important to acknowledge that both exploration and

exploration activities are needed in most firms and that balancing the two kinds of activities is an essential task. It is often suggested that activities of exploration and exploitation fight for scarce resources; still, in the collaborative project in Novozymes it becomes clear that the project holds elements of exploration and exploitation in different parts of the project.

The collaborative project between Novozymes and Solvay was born with a short-term project part in which knowledge, already patented by Novozymes, is exploited to improve one of Solvay's products. At the same time the collaborative project was extended with a more long-term part in which new knowledge is explored with the aim of improving the enzymes in ways that spurred a range of new opportunities for both firms. In this vein explorative and exploitative elements are included into the same project. The different motivational factors, whatever the mix may be, will foster a corporate intention to collaborate on R&D. However, the Novozymes case illuminated that different capabilities are needed when explorative and exploitative research activities are undertaken. A central finding is, then, that an aspiration to collaborate is a complex matter that needs to be thoroughly investigated by the involved partners before any collaborative project is started.

The intention to engage in collaborative projects has led many firms to formulate a partnering strategy, as illustrated in the Novozymes case, and some firms even base new business units on a wish to utilize external knowledge sources, as the Novo Nordisk case showed. In the CSC narrative, partnering is a new endeavor; however, it is seen as an activity that will become more prevalent in the future. Formulating a partnering strategy is a powerful tool when a corporate aspiration to collaborate needs to be communicated to the entire organization. A strategy that points towards external knowledge as an important source in the R&D process makes the benefits and goals of collaborating much more comprehensible and thus it may affect the employee's willingness to collaborate. A strategy describes the aims and reasons to collaborate but it can also prescribe the processes of partnering by outlining the different stages that a project runs through. As previously argued, it is important that the partnering strategy mirrors the overall ambitions of the firms and fits with the culture and perceptions held by the employees in order to be beneficial to the firm. This match will make it easier for employees to make decisions and act when an opportunity to collaborate suddenly emerges.

In the case narratives, a clear difference is that while Novozymes has defined a partnering strategy directing the actions of the entire organization, Novo Nordisk has only applied this more deliberate focus towards partnering in the recently established business unit; biopharmaceuticals. In

CSC, a learning process has just commenced. This difference in devotion to utilizing external knowledge sources may be explained by a difference in the dominant logic of the different companies. As outlined in section 4.2, Prahalad and Bettis (1986) introduced the notion of a dominant logic in strategy development based on the work on cognitive biases. Cognitive biases can arise from the various loyalties that a person may have, or from local risk and attention concerns that are difficult to separate or codify (Tversky and Kahnemann, 1974). The argument is that the actions and decisions of managers are often guided by heuristic rules, norms and beliefs; or in other words, a dominant logic that will focus their attention as they seek new opportunities for the firm (Prahalad and Bettis, 1995). In the present context, this could be an idea about the strength of partnering which will guide the decisions when new knowledge is searched for. Yet, the dominant logic of a company could also be that opening towards external partners is a dangerous venture that needs to be controlled or even limited, and such a conviction may be very hard to change as it was illustrated by a manager in the quote in chapter 1, section 1.1.

The application of a specific dominant logic guiding managers to make certain choices may constrain other choices and filter out certain possibilities (Chesbrough and Rosenbloom, 2002). As shown by Chesbrough and Rosenbloom (2002), decisions made in established companies are often more cognitively bounded, as new information is filtered through a heuristic logic that is established from previous successes. This heuristic logic informs the various strategies e.g. the R&D strategies, and may guide the firm towards a more or less open attitude towards external knowledge in the R&D process. This may explain why a young firm like Novozymes seems to be keener on defining a partnering strategy than a more mature firm such as Novo Nordisk with a well defined corporate strategy and organizational culture. In CSC the collaborative project is established in a relative new business unit, the FESD unit. This might be beneficial to the organization as this unit may be less marked by the dominant logic of acquiring instead of allying that marks CSC in general.

When a corporate decision is made to initiate close collaboration with external partners and base R&D activities partly on knowledge sourced externally, it is vital that this wish is reflected in the overall strategy as well. Thus, the various alliance design issues is not a task that should be taken care of only by dealmakers or a small group of partnership specialist; it needs to be integrated in the strategy making process at corporate level. The alliance design process may benefit from being based on a portfolio approach to enable coordination among alliances. Additionally, an important issue that must be addressed in the alliance strategy is how to develop organizational

structures that can aid both the specific collaborative projects and also generally sustain the development of a broad array of collaborative R&D capabilities.

