



Paper to be presented at the DRUID Summer Conference 2007

on

APPROPRIABILITY, PROXIMITY, ROUTINES AND INNOVATION

Copenhagen, CBS, Denmark, June 18 - 20, 2007

**PROCESSES FOR COOPERATION: INSIGHTS ON ABSORPTIVE CAPACITY,
COMBINATIVE CAPABILITIES AND INTER-ORGANISATIONAL ROUTINES FROM
A CASE STUDY ON A LARGE FIRM IN PHARMACEUTICALS**

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Inter-institutional cooperation is becoming the norm for innovations putting at centre stage of research inquiry the organisational knowledge for establishing, coordinating and innovating through cooperation. Case study evidence depicts the development of systematic processes for partner identification and management of cooperative agreements. Researchers recognising potential partners would perceive the innovations that could stem through cooperation, assess the joint project for its scientific merits and participate in its coordination, communicating results between scientists and senior management. By experience accumulation the firm builds capabilities in cooperating, which it refines further by investing in deliberate learning processes.

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Track

Inter-firm Interaction: Networks, Projects and Clusters

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Abstract

Inter-institutional cooperation is becoming the norm for innovations, which, puts at centre stage of research inquiry the organisational knowledge for establishing, coordinating and innovating through cooperation. Case study evidence depicts the development of systematic processes for partner identification and management of cooperative agreements. Researchers recognising potential partners would perceive the innovations that could stem through cooperation, would assess the joint project for its scientific merits and participate in its coordination, communicating results between scientists and senior management. Over time and through experience accumulation the firm builds capabilities in cooperating, which it refines further by investing in deliberate learning processes.

Keywords: Cooperative Agreements, Absorptive Capacity, Inter-organisational Routines

1. Introduction

The 1980s and particularly the 1990s have been characterized by a marked increase in the number of inter-institutional cooperative agreements that involve partners located within different countries and industries (Kang and Sakai, 2000; Hagedoorn, 2002; Hagedoorn and Roijakkers, 2006). Inter-institutional cooperation is not a new phenomenon. It has been argued that the features that differentiate the recent trend towards increased cooperation from that experienced in the 1920s and 1930s are its extent and, most importantly, the desire amongst firms to cooperate in order to innovate (Coombs *et al.*, 1996; Coombs and Metcalfe, 2000; OECD, 2001; Contractor and Lorange, 2002). In the current knowledge-based economy the abilities of firms to create new knowledge have come to occupy centre stage due to their importance for competitiveness (OECD, 1996; 2001). In an era that inter-institutional cooperation becomes the norm for innovations rather than the exception (Powell *et al.*, 1996), a greater understanding of the processes that firms adopt for the establishment, coordination and creation of new knowledge through cooperation becomes of importance. Such an understanding can assist in informing managerial practice on the organisational processes that effectuate cooperative agreements and innovation through cooperation.

Although a substantial body of literature exists that deals with the reasons that lead firms to cooperate and the effects that participation in such agreements may have, there is a relatively thin body of research that deals with the processes that firms employ when engaging in such agreements. Indeed, the main focus of the existing literature has been on the processes that firms employ to coordinate collaborative projects or tasks (e.g. Dyer and Singh, 1998; Lazaric and Marengo, 2000; Zollo *et al.*, 2002) and relatively little attention has been given on the processes that enable firms to establish cooperative agreements (e.g. Lane and Lubatkin, 1998; Lane *et al.*, 2001; Mowery *et al.*, 2002, 1998; Mowery *et al.*, 1996) and to innovate through cooperation.

This paper aims at exploring the processes that firms employ in order to establish cooperative agreements, to manage them and to innovate through cooperation. It

draws on the experience of a large multinational firm in pharmaceuticals with operations in the UK. This is because inter-institutional cooperation has traditionally been an important means of gaining access to external knowledge in this sector, a fact that is more pronounced recently due to the bio-pharmaceutical applications. The remaining of this paper is structured as follows. Section 2 reviews the literature on absorptive capacity, combinative capabilities and inter-organisational routines, to offer a background for the types of organisational processes that firms could employ at different stages of a cooperative project, pre-initiation period, the knowledge creation phase and the management and coordination of interactions with partnering organisations. Section 3 briefly discusses the methodological approach and issues relating to information gathering and research design. Section 4 analyses and discusses the findings. Section 5 concludes the paper and offers implications for managerial practice and further research.

2. Processes for Cooperation

2.1 Recognising and Evaluating Potential Collaborative Projects

One of the important attributes of organisational knowledge is that it enables firms to become aware of those changes in their environment that are of relevance to internal knowledge. Firms, on the basis of their existing knowledge, can recognise potential challenges or beneficial external developments, retrieve external knowledge that is made public and finally attempt the further use and exploitation of that knowledge. This attribute of knowledge underlies a firm's absorptive capacity (Cohen and Levinthal, 1990, 1989; Zahra and George, 2002) which enables adaptation to external environments.

