Collaborative Capability in R&D Alliances

Exploring the Link between Organizational and Individual Level Factors

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SMG WP 10/2008

March 9, 2008

SMG Working Paper No. 10/2008
March 9, 2008
ISBN: 978-87-91815-23-2

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Keywords: Innovation, collaboration, R&D alliance, dynamic capabilities, organizational practices

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Abstract

Collaborative capability has predominantly been conceptualized and analyzed from a firm-level perspective, paying inadequate attention to the individual level mechanisms that enable this ability to develop and flourish. Utilizing the dynamic capabilities perspective, we suggest that antecedents of collaborative capabilities can be found at the organizational and individual level. Hence, this study examines the role of collaborative capability in R&D alliances with particular focus on the interplay between organizational and individual level mechanisms. We explore the development of Novozymes' "Partnering Project" and show how individual level factors work in concert with organizational level mechanisms in creating collaborative capability. Based on the in-depth case study and a review of the extant literature, we propose a framework for explaining the multi-dimensional nature of collaborative capabilities in R&D alliances and show how firms can benefit from increased attention to the interaction between individual and organizational level issues when designing R&D alliances.

1. Introduction

In order to stay competitive, even the most capable knowledge-intensive companies have to identify and leverage knowledge produced beyond the borders of their own organizations as part of the innovation process (Teece, 1986; Chesbrough, 2003). In fact, crossing organizational boundaries in search of new knowledge seems to be a *prerequisite* for the firm that wishes to cope with fierce competition and growing complexity in the innovation process (Powel, Koput and Smith-Doerr, 1996; Ahuja, 2000; Chesbrough, 2006). This openness towards external knowledge sources results in a variety of collaborative activities such as joint ventures, partnerships, research consortia, network relations, etc. (Ring and Van de Ven, 1994). In many phases, from discovery to distribution, external collaboration is chosen as the appropriate way of conducting business deals (Ring and Van de Ven, 1994: 90; Powel, Koput and Smith-Doerr, 1996:116). As stated by David Teece (1986): "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). Thus, in response to competitive pressures, firms increasingly use R&D alliances to complement in-house R&D efforts.

A prominent view of strategic alliances suggests that inter-firm collaboration is a mechanism by which a firm can leverage its skills, acquire new competencies, and learn (e.g. Kogut, 1989; Hamel, Doz, and Prahalad, 1989; Huber, 1991; Larsson, Bengtsson, Henriksson, and Sparks, 1998; Lyles, 1988; Powell and Brantley, 1992). For the partnering firm, alliances represent interfaces with its environment that provide access to valuable external information and knowledge (Powell, Koput 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).

While some firms seem to be very effective in undertaking alliances, others suffer from high failure rates. The performance differences related to strategic alliances puts a premium on studies of antecedents of performance. Research has shown that a firm may posses some sort of superior level of capabilities (Kale, Dyer and Singh 2002) leading to better alliance management and superior utilization of external sources of knowledge and, eventually, to

enhanced competitive advantage. Various studies have examined the acquisition of capabilities through alliances (e.g. Inkpen and Dinur, 1998; Inkpen and Pien, 2006; Kale *et al*., 2000; Tsang, 2002), however, few studies have focused on the processes underlying the development of capabilities. Moreover, the vast majority of these studies have the organization or the alliance (dyad) as the unit of analysis, thereby lacking attention to individual level antecedents of collaborative capabilities. However, as noted by Kanter (2002), alliances "cannot be 'controlled' by formal systems but require a dense web of interpersonal connections and internal infrastructures that enhance learning" (Kanter 2002:100).

Discussions in existing organizational literatures lack attention to levels in general and micro-foundations in particular (for a discussion see Felin and Foss, 2005; Dansereau *et al*., 1999). Despite the growing use of collaborative alliances in a wide variety of settings, much of the organizational literature still treats the organization as the centerpiece of theorizing. The application of diverse theoretical approaches, such as resource dependence theory, microeconomics and strategic management, identify specific (industry or firm-level) preconditions for collaboration and use these to predict organizational outcomes, however, without regard to the underlying, individual level mechanisms that conditions these outcomes. Although studies have recognized the importance of individuals for alliances and learning more generally, few studies have incorporated the role of individuals into explanations for firm learning (innovation) in alliances. Research has found 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 that evoke problem solving and learning and contribute the most to a firm's ability to utilize 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). Despite these insights, researchers of strategic alliances have placed much greater emphasis on environmental conditions, and organizational level resources, practices and tendencies than individual level mechanisms as explanations for innovation in alliances.