Designing an alliance strategy is only one among many organizational mechanisms that may be used to aid the development of collaborative capabilities. A number of structural factors can be developed in a given firm to support the strategic focus on collaboration. These structural elements could pertain to the development of effective practices for negotiating formal contracts (e.g. licensing agreements, joint patenting, or joint ventures) as well as designing IT infrastructures and procedures that allow for some degree of standardization of knowledge sharing. For instance, the development of an alliance unit that facilitates the technical and legal aspects of contracting may significantly reduce the cost of setting up, monitoring and managing an R&D alliance (Simonin, 1997), as illustrated in the Novozymes case. The service that the pro man-unit provides to the collaborating employees is of inestimable importance. By the same token, the appointment of an alliance manager as a coordinating device in collaborative relationships is widely accepted (Spekman *et al.*, 1998). Draulans, de Man and Volberda (2003) found that organizations with a specialist, positioned at middle-to lower levels of management, are considerably more successful with alliances than those lacking one. In the Novo Nordisk collaboration the alliance manager played a key role in building a trustful relation between the partner firms. Moreover, the design of a specific knowledge management system, organized to match the level of complexity of the knowledge that is to be shared, ensures effective knowledge sharing across organizational boundaries. There is no doubt that CSC would gain from gathering their experiences with partnering in a structured way, as some employees suggested.

In the Novozymes narrative, it was described how the wish to collaborate with Solvay was fostered both at the organizational level and at the individual level somewhat simultaneously. It is important to remember that collaborative projects are not always initiated as a corporate activity, but might very well grow out of personal relations among employees. Individual initiatives are not as such a part of the analytical framework as it was originally designed by Coleman, and, thus, it is important to argue for additional arrows that may influence the framework from 'outside'. That is; factors at the individual level that are not part of the framework originally may very well be influential to the further dynamics of the framework (see arrow 'a' in model 9.1 below).

Another alteration to the framework is inspired by the fact that situations in the focal firm might require that the first plan or overall strategy of collaboration is changed. In Novo Nordisk we saw how an initial plan for a very close collaborative project was changed into a less involving

agreement on knowledge sharing (see arrow 'b', model 9.1). This was, among other things, due to the wish for more flexibility in the research argued by the employees. So, it is important to leave room for the feedback loop from individuals' experiences with the day to day activities and to the overall strategy of the project. All in all, the reviewed factors affect how willingness and ability to collaborate is formed by the corporate aspiration to collaborate and all the factors that mediate or moderate this dynamic process.

### *9.3.3 Findings Supporting or Altering Arrow 2*

An important element that supports the transformation from individual level willingness and ability to the fostering of an actual collaborative behavior is the core focus at the individual level of the framework. Employees that are willing and able to collaborate may develop a collaborative behavior, but factors may also influence this development negatively.

In Novozymes the development of individual abilities was given high priority and targeted training was undertaken by an external expert. Whether the training is done by an external expert or an experienced employee may vary from company to company; yet, in any case it is beneficial to design a corporate training program. As collaborating with external partners is not something that employees are trained to do through their formal education, it is essential that the firm offers a way in which people can acquire the necessary collaborative abilities—on top of the numerous disciplinary abilities that they may have attained through education or training. In general, it is essential that the different structural elements are designed to match the need of the employees, no matter what level of experience and capability they may have.

As I have shown through the analyses in chapter 4, the actual collaborative behavior of the individual employees are highly dependent on their abilities to engage in collaborative activities. When employees collaborate across organizational borders they need a range of different abilities. The most central abilities needed in a given collaborative project are, as stated, the disciplinary ones that are needed for the employees to be able to perform in the collaborative project. Individuals with a high level of expertise in a given field are more capable of understanding the laws, logic and rationales underlying the function or processes of a specific knowledge domain. This understanding provides the individual with the ability to identify critical configurations or complexes that contains several pieces of information such as information about the solution in a complex situation (Lofstrom, 2000; Camerer and Johnson, 1991). Individuals, who are experts, are better at integrating new knowledge in existing domains than individuals without expertise, and, as a consequence, individuals with high levels of expertise are more likely to learn from collaborative



activities. This is why it is a beneficial strategy to train or hire oncologists and assign them to a project, like the one in Novo Nordisk, where new ventures are done in a relatively unknown field; oncology. Even though the partner is specialist in the relevant field of research, the focal firm needs to have some knowledge in order to be able to absorb the new knowledge as well.