The concept of absorptive capacity has been used in the context of cooperative agreements to shed light on the factors that can influence the selection of potential partners and the extent that firms can absorb and commercialise knowledge from their partners (Lane and Lubatkin, 1998; Lane et al., 2001; Mowery et al., 2002, 1998; Mowery et al., 1996; Powell *et al.*, 1996). Firms will choose to collaborate with institutions with which they share, to a degree, common aspects in their knowledge bases. Such overlap in the knowledge bases of cooperating partners has been identified to exist between all pairs of partners before they established a cooperative

agreement and irrespective of them being motivated to cooperation from learning or knowledge access objectives (Mowery *et al.*, 1996). Relative absorptive capacity, capturing the commonalities in the knowledge bases between two cooperating partners, can be conducive to the abilities of partners to learn from one another (Lane and Lubatkin, 1998).

Commonalities across the knowledge bases of organisations can affect their likelihood of initiating cooperative agreements by enabling potential partners to perceive and evaluate the potential benefits that could arise by combining elements of knowledge across their boundaries (Nahapiet and Ghoshal, 1998; Senker and Faulkner, 1996). This is because common knowledge allows potential partners to establish a common language, or it re-enforces that which may exist due to joint memberships in communities-of-practice (Brown and Duguid, 1991). A common language could form the basis for partners to relate the cognitive aspects of their tacit knowledge¹ enabling them to develop a shared understanding and perception about the potential benefits that could arise from their cooperation (Nahapiet and Ghoshal, 1998; Senker and Faulkner, 1996). Indeed, existing research has linked alliance formation to social interactions of organisations or to those of their members, such as those that may arise through previously established formal agreements and memberships in communities-of-practice (Gulati, 1998, 1999).

Moreover, absorptive capacity underpins the processes of knowledge creation and coordination of inter-organisational projects. Indeed, as elaborated in the following sections, commonalities in the knowledge bases underpin the abilities of partners to create new knowledge through cooperation because they affect their abilities to recognise complementarities in their knowledge bases and to conceptualise these opportunities (e.g. Matusik and Heeley, 2005; Coombs and Metcalfe, 2000). Such commonalities may influence the efficient coordination of collaborative projects across partner boundaries by affecting the establishment of patterns of inter-organisational interactions (e.g. Lazaric and Marengo, 2000; Zollo *et al.*, 2002).

¹ Tacit knowledge incorporates both cognitive and technical elements (Polanyi, 1966). The cognitive elements relate to the ability (of individuals or organisations) to establish generalisations and correlations between elements of knowledge, as well as information (knowledge about facts). The technical part of tacit knowledge relates to the know-how and skills that apply to specific contexts (Nonaka, 1994; Nelson and Winter, 1982).

Indeed, as it has recently been argued a third face is emerging within a firm's R&D function, that which would allow the firm to cooperate with other organisations (Pavitt, 2002).

2.2 *Combinative Capabilities*

Most innovations arise by re-combinations of existing knowledge; combinative capabilities are the type of capabilities that could allow firms to innovate on that basis (Kogut and Zander, 1992). It has been argued that important for innovations to occur, it is for firms to identify complementarities across the elements of their knowledge base (Malerba and Orsenigo, 2000). Nowadays, and especially in industries such as pharmaceuticals, products and production processes are becoming increasingly more complex (Nightingale, 2000; Henderson, 1994), requiring the combination of a wider set of technologies and scientific disciplines (Pavitt, 2002). This leads to knowledge required for the creation of a product, or for a process, to become increasingly more distributed across institutions rather than to be mastered internally (Coombs *et al.*, 2003; Coombs and Metcalfe, 2000). It has been suggested that complementary elements of knowledge and capabilities are more likely to be distributed across firms rather than to be mastered internally because they underpin dissimilar activities (Richardson, 1972). Distribution of knowledge is concomitant to its systemic use² and also to the creation of new artefacts and/or new knowledge through systemic integration (e.g. Brusoni *et al.*, 2001).

Inter-institutional cooperation is argued to be driven by the need of firms to combine the distributed and complementary elements of knowledge with the view of innovating (Coombs and Metcalfe, 2000). In this connection, firms can create new knowledge through cooperation by combining aspects of internal knowledge with those of their partners and for which complementarities exist, allowing potentially fruitful combinations to arise. The realisation of such complementarities and of potential opportunities for innovations, depend on the overall and the relative absorptive capacities of firms and of the cooperating partners. That induces cooperation among partners with commonalities in their knowledge bases, which could diminish the potential of innovations due to eliminating diversity in the

² A system encompasses the integration of elements of knowledge and/or components that have significant complementarities among themselves .

knowledge bases and therefore diminishing the number of potential re-combinations that could emerge through cooperation (Hamalainen and Schienstock, 2001).

Several studies show firms to cooperate with institutions possessing complementary capabilities to theirs (e.g. Rothaermel, 2001; Colombo *et al.*, 2006). Agreements linking partners with complementary capabilities have been found to affect the probability of new product development for at least one of the partners (Rothaermel and Deeds, 2004). Engagement in cooperation is not only linked to the innovative abilities of organisations, as captured by patents, (Hagedoorn and Schakenraad, 1994) but it has also been found to induce their potential to initiate cooperative agreements in the future (Rothaermel and Deeds, 2004).

