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OUTSOURCING AS OPEN INNOVATION: EXPLORING PRECONDITIONS FOR THE OPEN INNOVATION MODEL IN THE PROCESS INDUSTRY

La Sous-traitance Comme Innovation Ouverte: Explorer les Préalables Pour Introduire l'Innovation Ouverte Dans les Industries de Transformation

Completed Research Paper

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Abstract

The open innovation model embraces the purposive flow of internal and external ideas as a ground for innovation and network formation. While the open innovation paradigm has been successfully applied in high-tech settings, there is a gap in the research on adopters of open innovation in other settings. This research was conducted in a process industry setting, performed as a case study at Alpha Corp., a large minerals group, and Remote Diagnostics Centre, its service provider, where ICT is being increasingly used to monitor the process line, resulting in the creation of new value networks. The underlying question is: Why and how do open innovation projects develop over time? Our findings show that adoption of the open innovation model is grounded in developing organizational environments that are conducive to innovation, including expertise in creating a culture for knowledge sharing, building a trustful environment, and a resourceful use of interaction technologies.

Keywords: Open innovation, trust, interorganizational knowledge sharing

Résumé

Pourquoi et comment se développent les projets d'innovation ouverte au fil du temps? Nos résultats montrent que l'adoption du modèle d'innovation ouverte est fondée sur le développement organisationnel des environnements qui sont propices à l'innovation, y compris l'expertise dans la création d'une culture de partage des connaissances, la construction d'un environnement de confiance, et une utilisation ingénieuse des technologies de l'interaction.

Introduction

With the extensive use of information and communication technology (ICT) in today's organizations, new business relationships emerge and a widespread outsourcing of services and business processes is enabled (Davidow and Malone 1992; Gallivan 2001; Venkatraman and Henderson 1998). Traditionally, the outsourcing decision has been made based on a desire to preserve core processes and outsource peripheral processes in order to make the firm more efficient and cost effective (Ang and Straub 1998; DiRomualdo and Gurbaxani 1998; Nagpal 2004). However, this traditional rationale has been challenged as the increased globalization, widespread use of new technology, and pressure to be on-line, flexible, and efficient have prompted organizations to rethink and reshape their original forms. As a result of these new and increasing demands, strategic alliances, joint-ventures and partnerships have been formed and the increased flow of interorganizational knowledge has made outsourcing no longer only apply to peripheral business processes. Under such conditions organizations actively seek cooperation and co-dependency in the pursuit of mutually beneficial behavior and added business value (Gallivan 2001; Van de Ven 2005).

As organizations turn to new forms of organizing, there is also a need for new business models that take into account the possibilities and limitations of such attempts. Chesbrough (2003, 2006) proposes the open innovation model, which assumes that "firms can and should use external ideas as well as internal ideas, and internal and external paths to market, as they look to advance their technology" (Chesbrough 2006, p.1). As an organization opens itself up for a partnership, it creates the possibility of acquiring knowledge and resources from external actors. However it also risks the outflow of internal core competence, which could make it more vulnerable to its competitors. The necessary openness is thus both a strength and a potential weakness. The changing boundaries and the process of creating and maintaining partnership relations over time thus have to be amply managed in order to maximize potential value and decrease potential risks (Vanhaverbeke 2006).

Much of the existing discussion on innovation examines static individual or organizational characteristics, and many existing process models are linear in nature (Rogers 1995; Van de Ven et al. 1999). Additionally, many authors focus on one specific type of innovation (such as administrative, technological, product, or process). However, Van de Ven et al. (1999) proposed a model that presents innovation as a complex, non-linear, dynamic process, and the open innovation model is in many ways a continuation of this dynamic model. While the open innovation paradigm has been successfully applied in high-tech settings, where it has been shown to have relevance for our understanding of innovation processes (Chesbrough and Kardon Crowther 2006), there is a gap in the research on adopters of open innovation in other settings. In this paper we turn to the processing industry, where information technology is being increasingly used to monitor the process line, resulting in the creation of new value networks between customers and service providers (Hibbert 2000). We have followed Alpha Corp., a large minerals group, that has created Remote Diagnostics Centre (RDC) as a joint-venture company together with two of its long term business partners in order to perform advanced equipment condition monitoring. RDC serves as a ground for innovation under the premises of being in an outsourcing partnership with Alpha Corp. The underlying question that this study sought to answer was: Why and how do open innovation projects develop over time? We seek to answer this question by examining the preconditions for open innovation projects. While much research attention has been aimed towards open innovation models, less attention has been directed towards the preconditions for their establishment.

The paper is organized as follows: the following section gives an overview of related research on partnership outsourcing, open innovation, and trust. The next section describes the research methodology. The actual case study with the empirical data stemming from our interviews at Alpha Corp. and RDC is then presented and thereafter analyzed. The paper ends with conclusions and suggestions for future research.