Employees with other professional profiles than the ones related to the core discipline of a given collaborative project will also be needed. A collaborative project may need for example a legal officer or a patent worker closely connected to the project as well as employees from development department or even marketing or customer relations who are often included in various processes of the collaborative project. Most firms have a template that they follow when collaborative R&D projects are staffed. This was the case in all three focal firms of this study. Following this procedure, all employees will be assigned with a disciplinary counterpart in the partner firm.

In addition to possessing the proper disciplinary skills, employees need additional skills that are directed towards the specific challenges that pertain to collaborative activities as such. An ability to designate the direction and understand the various phases of a collaborative project and to spot the potential problems that may occur at a given time in the project is especially beneficial. Firms, whose employees collaborate frequently, tend to make this kind of knowledge explicit in a manuals or a codex that can guide the employees through the phases of the project. The ability to maneuver skillfully is, however, often a question of experience and may thus be a personally held ability. Additionally, contributing to a positive collaborate culture of a given project is not something you learn from reading a codex. This was obvious in the Novozymes narrative, where a central employee played the role of a gatekeeper as well as a coordinator of internal relations between the units of Novozymes. Abilities that relate to understanding and aligning to the partner's goals or being good at working in trans-disciplinary teams are often gained through experience. This goes for many of the individual capabilities which can be characterized as collaborative capabilities, such as different interpersonal skills (see arrow 'c', model 9.1).

Specifically in alliances that are centered on core R&D activities the ability to absorb external knowledge is of primary importance. We have dealt extensively with the organizational absorptive capacity, yet the construct is specifically important to this study as it is said to have both an organizational and an individual level character. Building on research of problem solving and cognition at the individual level (e.g. Bower and Hilgard, 1981) Cohen and Levinthal (1989, 1990, 1994) point to the fact that individuals may differ in their ability to recognize, assimilate and utilize

external information. The authors suggest that absorptive capacity is actually a by-product of prior innovation and problem solving activities and thus the ability to absorb new knowledge is path dependent in nature. The breadth of knowledge already possessed by an individual will aid the process of making sense of and acquiring new knowledge. In the Novozymes narrative it was described how some of the project groups included more Novozymes employees than Solvay employees. One explanation for this could be that Novozymes aimed to gain new knowledge from this collaborative venture and they needed to have more employees from different business units included in the project to make sure that the employees with the needed basic knowledge and the ability to absorb the new knowledge was present at the meetings.

Additional important capabilities are the bonding and communicative abilities. A bonding ability is the ability to be attentive towards the partner and the need for support in the collaborative process. Communicative abilities relate to the abilities to communicate the need for knowledge and to communicate about the knowledge that is either shared or co created.

It is important to point towards a weakness of the theoretical framework that has been suggested in this study. The framework does not leave room for external moderating factors that impinge on, for example, an employee's willingness to collaborate. By external moderating factors, I refer to the personal traits of the employees or a previous employment that for some reason makes the employee more or less willing to collaborate. In sum, organizational level factors are not the only factors that can influence the dynamic processes (again see arrow 'c', model 9.1). Additionally, an employee who has been through diverse training sessions and is a skilled researcher may still be very reluctant to collaborate due to a belief in the dangers of collaboration possibly fostered by a close corporate culture or the like. The willingness may vary according to the job function or experience with collaboration. This was the case in Novozymes where a manager described how some researchers were reluctant to participate in the collaborative project because the project differed too much from the research projects they were normally engaged in. A core unwillingness related to the fact that the project was less predictable; as the manager put it, he was not able to tell exactly what they were going to do in a couple of months, which was a problem to some of the employees. Additionally it is worth mentioning that employees do sometimes engage in a given collaborative project not because they are motivated to collaborate as such, but because they have a specific interest in the specific kind of research or development that is undertaken in this project. This was the case in Novozymes where employees talked about being motivated simply because the project results were going to be used for curing severe diseases instead of developing a new kind of

detergent, as they were used to. Applying this to the framework we need to illustrate it with and arrow affecting collaborative behavior but not necessarily because of a collaborative willingness or ability (see arrow 'd', model 9.1)

The act of collaboration does sometimes, as described in chapter 4, run counter to the classical idea of the need for protection of the core knowledge of the R&D department. This is why it is important to work very deliberate on fostering a positive mindset towards partnering in the organization and to mitigate the potential hostility by unfolding the corporate motivation to collaborate and outlining the expected benefits of engaging in inter-organizational collaboration. This is one of the most essential tasks of R&D management.