2.3 Inter-organisational Routines

Several studies have identified the development of inter-organisational routines for managing and coordinating tasks that are undertaken within a cooperative agreement (Zollo *et al.*, 2002; Lazaric and Marengo, 2000). Inter-organisational routines are developed by firms that establish cooperative agreements and as any other types of routine have a context- or, in this case, partner- specific character (Zollo *et al.*, 2002). Partners have motives to develop inter-organisational routines in order to circumvent difficulties and inefficiencies that may arise in their cooperation because of their different ways of coordinating internal tasks.

During the execution of a joint task, partners need to coordinate knowledge exchanges across their boundaries in order to efficiently undertake interchangeably a sequence of steps or sub-tasks required for the execution of the joint task (Zollo *et al.*, 2002). The lack of a common language and of some degree of shared experience developed by working together may give rise to inefficiencies in coordinating knowledge exchanges in cooperative agreements. These inefficiencies, which may result in time delays across inter-partner sequential steps, because it is not easy for partners to predict when it is their turn to act, may give rise to inter-partner conflict and may diminish the incentives of partners to undertake investments in both tangible and intangible assets and/or to share the knowledge required for the execution of the joint task (Zollo *et al.*, 2002; Lazaric and Marengo, 2000). It has been shown that during the time-span of a cooperative agreement, partners develop an understanding of each others idiosyncratic ways of doing things and develop a common language and shared experience in

working together, which underpins their interactions (Lazaric and Marengo, 2000). This allows partners to observe each other, to discover the specific ways in which the other works, to learn about each other's cultures and managerial systems, and thus to develop partner-specific knowledge (Zollo *et al.*, 2002).

Partner-specific knowledge and a common understanding are further enhanced through subsequent alliances that partners may form with each other (Zollo *et al.*, 2002). Following the same reasoning, some form of common experience in working together, arising for example from historical and organisational associations, social or professional interactions such as those arising through memberships in communities-of-practice (Brown and Duguid, 1991; Powell, 1990) and engagement in prior alliances, may provide mechanisms that sustain a shared language among partners (Lazaric and Marengo, 2000). Partner-specific knowledge or the existence and further re-enforcement of a common language allows partners to develop inter-organisational routines to coordinate their interactions for the execution of a collaborative task (Zollo *et al.*, 2002; Dyer and Singh, 1998) and aligns partners' perceptions about the potential benefits of combining elements of their knowledge bases and induces firms to undertake the requisite investments for the agreement and to share knowledge (Nahapiet and Ghoshal, 1998). The existence of specific dedicated routines for the management and coordination of cooperative agreements has been related to their efficiency (Ireland *et al.*, 2002).

It has been shown that firms replicate elements or in their totality their inter-organisational routines when they cooperate with the same partner in subsequent points in time, which in turn further enhances the efficiency and beneficial outcomes of their cooperation (Zollo *et al.*, 2002). This suggests that as partners accumulate experience in cooperating with one another they become better in executing joint task between them (Zollo *et al.*, 2002). Such experience effects may not hold when firms accumulate experience in cooperating with different partners, because, first, cooperative agreements occur less frequently than other organisational tasks, and, second, the tasks that cooperative agreements entail are more heterogeneous in nature than other organisational tasks, because of the very different characteristics and situations of cooperating partners (Zollo *et al.*, 2002). On the other hand, some studies identified that firms may develop meta-routines for the adaptation and

refinement of past inter-organisational routines, such as in those for managing contractual compliance or sharing collective outputs, in different cooperative agreements (Lazaric and Marengo, 2000). The investment in meta-routines is something costly for the firm and it is argued here that frequent engagement in cooperative agreements may provide the appropriate incentives to justify such investments. In such cases firms could develop capabilities in cooperation, increasing their likelihood, in turn, to experience benefits from being more efficient in cooperative agreements over time.

3. Methodological Considerations

In order to scrutinise processes for cooperation this paper adopts the case study method. This method allows understanding of the systematic and un-systematic processes that firms employ when they establish cooperative agreements, manage them and innovate through cooperation. To achieve its purposes the study draws on two in-depth interviews with two senior managers of a large UK-Swedish firm in pharmaceuticals. Cooperative agreements have traditionally been used in pharmaceuticals to source the latest advancements in the field, such as scientific advancements stemming from universities. It was considered that the alliance manager would be the appropriate source for information on the firm's processes for cooperation. It was also deemed, that the intellectual property manager would be in the position to discuss issues regarding knowledge creation through cooperation. Patents are important means for appropriating knowledge in this industry (Pavitt, 1984) and for this reason they are used as a proxy of the knowledge that might stem through a cooperative agreement. This will in turn enable the identification of the role that combinative capabilities might play in such agreements and of the types of knowledge that are likely to be combined across partner boundaries. Both senior managers have long worked for the case firm. The alliance director has been relatively recently transferred to the UK-based facilities from the US to re-establish and re-invigorate a department dedicated to alliance management.

A list of questions was formed to guide discussions and it was communicated to the interviewees well in advance to assist in their recalling relevant information. Face-to-face and telephone interviews were taken from the intellectual property and alliance senior managers that lasted five and two hours respectively. The discussion went off

the original plan at many times, leading to richer and more diverse information gathering. The case study, in an earlier more raw form, was reviewed by the two interviewees and other industry experts to circumvent, as much as feasible, methodological considerations concerning the soundness of the methods employed (e.g. Yin, 2003; Scholz and Tietje, 2002).