Innovation in R&D alliances is a function of individual level processes in combination with organizational level strategies and structures. Treating innovation in alliances as a purely organizational level phenomenon ignores or underplays the interdependencies associated with these relationships. Hence, this study aims at exploring 1) the individual level antecedents of

collaborative capability and 2) the dynamic interaction between collaborative mechanisms at the organizational and individual level conducive to innovation in R&D alliances. Based on a single case study this article provides an analysis of different mechanisms at the organizational and individual level that facilitate innovation in R&D alliances. By tracing the specific mechanisms through which organizations exert influence on innovation we explore the interplay between individual level contingency factors and organizational outcomes (see Grandori, 1997, 2001; Foss, 2007). We argue that the most important issue for managers involved in inter-organizational collaboration is to create a foundation for collaborative capability which includes both individual and organizational level processes and, more importantly, secures an efficient and effective interplay between the two by embedding these capabilities in individual and organizational routines.

The article is organized as follows. First, we conduct a focused literature review of collaborative capabilities in R&D alliances with particular emphasis on the role of organizational and individual level antecedents. Next we present the research methodology of the study. We conducted an in-depth case study of 'The Partnering Project' at Novozymes, a project specifically designed to enhance the collaborative capabilities of the world-leader in production of biotech-based enzymes and micro-organisms. Section four presents the case summary and provides evidence of the dynamic interplay between organizational and individual level mechanisms in creating collaborative capability. Our data suggests that while organizational level mechanisms govern the flow of knowledge and provide the formal structure for collaborative behaviour, the individual level processes act as equally important determinant for collaborative capability and subsequently innovative performance. The case study results were used to develop a theoretical model that accounts for both individual and organizational antecedents of collaborative capability.

2. Literature Review

2.1 Alliances as vehicles of competitive advantage

The main motive behind the formation of R&D alliances is to exploit complementarities in knowledge related capabilities and technology in order to create innovative solutions (Hagedoorn and Schakenraad, 1991). The assumption is that firms engaged in R&D alliances can enjoy synergy effects by combining, not just sharing, knowledge related capabilities. The recent surge in alliances has accordingly been explained as 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 (e.g. Inkpen, 1998; Larsson et al., 1998; Kale et al., 2000; Muthusamy and White, 2005). This theme is part of a recent research impetus to focus on the effective management processes related to building, sourcing, developing, and sharing knowledge assets both within and between firms (Grant and Baden-Fuller, 2004; Argote, 1999; Grandori, 2001).

R&D alliances present unique coordination challenges, such as aligning the interests of the partners, which likely affect the outcome in terms of learning and innovation that firms reap from such alliances. Since R&D alliances are centred around knowledge based resources and capabilities, some level of transfer, sharing and absorption of knowledge across organizational boundaries is required. Most of this knowledge tends to be complex and often tacit in nature and thus sharing it requires certain organizational mechanisms to be developed. Further, given the substantial moral hazard or adverse selection problems that often accompany such alliances, incentives to share (often proprietary) knowledge need to be fostered. In the extant literature, these two concerns have often been conceptualized as the *ability* and *willingness* of partners to collaborate and (effectively) share knowledge based resources (Dyer and Singh, 2004).

2.2 Collaborative Capability

According to Dyer and Singh (2004: 351-352), collaborating firms can generate 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, 2004: 351-352). Relational rents are determined by 1) the degree of investments in relation-specific assets; 2) the degree of knowledge exchange; 3) the extent of the combining of complementary, but scarce, resources or capabilities; and, finally, 4) the extent of effective governance mechanisms (Dyer and Singh, 2004: 351). The main part of the rent-yielding factors are related to organizational level structural factors, for instance, contractual governance mechanisms, however, they also refer to the importance of more intangible aspects of cooperation such as trust, reputation and goodwill. The existence of specific collaborative capabilities may help explain why some firms perform

better than others when engaged in close collaboration activities as they 'develop superior capabilities at managing particular organizational forms such as alliances' (Kale, Dyer and Singh, 2002:748).