#### *9.3.4 Findings Supporting or Altering Arrow 3*

As the narratives of this study have shown, numerous factors impinge on the actual collaborative behavior of individuals. Organizational factors will affect behavior by supporting the ability and willingness of individuals, and the character of the knowledge processes that the employees are to engage in may hamper or facilitate the actual collaborative behavior as well. A collaborative behavior is composed by the abilities that are sketched in this study. I have dealt with how both disciplinary skills (insight in core knowledge) knowledge related capabilities (such as absorptive capacity) and other collaborative capabilities (such as communication skills) are all important in shaping an actual collaborative behavior at the individual level.

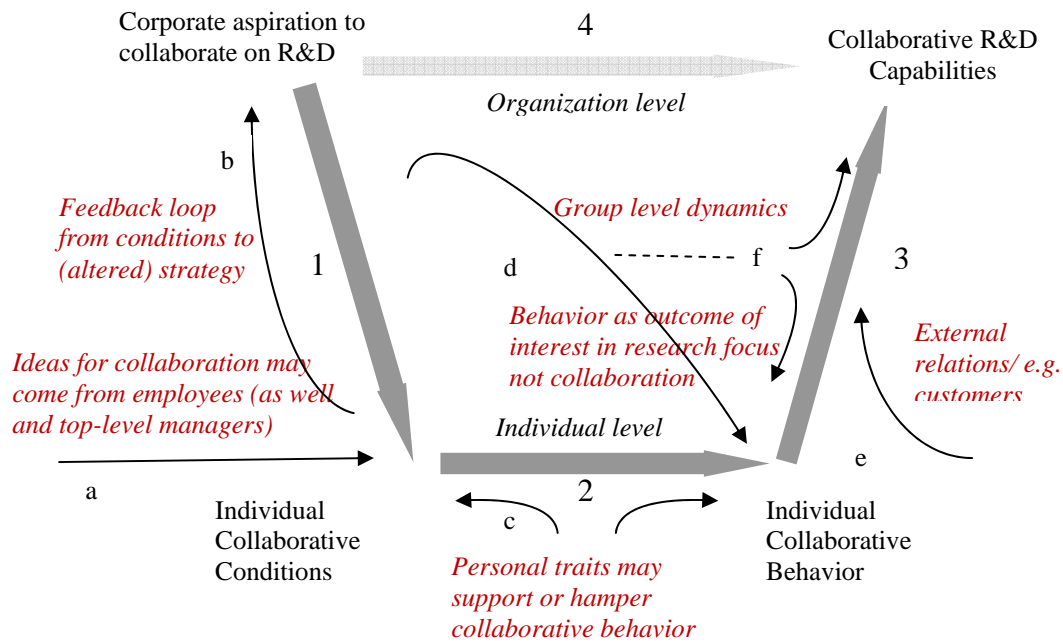
A central finding in the CSC narrative was that even third parties that are not as such involved in the innovation processes of the collaborative project may affect the project as well. Having to meet with customers early in the developmental phases of a project requires that you do agree on all core elements of the project in order for the partners to appear as one joint entity. It is not appropriate for the partners to start discussing issues of the product or the process in front of customers and thus a number of issues need to be settled beforehand between the partners. This can be a huge challenge especially for firms that just started to collaborate (see arrow 'e', model 9.1).

The way that the single employees behave will of course affect the behaviors of the group they belong to. In section 4.4.2 it was described how group dynamics play a role in this setting as well. A positive attitude towards current or future partner firms and more generally towards the idea of inter-organizational collaboration does have a positive effect on a given collaborative action as it impeded the development of mutual trust between project participants. The aggregated outcome of the individual level behaviors, the micro to macro transition illustrated by arrow 3, highlights the crucial role of interdependencies in social phenomena that affect changes or outcomes at the macro

level. Getting from micro to macro level is not a question of aggregating the behavior of group of individuals to get the outcome at the organizational level. As individuals react differently to, for example, two different motivational factors we can not just do a simple aggregation of the actions of the relevant individuals. The way individuals interact and respond to the actions of their colleagues and the work tasks as such, will inevitably lead to another outcome than if the hypothesized individual behaviors were just aggregated; simply because they interact and affect each other. People do learn from each other and they do co produce knowledge and thus unforeseen results may appear. When positive in character these synergetic effects are exactly what form the corporate R&D capability of the organization. The group dynamic may also impede the development of a positive corporate capability. In Novo Nordisk it was described how the partners had varying perceptions of how the project should be organized and completed and a number of asymmetries were described (se arrow 'f', model 9.1).