The firm establishes numerous cooperative agreements every year, particularly after the early 1990s that it started to engage into biotechnology. The firm's research strategy explicitly recognises the need to access third party research in order to support their internal drug discovery process. For instance, the firm has established a total of 250 agreements in 2005, a year before conducting the case study, including substantial agreements, lasting on average 5 years, and less substantial ones, such as six-month secondments. The majority of the agreements established by the firm involve cooperation in research and second come licensing agreements. The discussions concentrated on the substantial agreements that involve cooperation in research. However, because most licensing agreements involve cooperation in research they are ruled by similar processes to those discussed below. Indeed, as stated in the literature it is a common occurrence that licensing agreements are accompanied by close interaction, consultation and joint research among the parties involved (e.g. Grimaldi and Torrisi, 2001).

4. Case Study Analysis

4.1 Processes of Recognising and Evaluating Potential Cooperating Projects

Both systematic and non systematic processes for recognising potential partners are used. The systematic processes for partner recognition were developed after the firm realised the importance of accessing third party research to its in-house drug discovery process. The systematic processes are reflected in the group of *Alliance Professionals*, with a scientific background, that keep track of the latest developments in research areas relevant to in-house projects. This team is dedicated to identifying partners and in scanning the unsolicited opportunities for cooperation that the firm receives from third parties. This aspect of the case reflects the importance of in-house knowledge for the recognition of potentially beneficial to the firm externally originating advancements. Absorptive capacity lies at the heart of the systematic process for partner recognition and shows that firms have directed investments in

forming groups of 'gate keepers' and 'boundary spanners' (Cohen and Levinthal, 1989, 1990) that would allow the organisation to keep abreast of changes in its environment and to establish formal agreements for cooperation.

At the non-systematic level, potential opportunities for cooperation are recognised through the armory of the firm's researchers getting exposed to the research projects of other institutions through participation to academic conferences. Conferences also offer the gateway to other institutions to approach the organisation with offers for potential collaborative projects. Such non-systematic processes have traditionally formed a major source of identifying potential partners, even before the establishment of the team of *Alliance Professionals*. The firm has long witnessed that this process for partner recognition has been beneficial for establishing a smooth and effective cooperating relationship with forthcoming partners. This is due to the importance that personal networking and friendships play in establishing a cooperative climate among potential partners. Such networks and friendships have in turn been built by researchers meeting one another frequently in conferences and other, less formal meetings. Indeed, a climate conducive to cooperation and exchange of ideas is established even since partners contemplating and negotiating their potential cooperation. Moreover, personal networking and friendships form the main source for assessing the reputation, reliability and commitment to cooperation of potential partners that are unknown to the firm through previous encounters via conferences or prior cooperation, such as those stemming from unsolicited offers for cooperation. This aspect of the case study reflects previous studies suggesting cooperative agreements to be embedded in a network of personal relationships and handshakes (Gulati, 1998, 1999). Social interactions and joint memberships in communities-of-practice (Brown and Duguid, 1991) increase the likelihood of partners interacting, and offer a shared language that allows them to communicate their expectations and visions of a joint project. These, in turn, act as lubricants to the smooth cooperative interaction of partners within a formal agreement (Senker and Faulkner, 1996; Nahapiet and Ghoshal, 1998; Gulati, 1998, 1999).

The processes for evaluating potential partners fall under two groups, those taking place before a final decision for cooperation is made and those that take place after partners have committed to cooperation. The evaluation of a cooperative project

begins with discussions among researchers of the potentially partnering organisations, in which the benefits that can stem from their collaboration are assessed. It is crucial for partners to be able to perceive the common, and individual, benefits that may result from their cooperation in inducing them to form a substantial case for that agreement when requesting managerial approval. The process of managerial review entails assessing the financial viability of the project and its alignment to the research strategy of the firm. A proposal getting the green light from managerial review moves the negotiations to a series of further discussions amongst the research teams. Further details of the project are discussed and partners develop a greater understanding of each others research. However, and even as far as this stage, partners pay particular attention to not exchange confidential information about their in-house research agendas that is of relevance to the potentially joint project.

Projects deemed to be beneficial after such discussions move to a formal and binding stage in which a due diligence process takes place. This process engages a team of professionals with expertise in intellectual property, legal and financial issues, as well as researchers engaged in the recognition of the project and/or *Alliance Professionals*. During this stage confidential information about the collaborative project is exchanged and a detailed cost-benefit analysis is undertaken to justify engaging resources to this purpose to all external stakeholders. The due diligence process formalises the agreement and ends with the specification of the legal terms of the contract that will specify the rights and obligations of the parties involved. The duration, effort and rigorousness of the evaluation process vary depending on the size of the agreement, in terms of its cost, potential returns, duration, numbers of researchers and organisational departments involved. As stated before, it is the firm's absorptive capacity, reflected in the group of *Alliance Professionals* and the group of researchers that are involved in establishing collaborative projects with external institutions, which is engaged in project evaluation. As one moves towards the formalisation of the agreement, the processes for evaluation become more systematic, with the active involvement of management and the due diligence team that incorporate other benchmarks, such as alignment with the overall strategy of the firm and financial viability, in the evaluation process. It is notable that the potential cooperative project is first judged upon its scientific viability and usefulness to the

existing research objectives of the firm and then for its monetary and resource commitments.