Many scholars have studied the existence of collaborative capabilities albeit under slightly different labels, e.g. 'relational capability' (Dyer and Singh, 1998), 'alliance capabilities' (Kale, Dyer and Singh, 2002; Heimeriks and Duysters, 2007) and 'collaborative know-how' (Simonin, 1997). The majority of these studies agree that alliance management represents a unique resource or capability which is positively related to alliance performance (e.g. Anand and Khanna, 2000). The capabilities associated with the ability to perform better in (subsequent) alliances is 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, these studies by and large neglect to empirically account for the *individual* level attributes that ensure the effective embeddedness of alliance capability.

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 nonsubstitutable (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). While promising in clarifying the meaning and application of resources and capabilities under different conditions, these studies 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), thereby ignoring the fundamental questions related to the individual level attributes of the phenomena. From this perspective, performance differences between firms are driven by efficiency differences that can somehow be attributed to organizational (collective) level constructs.

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). By the same token, Kogut and Zander (1992) use the term 'combinative capabilities' to describe organizational processes by which firms acquire, synthesize and generate new knowledge from external knowledge resources. Interestingly, RBV specify critical resources as being physical (e.g. specialized lab equipment), *human* (e.g. expertise in biomechanics), and organizational (e.g. superior R&D department) assets that can be used to implement value-creating strategies (Barney, 1986; Wernerfelt, 1984). Consistently, we argue that collaborative capability is a dynamic capability consisting of the interplay between strategic (organizational) and structural (physical) resources at the organizational level and (human) competences at the individual level. As such, the value of collaborative capability lies in its ability to integrate and leverage the organizational and individual mechanisms that govern inter-firm relationships.

A firm's ability to "integrate, build and reconfigure internal and external competencies to address rapidly changing environments" lies at the center of its ability to innovate (Teece, Pisano and Shuen, 1997: 516). Eisenhardt and Martin (2000:1107) suggest that antecedents to dynamic capabilities, which they describe to be "processes to integrate, reconfigure, gain and release resources – to match or even create market change", can be found at the individual, firm and network level (see also Zollo and Winter, 2002). Nevertheless, extant research generally focuses on only one level of analysis, while neglecting other levels, thus opening the door for spurious findings due to unobserved heterogeneity. To address this issue, next we explore the dynamic influences of organizational level and individual level factors in a case study in order to develop a conceptual model of collaborative capability.

3. Methodology

3.1 The research design

This article is based on an exploratory case study with the aim of understanding the dynamics present within a single setting (Eisenhardt, 1989; Yin, 1994). To get a firm understanding of how different variables affect the development of collaborative capabilities in general, it is essential to study if or how it affects the specific case. An instrumental case study (Stake, 2003) such as this one is carried out to provide insight into the core theme, e.g. the antecedents of collaborative capabilities at different levels of the organization, rather than to learn about this single company. As suggested by Stake (2003), a better understanding of a single case could lead to a better theorizing about a still larger collection of cases. 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 factors behind alliance success (Shenkar and Reuer, 2006). 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). According to Yin (1994), a good research design demands a statement of purpose as well as a clearly defined set of success criteria. Given the emerging nature of micro-foundational research on innovation, capabilities and alliances (see Felin and Foss, 2005) the purpose of this case study is to identify the organizational and individual level determinants of collaborative capability in the case company 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.

3.2 Data Collection

The empirical data presented and discussed in this article has been collected as part of a large-scale research project on R&D collaboration. We started by conducting a number of focused literature reviews related to innovation, R&D collaboration and knowledge transfer. On the basis of the literature reviews and pilot interviews with a few core employees at four collaborating firms, the research team developed a template for conducting case studies and writing case descriptions of a few selected R&D intensive MNCs, who were known to be particularly concerned with building collaborative capability.

We contacted 4 MNCs operating in different sectors, each with ongoing collaborative efforts, and conducted face-to-face interviews during the period 2005–2007. Of the companies studied, Novozymes provided the best illustration of a conscious effort to develop a distinct collaborative capability. At Novozymes primary data was collected through in-depth interviews with 12 employees during the summer of 2005. The employees were chosen due to their engagement in a central collaborative R&D project. In addition to interviews with employees from different functions (e.g. R&D, Patenting, Strategy, Development, Quality Assessment, etc.), central interviews and meetings were held with the Partnering Project Manager in order to ensure validity of the information about the partnering project. The findings were discussed with

a number of managers at a workshop meeting in December 2005 in order to consolidate the findings. Table 1 provides descriptive information about the case company.