From the outset the Coleman diagram is not designed with a focus on group level dynamics. This is problematic when the framework is used to study social processes in a collaborative setting. The interaction between individuals will inevitably play a central part in the development of collaborate R&D capabilities at the corporate level. This could indicate that an additional level ought to be applied to the framework that would underline the importance of the group level dynamics.

## Model 9.1: Theoretical Framework Model - revised



Own model

### 9.4 Core Contributions

The findings from the three case narratives have been applied to the theoretical framework inspired by the work of James Coleman. The empirical findings have formed the basis for a partially revision of the theoretical framework as it was presented at the outset. This revision is visualized in model 9.1. It is illustrated how dynamic factors exist at different levels and that a few factors even seem to work in the reverse direction of what was displayed at the first description of the theoretical framework. For example 'arrow b' illustrates how conditions at the individual level may affect the way a corporate strategy on collaboration is designed and 'arrow e' illustrates that external factors for example the relation to customers may impinge on the development of collaborative capabilities. A main contribution of the present thesis relates to the work on the theoretical framework. Throughout the thesis the analytical strength of the Coleman framework has been illuminated and I concur with the scholars that see this framework as a solid basis for searching out the micro-foundations - or explanations - of a given phenomenon (e.g. Gavetti, 2005) or as a good way of structuring the analysis of how individual actions affect collective level outcome (Felin and Foss

2007). Still, it is important to mention that the empirical work of this thesis has vindicated a revision or extension of the framework, as shown in model 9.1.

Additionally the thesis contributes to the emerging field of multi-level studies. The study acknowledges that we need to emphasize the interaction between organizational level factors and individual level processes when we want to understand collaborative R&D capability. These levels are interrelated and impinge on each other for example when a partnering ambassador assists a given group of employees in their collaborative activities by introducing the different communication tools of the firm. In this way, the ambassador makes use of organization level structures in order to help improve the individual level collaborative capability. In sum, collaborative capability is a function of the interplay between organizational level factors related to strategy and structure and individual level competence-building.

## **9.5 Conclusion**

At the outset of this thesis I argued for a general need for a better understanding of the micro-foundations of organizational level collaborative R&D capabilities. While promising in clarifying the application and performance implications of capabilities under different conditions, scholars often assume capabilities to be 'strategic and organizational processes' like product development, allying, and strategic decision making (Eisenhardt and Martin, 2000: 1106). From this perspective, performance differences between firms are driven by efficiency differences that can somehow be attributed to organizational (collective) level constructs, while fundamental questions related to the individual level issues of the phenomena are ignored (Felin and Hesterly, 2007). What is needed is a comprehensive understanding of the micro-foundations of these capabilities.

Capabilities are collective level constructs that refer to firm-specific knowledge being collectively held, and the fact that capabilities are what make organizations achieve a particular set of objectives are already well established (Nelson and Winter, 1982; Dosi *et al*, 2000; McEvily and Markus, 2005; see Foss, 1996 for an comprehensive overview of the theoretical contributions to this line of thought). Understanding the foundations of collaborative R&D capabilities is of utmost importance to alliances scholars and practitioners alike, as these capabilities mediate the relation between a corporate intention to collaborate and the actual successful outcome of the collaborative endeavors. Thus, the aim of this study has been to study the actions and interactions of collaborating individuals and additionally to investigate factors that either mediate or moderate the process of developing collaborative R&D capabilities.

A central reason for the importance of dealing with the explanatory mechanisms at a lower level is that this kind of explanations provides a more fine-grained understanding of the organizational-level phenomenon that we study (Coleman, 1990; Abell, Felin and Foss, 2008). An explanation that rests at lower level units, that is, the actions and interactions of individuals, will be more solid than an organizational level analysis that rests on ‘surface characteristics’ of the collective level phenomena (Coleman, 1990:2). All in all, internal analysis based on actions and orientations at the individual level can be regarded as more fundamental as it seeks to uncover the micro-foundations of macro-level phenomena.