4.2 Combinative Capabilities, Knowledge Complementarities and the Creation of New Knowledge

Knowledge creation through cooperation depends on partners' abilities to combine elements of knowledge across their boundaries. Complementarities in the knowledge that partners bring together in cooperative agreements may affect their potential to create new knowledge. In order to shed light in these aspects focus is placed on a cooperative agreement that led the pharmaceuticals firm to successfully apply for at least one patent. The cooperative agreement involved licensing of a method for administering drugs to cancer patients, illustrated in Figure 1, and joint research.

FIGURE 1 ABOUT HERE

Based on this method cancer patients are initially injected a substance containing an antibody linked to an enzyme through a linker and subsequently get administered with a prodrug. The antibody gets attached to the cancerous cells, while the enzyme attracts the later injected prodrug. The enzyme would remove the non-toxic part of the prodrug releasing its toxic element close to the cancerous cells. By these means the cancerous cells would be attacked by the toxic element of the prodrug.

At the time of the cooperative agreement the firm had substantial in-house research concentrating on exploring different and more effective prodrugs targeted to different types of cancer. The partner was undertaking research in the remaining four elements of the treatment method as depicted in Figure 1. The firm engaged in that cooperative agreement due to the potential that it could offer to exploit further its in-house research on prodrugs. The cooperation could enable the firm to attempt exploiting further its prodrugs by linking them with the conjugant of the method patented by their partner. The partner would engage in research, in cooperation with the firm, in identifying the most suitable antibodies, linkers and enzymes for each of the prodrugs supplied by the firm.

This aspect of the case study offers an illustration of the type of complementary capabilities that partnering organisations may bring together through cooperation. The firm in case had substantial in-house research on prodrugs while the partner excelled in research on all other elements involved in the method for cancer treatment. It should be highlighted that the existence of such complementarities provides a motive for cooperation by creating an imbalance between the knowledge bases of cooperating organisations (Coombs and Metcalfe, 2000). Through cooperation partners can exploit their internal expertise further and in dimensions that might have not arisen if they were to work in isolation. In order to take advantage of these opportunities for exploitation firms need to recognise complementarities between their knowledge base and those of external institutions, which, in turn, depends on their combinative capabilities (Malerba and Orsenigo, 2000; Kogut and Zander, 1992). As the next section argues, the actual combination of knowledge across the boundaries of partnering organisations depends, as well, on the establishment of inter-organisational routines.

In addition, the case shows the increased complexity in the processes of discovering new pharmaceutical products, such as the one depicted in Figure 1, a fact that was also stressed by the interviewees. Indeed, there are five elements involved in the method of Figure 1 and each one is quite sophisticated in its own right. The case reflects the effect that the increasing complexity of products and processes has on the abilities of firms to develop internally all the required capabilities for innovation, leading to the distribution of these capabilities across a range of actors and to the upsurge of inter-institutional cooperation as a means of bringing together the requisite elements (Coombs and Metcalfe, 2000).

Moreover, the case shows how in-house research might allow partners to realise the benefits that could stem from their cooperation and how it could make it easier for them to conceptualise the potential innovations that could arise by combining their complementary capabilities (Nahapiet and Ghoshal, 1998). It is also notable that although partners have independently developed expertise in different elements of the drug discovery process of Figure 1, the systemic integration of their expertises required them engaging in joint research, concerning aspects of the integration, such as undertaking adjustments on the different elements of the conjugant to achieve a

more effective match with the new prodrugs provided. Although strong judgements on the basis of this finding should be eluded, the case reflects the arguments raised elsewhere (e.g. Pavitt, 2002) that, standardisation of systemic interfaces is difficult to be sustained the higher the complexity of the system and particularly in sectors, such as pharmaceuticals, that knowledge regarding the components of the system advances rapidly.

It should be noted that, participation in the above cooperative agreement not only led the firm to a successful patent filing concerning a drug for cancer, but it also led to a series of other effects. One of them is that the firm gradually internalised the knowledge of its in-licensed method. This had a twofold implication. First, the firm initiated cooperative agreements with other institutions to explore the possibility of altering parts of the conjugant of Figure 1, in an attempt to improve the effectiveness of the existing method and of its elements. For example, a group of subsequent agreements focused on improving the properties of the linker. This entailed research on the effectiveness of alternative linkers in order to avoid the enzyme from being released in other parts of the body, which could, in turn, lead to damaging healthy tissues by freeing the toxic element of the later injected prodrug close to them. Thus, the case reflects how the internalisation of a partners' knowledge becomes embodied with the firm's processes and that it can be used further for other purposes. This shows that engagement in cooperative agreements could have more profound effects on the knowledge base of firms and on their innovative potential, compared to what stems as an immediate outcome of cooperation (i.e. a patent application). This occurs when firms are able to internalise and further exploit the knowledge that they were exposed to through cooperation.