Insert Table 1 about here

The primary data was triangulated with secondary data consisting mainly of company profiles, annual reports, fact sheets, non-confidential presentations and other internal documents, 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.

4. Case Study

Novozymes is a world leader in the field of enzymes and micro-organisms. 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 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 expect 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.

4.1 The Partnering Project: Part of the Corporate Strategy

Novozymes can 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 have been 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 2004 states that "*partnerships are the key to new markets*"[1]. Under this headline the company's latest conquest in the field of biopharmaceuticals is presented. But the headline does more that 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

[1] Novozymes annual report 2004, p. 32

undertaken in collaboration with external partners[2]. 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, 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 had 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 necessary information about the partnering process. A process model was developed, labelled 'The Partnership Life-Stages'-model, describing the elements of a given partnership, and this makes up the structure of the website.

Insert Figure 1 about here

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

[2] Interview with the manager of the strategy and licensing department, Novozymes

strategy, structure and mindset pertaining to collaboration. Figure 2 shows the interaction between these elements in the Partnering Project at Novozymes.

Insert Figure 2 about here

4.2 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.[3]

As such partnering has become a fruitful way of testing new business areas. One manager comments:

[3] Interview in BioTimes, an internal Novozymes magazine, December 2004

> In New Industries is it 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)[4]

Yet, one thing is to develop a partnering strategy that is convincing, 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 Silvia 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)

Although the respondent seems to acknowledge that the existence of the partnering strategy makes a difference, it seems fair to conclude 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.

4.3 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

[4] 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.

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 interrogate 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 mined, 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.

4.4 Partnership Competences

In addition to the strategic and structural mechanisms, a set of initiatives have been designed to enhance the individual employees' ability to collaborate. Novozymes developed a specific *partnering course* and offered it to all employees engaged (or expecting to be engaged) in collaboration. It is taught by an external consultant who has developed 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 main link between the defined principles of how partnerships are to be 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. For instance, in one course the participants worked with partnership related issues such as the importance of mutual dependence, commitment, and the appropriate behaviours in collaborative projects. In addition, topics like the importance of openness and clear communication between partners, 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. 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.

5. Analysis

The positive attitude towards openness in the R&D process is gaining ground at Novozymes and this makes it essential to build specific competences that support the inter-firm processes. Asking a newly hired employee from the quality assessment department how she perceives the attitude towards partnering she answers:

> In a research context it is very common that you collaborate with other companies, at least in the pharmaceutical industry, and it is very important because of the learning and knowledge sharing that takes place. What is different at Novozymes is that it is not only in the context of research, but throughout the entire organization that you find this openness. (#5)

In addition to the core areas of doing basic enzyme related research, Novozymes seek to gain advantage from the emphasis on developing collaborative competences and strategic and structural 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 valuable, rare, inimitable and organizationally exploitable competence (Barney & Hesterly, 2005) that is likely to give the firm a competitive advantage. Thus, building and maintaining collaborative capability constitutes an important source of advantage for Novozymes. The strategic focus on the

importance of partnerships and the many structural initiatives implemented will promote the collaborative capability at the organizational level.

Further, a number of organizational mechanisms have been implemented at Novozymes to support the employees engaged in collaborative projects. For instance, the course program and the organization of experienced employees into a partnering community provide employees with important collaborative competences beyond the scope of their professional training. The individual level competences and organizational level mechanisms interact in a number of specific ways. First, the partnering course aims at linking the collaborative policies with the individual capabilities. By working with the employees' own experiences and providing them with action plans for their projects based on shared routines and common guidelines, an interaction between corporate strategic factors and individual level capabilities are made. Another factor that helps integrate the two levels of the collaborative capabilities is the fact that the partnering website is continuously updated with experiences and best practices by the employees engaged in collaborative projects. This feature aids the creation of common routines as the employees continuously are able to follow and learn from the shared partnering activities. An important purpose of many of these activities has been to help shaping the desired partnering mindset. In Novozymes the requested partnering mentality is also described in terms of a win/win mentality, aiming at satisfying the goals of both partners simultaneously.