Related Research

In order to understand the mechanisms behind an outsourcing partnership and how these can become grounds for open innovation networks, it is fruitful to examine previous research done within these areas. We also include a discussion of trust and show how different researchers have provided valuable insights that help us further our understanding of the concept.

Partnership Outsourcing and Open Innovation

Although the act of outsourcing can simply be described as the contracting of services and business processes to an outside part, the emergent relationship between the customer organization and the service provider may take many shapes and forms. In the traditional view of outsourcing, an outsourcing decision is made on the basis of whether the particular operation is seen as a strategic asset, and thus kept in-house or as a commodity, and thus subject to outsourcing. (Lacity et al. 1995; Prahalad and Hamel 1990; Quinn and Hilmer 1994; Yahklef 1997). This type of outsourcing arrangement can be seen as a support relationship, where ownership substitution and the strategic impact of the outsourcing decision are low (Kishore et al. 2003) and the goal of the relationship is to make the customer organization more focused, efficient and cost effective (Ang and Straub 1998; DiRomualdo and Gurbaxani 1998; Nagpal 2004). However, this traditional approach to outsourcing has been challenged as organizations actively seek cooperation and co-dependency in the pursuit of mutually beneficial behavior and added business value. (Gallivan 2001; Van de Ven 2005). An outsourcing partnership, is an outsourcing relationship in the form of an alliance, and has a high degree of ownership substitution and monitoring mechanisms that are high on mutual trust and low on contractual control (Kishore et al. 2003). Such an outsourcing relation is different from traditional outsourcing in its focus on a partnership based on trust instead of on hierarchical structure (Lee et al. 2003; Lee and Kim 1999). Furthermore, an outsourcing partnership entails common objectives and goal symmetry between the customer organization and the service provider, where they are both responsible for adding value to the relationship, and where the goals of becoming focused, efficient and cost effective apply to both customer organization and service provider. (Kishore et al. 2003). Under such auspices organizations tend to outsource not only peripheral, but core processes which they believe will benefit from external input, and the strategic impact of such a relationship is considerable.

The traditional view of outsourcing has strong ties to the closed innovation paradigm or the vertical integration model, where an organization's research and development activities were considered strictly internal processes that should be guarded from external influence. Ideas should be produced in-house, and the only way to market them was through the originating firm (Chesbrough 2006). This view of the organization as an entity, separate and self-sufficient can also be found within the context of traditional outsourcing relationships. In such relationships only peripheral processes with low strategic impact are outsourced and the structure of the customer organization is kept intact (Kishore et al. 2003). Internal processes, in this case defined as those inherent to the customer organization, and external processes, defined as those pertaining to the service provider exist in two separate contexts and do not mix. The open innovation paradigm on the other hand is based upon the notion of using both internal and external knowledge to accelerate internal innovation. Chesbrough (2006, p. 2) notes: "*Open innovation processes combine internal and external ideas into architectures and systems. Open innovation processes utilize business models to define the requirements for these architectures and systems. The business model utilizes both external and internal ideas to create values, while defining internal mechanisms to claim some portion of that value*". This suggests that the innovating firm actively partakes in the value creation process together with external partners, using the business model as an innovation intermediary, something that resonates well with the concept of partnership outsourcing where organizations engage in mutually beneficial behavior in order to create a win-win situation (Kishore et al. 2003; Yahklef 1997). With the advent of outsourcing partnerships, internal and external processes co-exist within the premises of the partnership, and are given equal value and attention. The organizational boundaries are redrawn, and become fuzzy as customer organizations seek added value through long-term, mutual relationships with their service providers. Furthermore, in an outsourcing partnership, the outcomes of outsourcing information services are ambiguous, uncertain and dynamic, and this type of relationship therefore benefits from behavior-based performance measurements instead of output-based performance measurements (Kishore et al. 2003).

The open innovation model draws upon previous research done within the innovation area. There is ample work done on strategic alliances (Gulati 1998), open source software (Von Hippel and Von Krogh 2003), and on the impact of geographic location for knowledge exchange between firms (Jaffe et al., 1993). However most of the work has focused on how organizations can make use of external knowledge and has paid little or no attention to positive and purposive outbound flows of internal knowledge. Critical voices have been raised towards the outsourcing of core activities, stating that dynamic and complex processes are often poorly managed in loose networks, with organizational dysfunction being the result (Hui et al. 2008). It has also been argued that partnership outsourcing opens the organization up for potential knowledge-drainage as skills are moved from residing within the organization to the external supplier, putting the client at the supplier's mercy (Hui et al. 2008; Ross and Westerman 2004; Yahklef 1997). Dyer and Hatch (2006) have however shown that organizations can gain competitive advantage by developing their network relations, as this enables interorganizational knowledge sharing. Kern and Willcocks (2000; 2001) point out that the relationship dimension in IT outsourcing is key to outsourcing success, but often neglected in outsourcing research. Open innovation presupposes collaboration and knowledge flows between organizations. Although open innovation has mostly been analyzed at the level of the innovating organization, the network level is implicit in the business model (Vanhaverbeke 2006). As a result, the earlier recommendation to "ally with caution" has transformed into "manage your inter-organizational value network" (Maula et al. 2006). Network management is therefore a central concern for open innovation in the same way that partnership management is essential in an outsourcing partnership.