The framework, which relies heavily on the work of James Coleman (1990), has been discussed and contested by the findings of three case narratives. The objective of the case studies has been to challenge the existing theories accounted for in the theoretical framework and to qualify it by joining theoretical knowledge about firm level benefits of alliances with theories on individual level work motivation and behaviors in connection to R&D collaboration. The case studies have enhanced our knowledge about collaborative R&D capabilities and they have shed light on the individual level factors that affect the dependent variable. The main contribution is illustrated in model 9.1. This model shows that a number of dynamic factors need to be incorporated in the overall framework if we want to provide a thorough understanding of how collaborative R&D capabilities come about. Collaborative R&D capabilities are much more complex than the model seems to indicate. Not all individual (that is; micro-) level factors in the narratives originated from organizational (that is; macro-) level factors. And it even became clear that individual level factors, such as willingness and ability to collaborate, might influence the corporate level decision, that is; the arrows need to be drawn with a feedback mechanism from the micro to the macro level. The actions and interactions of individuals play a prominent part of the analysis of this study, and I have argued that understanding these micro-foundations is vital for strategic actions and decision making and that alliance scholars, and alliance managers, alike need to take account of the micro level issues.

## **9.6 Managerial Implications**

The findings from the case narratives as well as the cross case analysis suggest that successful collaborations depend on a mosaic of relations between key individuals that span organizational levels and organizational boundaries. In Novozymes, for instance, a central employee played the role of gatekeeper both in relation to internal employees and to external partners. To a certain

degree this function can be professionalized as it is done in Novozymes and Novo Nordisk. Also, despite their limited experience with partnering, CSC has a large focus on the interpersonal relations as they have made an effort to bring employees together and eliminate the tensions that could have emerged from the inequality of knowledge levels at the beginning of the project. In Novozymes, many of the project tasks in the collaborative project were performed by an employee from the Pro Man business unit (internal project management). At the Pro Man-unit employees are trained to be project leaders and to help colleagues through difficult parts of any research project. Their specific experiences from previous external collaborations make them good at guiding any collaborative project through all project phases based on the written 'tools and guidelines' as well as own previous experience.

The research manager (e.g. R&D project leader) plays a central role in firms that engage in collaborative R&D endeavors. The majority of scholars studying alliance capabilities as such agree that alliance management represents a unique resource or capability which is positively related to alliance performance (Anand and Khanna, 2000). The analyses of this thesis have shown a number of strategically important activities, decisions and people management processes that can actually be ascribed to the R&D manager. By way of example, the staffing of core collaborative projects is central to the development of collaborative capabilities. Employees with the right disciplinary skills need to be part of the project but other competencies are vital as well. Interpersonal skills and an ability to build and support at positive line of communication are vital, and the right 'mix' of these capabilities need to be present in the project groups.

The importance of relations between employees becomes especially apparent when employees work together in close interaction as it is the case in this study. This is why the group level, which was not a part of the original framework, must be added in order for the framework to be adequate. Group dynamics will often moderate the relation between individual collaborative behavior and collaborative capabilities at the corporate level. Understanding the importance of group level dynamics will help managers to a better understanding of why the right collaborative capabilities might not be developed, even though the individual employees demonstrate both willingness and ability to participate in a given collaborative project.

Another central finding that has implications for managers in collaborating firms, regards the importance of the dynamic interplay between organizational level and individual level mechanisms. These levels are interrelated and impinge on each other for example when a partnering ambassador assist a given group of employees in their collaborative activities by introducing the different



communication tools designed in the partnering project. In this way, the ambassador makes use of organization level structures in order to help improve the individual level collaborative capability, which is just one example of the interconnectedness of organizational and individual level mechanisms.

In Novozymes, a special emphasis is put on the development of a partnering mindset in the organization. All three narratives revealed that collaborative activities sometimes put a challenge to the classical perceptions that both employees and managers hold about the R&D processes of the firm. Considerations about when to conceal and when to reveal knowledge is just one example that shows that performing R&D management in a firm that is active in inter-organizational activities is often a question of balancing a range of considerations. Developing a partnering mindset among employees that spur a positive attitude towards partnering may mitigate many of the difficult considerations. A partnering mindset seems to encapsulate both the organizational level and individual level capabilities and it constitutes an important access to understanding collaborative capabilities in firms. Although difficult to manage, a partnering mindset can be cultured and nurtured via conscious attention to training programs as well as careful staffing of collaborative projects.