Another effect arising from the participation in that cooperative agreement was that the firm was subsequently led to establish other cooperative agreements with different partners in an attempt to create an alternative method for cancer treatment based on that of Figure 1. The alternative method involved exploring altering elements of the conjugant of Figure 1. For example, the firm explored, in cooperation with another institution, the idea of a gene directed therapy for cancer treatment that would entail substitution of the antibody in Figure 1 with an RNA sequence that could better match the genotype of the cancerous cells. This method could overcome some of the side

effects of the original method. For example, antibodies may get attached to other than cancerous cells, ending up damaging healthy tissues, which the firm has identified through undertaking product development and conducting clinical trials. This new enriched experience that stemmed during the application of the original method for cancer treatment was fed back to research leading to further exploratory research with regards to whether and how such side effects could be overcome. This reflects the cycle of knowledge creation inside firms, arising from the interplay between exploration and exploitation, described in Zollo and Winter (2002). In that cycle exploitation can lead to exploration when the firm makes investments in gathering and analysing the new information that may arise during the application of a new method or a process (part of exploitation). The case also shows that the firm may not undertake all steps in that cycle independently but in cooperation with other institutions. Indeed, the firm attempted to undertake further exploration in cooperation with another organisation in order to reduce the risks and costs involved with exploratory search and to further build on its existing understanding of gene directed treatments. In this respect the case reflects the co-evolving relationship that exists between knowledge and cooperation.

4.3 Processes for Coordinating and Managing Cooperative Tasks

There are two aspects in the processes of managing cooperative agreements. The first refers to the management of contractual compliance and the second to the management of its performance. The contractual element of the agreement itself is highly rigid because many of its aspects are governed by specific laws and regulations, regarding issues such as financial reporting and competitive interaction. This has facilitated to the standardisation of processes for managing contractual compliance, increasing their similarities across cooperative agreements. This, in turn, allows the firm to replicate elements or in their totality its processes for contractual compliance across its portfolio of agreements. Processes for contractual compliance are augmented with those for managing alliance performance and are described in the following paragraphs. The replication of processes for contractual compliance across different agreements has been identified elsewhere (Lazaric and Marengo, 2000), while, also in line with that study, the firm acknowledges that, by gaining experience in cooperation over time, it has learned how to avoid loopholes

arising by incomplete contract specification and it has developed mechanisms to deal with such conditions in forthcoming situations.

A three-level hierarchical framework can be used to describe the processes that the case firm uses to govern and manage the performance of its cooperative agreements. At the top of this hierarchical framework stands a *Joint Committee* formed by members from all cooperating parties, at the intermediate level stands the *Alliance Management Team*, comprised by members of the case firm only, and at the lowest level stands a *Team of Scientists* comprised by members from all cooperating parties.

The *Joint Committee* is a decision making mechanism and is responsible for forming and implementing the strategy of the agreement, its research targets and objectives and other operating issues. The committee meets a pre-specified number of times per year, usually biannually or quarterly, as ruled by the contract. The issues central to the role of the committee are, first, to ensure that the agreement evolves in compliance with original plans and aspects of the contract, and second, to take action in cases that the agreement has evolved in ways quite different to those initially specified³. Cases falling under the second scenario are resolved by using a three-pronged approach. The menu of choices is: first, to redirect the agreement so that it complies with initial plans, second, to terminate the agreement, especially when its redirection is deemed unfeasible and it is plausible to redirect funds in alternative projects, and third, to amend the initial plan and contract when the emerged direction of the agreement is deemed sensible or even superior to initial plans. The committee acts upon information received mainly from the *Alliance Management Team*, which is the second and intermediate layer in the alliance governance hierarchy.

The *Alliance Management Team* oversees the research collaboration by being in close contact and constant interaction with the researchers making up the *Team of Scientists*. This close contact and interaction aims at ensuring that the agreement evolves according to initial plans and that all related problems are identified and directed promptly to the *Joint Committee* for consultation and resolution. The *Alliance Management Team* is comprised by members with skills in management, finance, law and intellectual property rights and also with scientists specialising in

³ The processes undertaken by the *Joint Committee* also relate to those for ensuring contractual compliance.

areas relevant to the research project. The IP Director referred to the alliance management team, as ‘...*the Discovery Alliance Group...*’, with the view that the same people, or at least a group of them, have also been engaged in the process of recognising, negotiating and evaluating the agreement at the first place. Indeed, as noted by the IP Director, by being involved in the negotiation of the agreement these people are in a position to know exactly its content and purpose and are able to communicate effectively with researchers at the lowest level of the governance hierarchy, ensuring that the collaborative research meets its initial requirements.

At the lowest level of the alliance governance hierarchy stands the *Team of Scientists* undertaking joint research. Cooperating parties may conduct research in isolation and arrange meetings to combine their findings, or alternatively, they may engage in real time joint research. Processes for cooperation at this level are standardised only when joint research is real time. For instance, the firm has developed a highly sophisticated web interface through which researchers of all cooperating parties submit their research outcomes whenever they are arising. High encryption technologies ensure protection of uploaded information to external parties and allow access to this information only to researchers participating in the joint project. The case offers an example of the role of ICTs in facilitating interaction and sharing of information and data (Howells, 2002). This process has been redeployed by the case firm in at least two other cooperative agreements with different partners that involved real time joint research.