A mindset is a set of attitudes, thoughts and feelings that influence decisions and actions (Berdrow and Lane, 2003) and a partnering mindset can thus be defined as a positive attitude towards current or future partner firms. A positive attitude is reflected in the New Industry department where employees are encouraged to search for new knowledge externally. The presence of a partnering mindset is also thought to have a positive effect on the current collaborative actions as a central theme in the partnering project is the development of mutual trust between partners. 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 partnering mindset is a central factor in building and maintaining collaborative competencies and routines at both the organizational and individual level.

6. Towards a Multi-level Model of Collaborative Capability

Collaborative capability is, as illustrated in the case, a multi-dimensional construct since its antecedents can be found at both the organizational and the individual level in the collaborating firm. The case study and ensuring analysis has revealed the existence of three distinct factors representing important antecedents of collaborative capability. We argue that it is precisely the interplay (represented by overlapping circles in figure 3 below) between the organizational level strategy-structure dimension and the individual level competence dimension that constitutes collaborative capability. In the following we will briefly outline the contours of a multi-level model of collaborative capability and discuss future research directions.

Insert Figure 3 about here

6.1 Strategic Antecedents of Collaborative Capability

The strategic antecedents of collaborative capability are associated with anchoring the partnership within the overall organizational strategy. Examples of collaborative capabilities include pre-alliance formation routines that assess the task-related and partner-related fit (Geringer, 1991) in relation to the strategic objectives (innovation). Other examples are post-alliance formation routines pertaining to speed of knowledge transfer and development of effective ways to capture synergies among complex, dispersed knowledge-related resources (e.g. via rotation of scientists or joint reward systems). In the pharmaceutical industry, for instance, these linkages are often encouraged via prepublication incentives by which scientists are rewarded for maintaining external links to the wider scientific community through the use of publication in scientific journals as a promotion criterion (Henderson and Cockburn, 1994).

6.2 Structural Antecedents of Collaborative Capability

The structural determinants of collaborative capability pertain to developing 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 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). By the same token, the role of the alliance manager as a coordinating devise in collaborative relationships is widely accepted (Spekman *et al*., 1998).

Draulans, deMan and Volberda (2003) found that organisations with a specialist, positioned at middle-to lower levels of management, are considerably more successful with alliances than those lacking one. Moreover, the design of a specific knowledge management system, organized around the content and complexity of knowledge to be shared in conjunction with organizational structural characteristics (Nielsen and Michailova, 2007), ensures effective knowledge sharing across organizational boundaries.

Specifically in R&D alliances, the organization's ability to absorb external knowledge is of primary importance. Building on research of problem solving and cognition at the individual level (e.g. Bower and Hilgard, 1981) 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. It is the mechanisms that connect new external knowledge to existing internal practice, thereby affecting overall innovation capacity, that comprise the structural elements of collaborative capability.

6.3 Individual Competence-Based Antecedents of Collaborative Capability

Individual skills 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). For instance, Knott (2003) found that, while operationalizing routines by such mechanisms as training, assistance and operations manuals, these mechanisms positively influenced franchise performance. Gittell (2002), on her part, investigated skill and knowledge transfer in the health care sector and found mechanisms such as regular team meetings and best practices to be positively related to capability development. The individual level factors that contribute to the collaborative capability are related to the acquisition of new knowledge from external sources (Powell *et al*., 1996; Capron *et al*., 1998; Gulati, 1999; Lane and Lubatkin, 1998).

The employees that are participating in collaborative R&D projects or other activities where knowledge is sourced externally, plays an important role. This is pointed to specifically in the work done on absorptive capacity where the role of 'gatekeepers' are pivotal. In their 1990, article Cohen and Levinthal turned their attention towards the cognitive structures of the individuals of the organisation, and showed that in addition to being an organizational level construct absorptive capacity also exists at the individual level. Looking at the employees' part

in the process of absorbing the knowledge it becomes apparent that some employees are of special importance to the process as they may come to stand in the interface of the firm and the external partners (Cohen and Levinthal 1990: 132). 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, or act as mediators between the partner and the relevant employees of the focal firm (much like the 'partnering ambassadors' at Novozymes).