### **9.7 Limitations and Directions for Future Research**

The theoretical framework model developed in this study has been of value to the present study as it has guided the analysis and, at the same time, helped elucidate the many factors that impinge on the dependent variable of the study. The framework has, however, certain limitations. A central limitation relates to the fact that elements *external* to the framework also affect the collaborative abilities of the individual's engaged in collaboration. More precisely, it is a limitation to the model that it only includes organizational (or collective level) issues as informing the conditions of individuals. This does not give a complete representation of the empirical states of the world that was described in the narratives. The narratives revealed that the willingness of employees is also formed by their previous work experiences or their disciplinary background—not only by factors informed by or located at the organizational, collective level. The framework does, however, provide a beneficial starting point for the present study.

Despite a careful research design, this study is subject to potential biases as a result of data limitations. First, the limited number of cases constitutes a potential limitation in terms of generalizability of the findings. However, given the relatively small number of firms explicitly

engaged in activities surrounding development of collaborative R&D capabilities, an emergent phenomenon, it was deemed sufficient for the purposes of this thesis. Moreover, a tradeoff between collecting data on multiple collaborative projects within each case firm versus one in-depth case in multiple case firms existed. Given the complex nature of the phenomenon under investigation, access to richer and more in-depth data on fewer cases was considered of utmost importance. Since negotiating access to project-specific data is very difficult, one project per case firm was chosen to ensure adequate depth in the analyses. It should be noted that I was involved in the selection of the projects in the participating firms in order to reduce potential selection-biases. Moreover, given that all projects were still running during the period of the data collection, the risk of self-selection bias toward only successful collaborations is minimized.

A serious challenge in this study is that information about individual motivational schemes and beliefs in regards to collaboration is limited. Despite a huge effort to get all the data possible from the involved employees through interviews, observations, secondary data, expert interviews and focus group interviews there is always a risk that access to the best suitable data is not provided. More ethnographic oriented data collection, such as event study methodology, could have been beneficial to this study. However, given the access and time constraints on the part of the participating firms, this was not feasible. Future research may benefit from following collaborative projects from their inception throughout the entire life-cycle in order to investigate the evolutionary dynamics involved in development of collaborative R&D capabilities over time.

Finally, it is a potential shortcoming that information about alliance attributes was obtained from the responses of focal firm employees and managers solely. The key issue is whether data collected from one partner represent reliable measures of collaborative operations in general and a reliable estimate of the other partner's perception of these same issues. Only very few studies have tested the consistency between objective and subjective measures in alliances. Geringer (1991) finds significant positive correlations between two parent firms' assessments and perceptions of performance in collaborative projects in his samples. Thus, reliance on respondents from a single company as a data source appears to be a justifiable option, particularly when the respondents represent the key stakeholders. Needless to say, future studies may benefit from access to both parties to a collaborative project in order to gauge the degree to which collaborative capabilities are influenced by organizational and individual level factors on the part of the partner firm.

Future research on the present topic would benefit from being done on a larger number of narratives. It would be valuable to utilize the analytical framework in different empirical settings. I

have showed how differences among the three focal firms studied in this thesis have led to different strategies in relation to their collaborative activities. While Novozymes decided on a very integrated process when allying with their partner, Novo Nordisk agreed on a collaborative model based on a number of less integrated knowledge sharing activities, and CSC is working closely with the partner on parts of a developmental project at many levels. All strategies require that collaborative capabilities are developed and it would be relevant to study how firm differences impinge on the kind of collaborative R&D capabilities that are needed. In fact, the field of collaborative R&D capabilities would benefit from further examination, particularly in regards to the issues pertaining to the important micro-foundations of the field.

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**Case material:**

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## Appendixes

### *1: Interview guide*

The purpose of this interview is to gain knowledge about collaboration in general, yet this is done by asking about general considerations and through information on a specific project in each company...