In general, the type and frequency of interaction of the researchers within the *Team of Scientists* it is not overly prescribed by the firm. The firm considers scientists to have a natural drive and interest to pursue the project further, and that they will therefore strive to communicate with one another in ways and as frequent as they deem that it is best for the joint project. Indeed, their drive and commitment is being evident even at the initial stages of a cooperative agreement, when they start exchanging ideas even before the legal terms of the agreement are fully specified (See also Section 4.1). Scientists are considered to have the best interest of the collaborative project in mind and therefore are allowed the flexibility to interact with one another as frequent as they judge is necessary for the project to progress according to initial plans. Scientists

interact in a variety of ways, such as informal face-to-face meetings, phone calls, emails and videoconferencing.

This three-tier alliance governance system is employed in the management of contractual compliance and performance of most cooperative agreements. A characteristic feature of this system is that the processes within each of its levels, as well as between them, become more standardised as one moves towards the higher levels of the hierarchy. It is interesting that researchers are allowed to interact freely and as frequent as they need to, reflecting the realisation that frequent interaction plays an important role as a conduit for exchanging tacit knowledge which can effectuate the combination and use of knowledge across partner boundaries.

The firm established this framework for managing cooperative agreements by accumulating experience in cooperative agreements over time and as it became to engage in cooperation more frequently. The three-tier framework was established in order to enhance the efficiency of cooperative agreements by establishing a better communication between researchers and top managers and by detecting cooperative agreements deviating from initial plans early on. The firm, through accumulating experience in cooperating, realised that these two aspects are important for the efficiency of cooperative agreements. This realisation sources from two main types of observations. The first one relates to the dissatisfaction expressed by the research team regarding the lack of sufficient interest and managerial involvement in joint research projects, which increased their frustration and adversely affected their motivation towards the project. Second the firm realised that the drive and enthusiasm of researchers to work together in a new project sometimes reached overwhelming levels leading to the project drifting away from its initial aims. As described by the IP Director: '*...the agreement sometimes develops a life of its own...*'. Most importantly the firm realised over time, by experiencing several agreements, that the further away from the initial targets the project departed the more difficult it became to redirect it to its initial objectives. Therefore it was deemed that the introduction of an *Alliance Management* team, being in more immediate contact with the joint research team, could allow for a more timely detection of cooperative agreements that drifted away from their original objectives. The *Alliance Management* team could also act as a reporting and communicating mechanism

between senior managers, lawyers and end researchers, assisting the firm to manage its cooperative agreements more effectively and to achieve contractual compliance. The development of a dedicated alliance management team is a practice followed by other firms and it has been identified to improve the efficiency of cooperative agreements compared to those without such a team (e.g. Ireland *et al.*, 2002). It is also notable that the *Alliance Management* team is made up from researchers that were engaged in the processes of identifying and evaluating the cooperative agreement at its nascent phase. The researchers that identified the partnering organisation and that envisioned the benefits that could stem from their cooperation were those that have been selected to form the *Alliance Management* team, an intermediate alliance management layer placed between top management and end researchers. This is due to their capabilities to comprehend both the scientific workings of the joint project and its potential outcomes and contribution to the overall research strategy of the organisation.

The firm has also recently increased its interest in becoming better and more efficient in managing their cooperative agreements. It has invested resources in building up a specific department dedicated to replicating, developing and improving their processes for cooperation. The firm also actively attempts to internalise the processes and approaches to manage cooperative agreements devised by specialist consultants, with the view of enhancing the efficiency of its cooperative agreements. This reflects even further the importance that the firm places in building capabilities in cooperating. The firm not only invests in processes that would enable learning from its past experiences, manifested in refinement of existing inter-organisational routines, but it also invests in deliberate learning, or in getting exposed and internalising the knowledge of specialists in the field of cooperation.

5. Discussion and Conclusions

This research paper aimed to scrutinise firm processes for establishing, managing and innovating through cooperation. The research claims are anchored on the literature on absorptive capacity, combinative capabilities and inter-organisational routines. To achieve its purposes the research drew from a case study on a large pharmaceuticals firm with extensive experience in cooperation. Therefore the purpose of this work is

is not to make any strong claims with regards to its objectives, but to offer an in-depth exploration and description of the processes for cooperation.

The findings suggest that the firm makes substantial investments in building systematic processes for the recognition, evaluation, management of contractual compliance and of performance of its collaborative agreements. Indeed, the firm has created a dedicated group of *Alliance Professionals* to scan the external environment with the view of recognising potential opportunities for collaborations. These efforts are accompanied by less systematic processes that have proved to be efficient and fruitful over the years. This refers to the identification of partners through professional, social and personal networks that the firm's researchers have created over time by active engagement in their research communities. These networks form a repository of potential collaborators with which forthcoming cooperations are likely to run smoothly. This is, in turn, due to the trusting relationship that is created between partners, resulting from common memberships in communities-of-practice and the existence of a common language that facilitates their communication and interactions. It is notable that researchers who identified potential partners, either members of the *Alliance Professionals* team or in general, will also perceive the potential benefits of the forthcoming cooperation and would assume the responsibility to assess and evaluate its scientific viability and merits.