The gatekeeper function may be centralized and performed by one employee or shared between members of a group. Focusing on the process of absorption it is important to bear in mind that some kind of shared knowledge and expertise is nearly always a necessity to make communication happen between the gatekeeper(s) and the rest of the group. This could be both a basic level of shared language and symbols and of more technical forms of knowledge. 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 (or inward looking) and external absorptive (or outward looking) capacity of a firm (Cohen and Levinthal, 1990). While both internal and external absorptive capacities are important components of a firm's collaborative capability, 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 will have a hard time linking up with an external knowledge source.

7. Conclusion

Our findings from the case study suggest that alliance innovation depends on a variety of connections and resources patterned among key individuals that span organizational levels and boundaries. Specifically, we investigated the interplay between certain organizational level mechanisms, such as a partnering strategy and individual level mechanisms, such as competence building that play a role in the development of collaborative capability at Novozymes. We found support for a multi-dimensional framework that emphasizes the interaction between organizational level factors and individual level processes for understanding collaborative capability in R&D alliances. 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. A special emphasis is put on the development of a partnering mindset at Novozymes. This concept seems to encapsulate both the organizational and individual dimensions and constitutes an important foundation for understanding collaborative capabilities in firms.

In sum, collaborative capability is a function of the interplay between organizational level factors related to strategy and structure and individual level competency-building. At the individual level, collaborative capability is contingent upon developing routines for collaborating and sharing knowledge. These routines, in turn, are a function of the level and nature of training, corporate culture, cross-functional communities of practice, and open communication. In technology-intensive firms, linkages to external sources of knowledge are initiated and maintained by the 'gatekeepers', typically scientists, who develop social relationships to key scientists at other firms, government laboratories or universities. Individuals, however, are embedded in firms and thus are governed by the organizational level strategic and structural mechanisms related to coordination and execution of collaborative relationships. These organizational factors include (inter)organizational policies and structural arrangements designed specifically to facilitate knowledge flows between firms in R&D collaborations as well as absorption and utilization (internalization) of this knowledge for innovative purposes.

Future studies will need to acknowledge the multi-dimensionality of the collaborative capability construct and adequately account for the possible heterogeneity at both organizational and individual levels, as well as seek to further our understanding of the crucial interactions between the organizational and individual dimensions of collaborative capability.

Tabel 1: R&D activities and collaboration in Novozymes

Novozymes	**Facts and Figures**
Industry	Biotechnology. Novozymes' biological solutions are used in more than 40 industries in more than 130 countries
Number of employees (2006)	4500
Annual Turnover (2006)	6.806 million DKR
ROIC (2006)	20.2%
R&D spending (2006)	13% of turnover
Patents (end of 2006)	5000+ granted or pending
Alliance strategy	50% of all R&D is to be done in collaboration with external partners