Theme	Core question	Extension - or further explanation
Background on the project (facts and perceptions)	How long have you been involved in the YY project	
	What is your role in the project	
	Do you think the YY project is a classical XX collaborative project	If not: what are the differences?
	Why was this project started (motivation, drivers)	Where / At what level was the decision taken?
Elements of success	Is this project successful	If yes: How does this show?  Does this success pertain to: Skilful employees (how) Managerial ability Organizational issues (structures, strategy)
	How does one become good at collaborating	Experience, training, others
... and challenges	In your opinion, what are the challenges of this project?	...in relation to: 1) organizational issues 2) individual issues 3) managerial issues
	Are the challenges related to: - XX characteristics - the partner - the project as such? - other issues	
	Does challenges in this project say anything about future challenges in all XX projects	
	Are any specific initiatives made in NZ in order to facilitate collaborations or mitigate problems (which)	If yes: are these, in your perception, the right things to

		do
	Have these initiatives helped you or affected the XX project in any ways	How /why not
	Please tell me about the important events of this project	Related to: - Initiation of the project - Important changes - Participants
General tendencies in relation to collaboration in XX (your firm)	Does XX engage in more collaborative projects now than (a couple of years) before	
	Are you involved in research collaboration to a rising degree	
	How would you characterize these collaborative relations	- Formal or informal relations - Same/new partner - based on contract or not
	Who are the partners	Single researchers - Universities - Firms (competitors) - Research groups
Decisions and considerations in relation to collaboration	What is the general motivation to collaborate	- Push / pull - Knowledge - Financial aspect
	Are collaborative projects initiated by single researches or by NZ management, or by partner	
	Are any projects initiated without a contractual agreement?	If yes: - Which - How - Why
	What factors influence the decision on whether to produce new knowledge in-house (training, hiring new employees) or source knowledge externally?	
	Is there a tendency towards collaboration in other firms that you know of (through friends, former colleagues or former fellow students)	

	Do you think that external collaboration gives rise to special considerations compared to doing the research in-house	- to the researchers - to the company
	How does these considerations affect the projects	
Personnel information (if not already answered)	How many years have you been in XX	
	What is you educational background	
	Have you received any formal training preparing you to collaborate	
	What is the core abilities needed to engage in collaboration	
	What is your job function / what department are you from	
	What is you personal perception on external collaboration	Does this reflect the general perception in XX
	Additional comments	

## 2: Summary

### **English Summary**

The aim of this thesis is to improve the understanding of how collaborative R&D capabilities come about and how they are jointly determined by individual and organizational level factors. I argue that despite the fact that a surge of interest in inter-organizational collaboration has been witnessed in research fields as diverse as strategic management, economics, sociology, and organization theory, we know very little about the micro-foundations of collaborative R&D capabilities. Processes going on internally in collaborating firms are treated like a ‘black box’ in many strands of research. How, we may ask, does openness towards external knowledge sources lead to enhanced R&D performance? What are the internal organizational mechanisms that facilitate the collaborative processes? How are specific collaborative capabilities developed to ensure collaborative success, and—most importantly—what is their composition in terms of organizational and individual level factors?

In this thesis these and related questions are addressed by means of empirical as well as theoretical analyses. It is argued that studies of strategic alliances and R&D collaborations have suffered from being mainly conducted on large datasets and with little attention to individual level factors that may be key drivers of alliance success. The case-study methodology is emphasized as a useful complementary method as it entails the option of learning from the employees engaged in the formation and operation of collaborative arrangements. Three narrative studies are undertaken with the aim of identifying the micro-foundations of collaborative R&D capability in the firms. This is done to provide an explorative overview of the determinants rather than to evaluate the degree to which the capabilities have been implemented successfully leading to better performance. The objective is thus to challenge the existing theories in the field of strategic alliances and to qualify them by joining theoretical knowledge about firm level benefits of R&D alliances with theories on individual level work motivation, and behaviors in connection to R&D collaboration.

The study is focused on knowledge intensive firms (as distinct from ‘supplier dominated firms’, ‘specialized equipment suppliers’ or ‘scale intensive firms’). It is stressed that even core knowledge used in the various R&D or innovation processes does not necessarily need to stem from sources internal to the firm, but is likely to originate externally. R&D collaboration has become an important means to foster opportunities to learn, and to access, transfer and utilize knowledge to create innovative solutions. But very high failure rates are shown and between fifty and seventy

percent of all alliances do not justify the expectations. This vindicates a better understanding of collaborative R&D capabilities. A study of the micro-foundations of these capabilities is both timely and warranted.