The case study illustrates the importance of complementarities in the capabilities that partners bring together in their cooperation for new knowledge to stem from such agreements. Recognising the existence of such complementarities it is important not only when firms attempt to innovate in isolation one to another but also when they aim to do so in cooperation with other organisations. In this case study, the researchers, either through the *Alliance Professionals* team or through participation and interaction with their research communities, that identified potential partners will also be the ones to recognise complementarities and envisage the potential outcomes that could stem from combinations of knowledge across the partners' boundaries.

In terms of the processes for managing interactions with partnering institutions, the firm has developed a systematic pattern of a three-tier hierarchical framework to coordinate contractual compliance and the alignment of cooperating projects with their pre-specified targets and with the overall strategy. Interactions within the

different layers of this framework, consisting of the *Joint Committee*, *Alliance Management Team* and the *Team of Scientists*, become less standardised by pre-specified rules and more frequent as one moves towards the bottom of the hierarchy. Frequent interaction through means that are specified by the researchers in accordance to the needs of the specific cooperative task, allows the cooperative project to be coordinated with the most efficient of the means available, as specified by the people in closer connection with its actual requirements over time. This allows the firm to benefit from the drive that its researchers depict in carrying out the cooperative project, something that it is evident even as early as at the nascent phase of an agreement.

It is notable that the intermediate layer of the *Alliance Management Team* is formed by the researchers that identified, evaluated and perceived the potential benefits that could stem from the combination of the capabilities of the firm with those of its partners. The *Alliance Management Team* acts as a means of coordinating the interactions of the *Team of Scientists*, aligning them to the initial objectives of the agreement and communicating the on-going outcomes of the research cooperation to higher order decision making authorities, the *Joint Committee*. It is of interest that the case depicts the important role that the internal knowledge of firms has on its ability, not only to identify, evaluate and use external knowledge (Cohen and Levinthal, 1990, 1989; the second face of R&D), but also on its ability to establish cooperative agreements (Pavitt, 2002; the third face of R&D) as well as to management and coordinate them.

Although being beyond the initial objectives set out for this study, the case study reflects on some of the outcomes that may result from participation in cooperative agreements. These can be identified in three areas. The first one refers to the immediate outcomes of the cooperation on the firm's innovative activity, as reflected in its successful patent filing. An interesting point arises with respect to this finding. The case shows that patents do stem from cooperations and, for reasons that are beyond the means of the present study to identify, may not necessarily be co-filed by the cooperating organisations.

The second outcome stemmed from the knock-on effects that the participation in that cooperative agreement had on the future innovative potential of the firm and its

pattern of subsequent cooperations. Indeed, participation in that cooperative agreement led the firm to engage in further search around the knowledge that it internalised and created from that cooperation. Not only the firm came up with new ideas on how to further exploit and even improve that knowledge, but it also identified other organisations that possessed related and complementary capabilities that they would allow the firm to do so through cooperation. Again, this experience of the firm depicts the importance of identifying complementarities for the further exploitation of internal knowledge through cooperation. This effect also depicts the co-evolving relationship that exists between the knowledge of the firm and its patterns of cooperations. This co-evolving relationship could be visualised as a spiral in which, prior knowledge affects the firm's ability to establish cooperative agreements, which, in turn, may lead to the expansion of the firm's knowledge base, and to a range of more cooperations in the firm's attempt to further use and built upon that new knowledge.

The third outcome that participation in cooperative agreements had on the firm relates to the experience that the firm accumulated over time in coordinating and managing inter-organisational interactions, which enabled it to gradually refine its inter-organisational routines and to add processes that, based on its experience, could improve the efficiency of its future cooperations. The firm by cooperating frequently and by investing in gathering and analysing the opinions of its researchers and incidences of mall performance of cooperations realised the need for and committed resources in establishing a dedicated process for alliance management captured by the *Alliance Management Team*. Moreover, the firm undertook investments in deliberate learning processes with regards to coordinating and managing cooperative agreements, by establishing a department dedicated to the refinement of its existing inter-organisational routines and their replication across its portfolio of cooperative agreements. This is also evident in the firm's attempts to internalise practices and the expertise in managing cooperative agreements of external consultants gained through their analysing the experience of different organisations with respect to managing cooperative agreements. Therefore the case illustrates that the firm has built capabilities in cooperation through experiential learning and invested in meta-routines for the replication, further refinement and improvement of these capabilities.

The present study sheds some light with respect to the processes that a specific firm followed when established, managed and innovated through cooperation. This case can inform managerial practice of other organisations interested in such issues. The present study is quite restricted in its focus and the type of recommendations and claims that it can make, but, in general, it opens up a window to a set of issues that may call for further research. For instance, it would be of interest to investigate the processes for cooperation that are followed by other firms operating in other sectors. Moreover it may be of interest to examine the actual learning processes that lead firms to establish such processes for cooperation.

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Figure 1
Method for Cancer Treatment