Figure 1: “The Partnership Life-Stages” at Novozymes

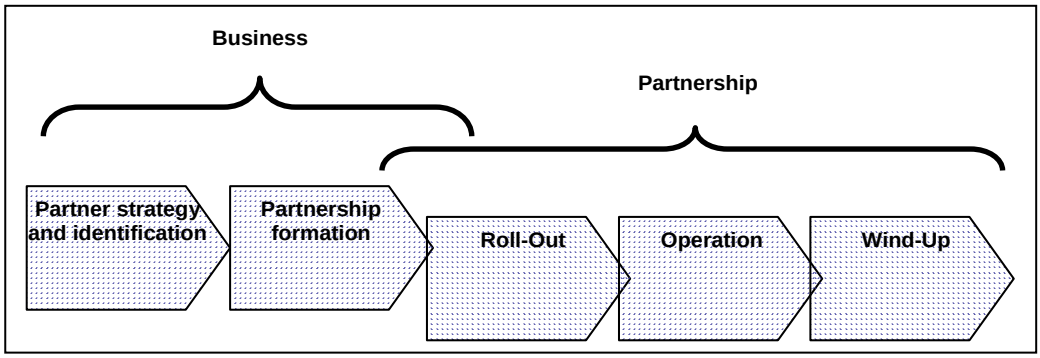


Figure 2: The Partnering Project at Novozymes

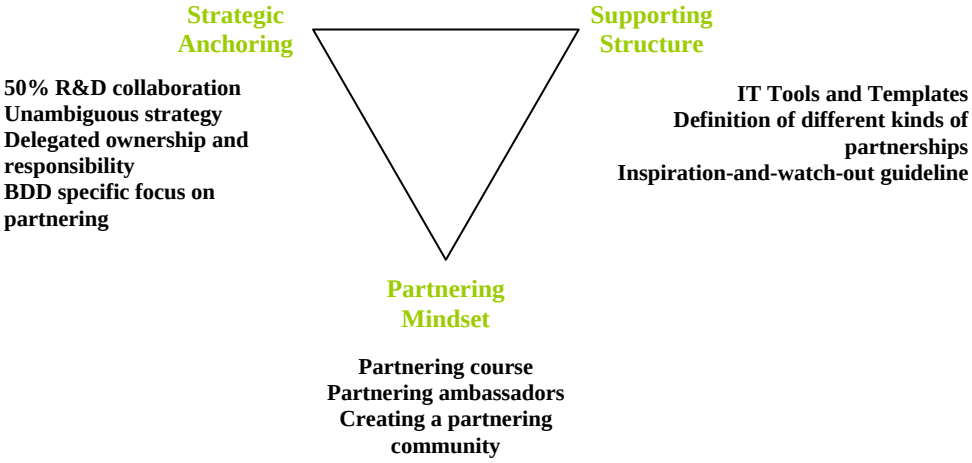
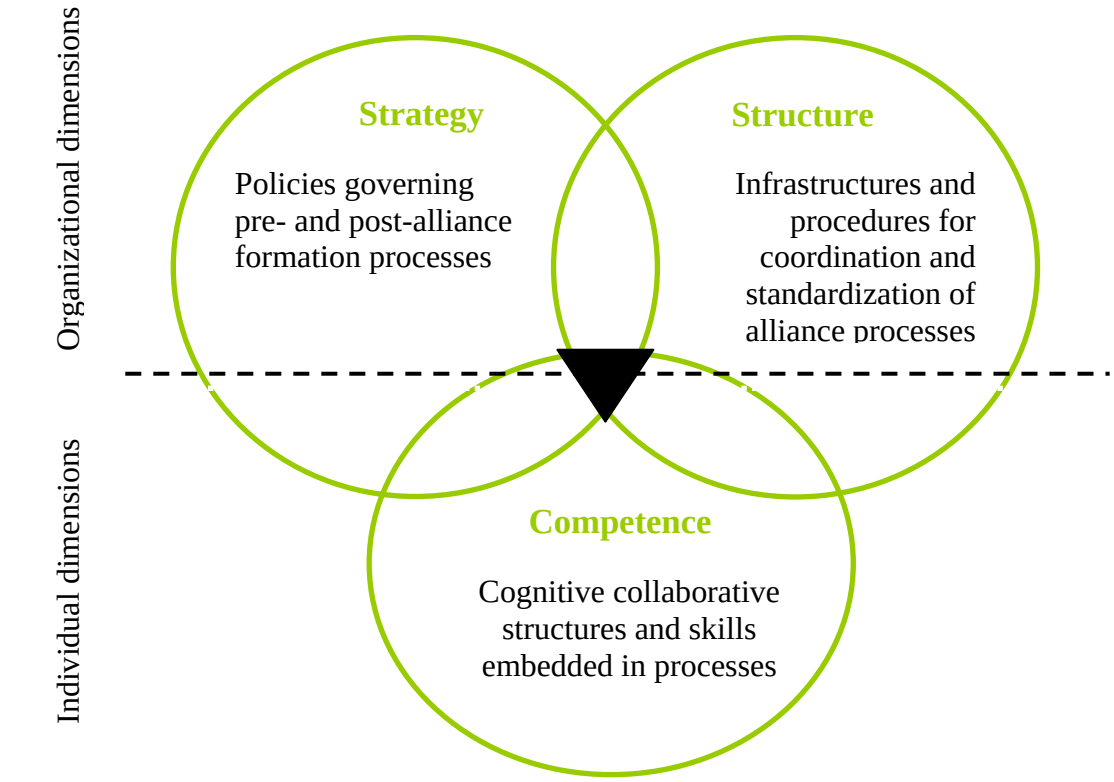


Figure 3: A Multi-Level Model of Collaborative Capability



▼ The overlap between organizational and individual dimensions represents Collaborative Capability

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