The Trust Aspect

Trust is seen as a critical part of the process of developing interorganizational relationships (Warne and Holland 1999) and considered to be essential in the success of interorganizational systems (Ibbot and O´Keefe 2004). Organizational relationships where the objective is to pursue mutually beneficial goals only exist where trust is well developed. Furthermore, they are focused on cooperation and collaboration rather than domination and control (Oliver 1990; Williams 1997). Consequently, a lack of trust is among the most frequently cited reasons why organizational cooperation fails (Williams 1997). Mishra (1996) defines trust as *"…one party's willingness to be vulnerable to another party based on the belief that the latter party is 1) competent, 2) open, 3) concerned, and 4) reliable*". These four dimensions form an overall trust construct, and a low level of trust in any one of the dimensions offsets a high level of trust in any of the other dimensions. That is, it is the combination of these four dimensions that determines the general level of trust that one party has for another. Another way of looking at trust is presented by Lee et al. (2008), who have developed a trust-based relationship research model to assess perceived outsourcing success. Their specific goal is to "understand outsourcing success in terms of (1)mutual trust with its temporal dimension of initial trust and initial distrust, and (2) knowledge sharing with the moderating effect of mutual dependency". Their model is based on four factors: initial trust, initial distrust, knowledge sharing, and mutual dependency. They show that mutual trust between the customer and service provider is important for knowledge sharing and outsourcing success, and that initial trust is a contributing factor in the perception of mutual trust from the customer's perspective.

One way to classify trust is to distinguish between what is called personal trust, which is trust developed in close relationships, and trust in abstract systems, which can be trust in society and the rules and norms it is made of or trust in abstract technology. Giddens emphasizes in his "Consequences of Modernity" the significance of "access points" for the development of trust in abstract systems (Giddens 1990). Moreover, Giddens states that individuals that occupy certain roles within an organization represent such access points at which trust can be built up and maintained. Trust in abstract systems is considered not to be as psychologically satisfying as its interpersonal counterpart. To this end, Giddens argues that people are seeking others to rely on and place trust in because interpersonal trust is the type of trust that is anchored in human nature whereas system trust differs from it. Network trust is a kind of "system trust" (Giddens 1990) that is based on the existence of abstract regulatory mechanisms.

Giddens bases his definition of trust on his discourse on modernity, where his basic premises are that the dynamic, transformative character of the modern world has led to the transformation of intimacy and the increase of high risk environments. (Giddens 1990). Thus trust becomes a way of handling the complex environment construed by modernity. This is also a main point in the work of Luhmann (2000) where trust is explicitly treated as a reduction

of complexity. Luhmann (1995) discerns between confidence and trust, and states that the latter is the product of a consciously made choice; that is, to trust is to consider the alternatives available, and to acknowledge the risks involved, and to make a rational decision, based on that information. In addition, Luhmann (2000, p. 96) draws on Deutsch (1958) and states that "Moreover, trust is only possible in a situation where the possible damage may be greater than the advantage you seek". For Giddens (1990) trust is a continuous state, based on contingency, and related to the absence of time and space, and not a specific and conscious choice. Nevertheless, both authors stress that trust and risk go hand in hand and that one should always be considered in relation to the other. This is also a key concept for Sztompka (1999) who claims that trust and risk are intrinsically associated; without risk, there is no need to trust.

Trust has become a rather fashionable research topic, and its pervasive role in information systems research is related to the emergence of interorganizational partnerships, enabled by new IT and relying on a trusting relation between the involved parties. While trust is widely acknowledged as being important for the efficient operation of interorganizational business arrangements, the formation of trust remains challenging. Open Innovation is by its very nature a co-operative effort that involves more than one actor. However, it is often analyzed at the firm level, with one organization as the focal point, instead of at the value network level. The open innovation model presupposes a trustful relation between the actors involved in an open innovation partnership. To this end, a detailed exploration of trust as a precondition for the open innovation model is necessary for the successful deployment of the open innovation model in contemporary business relationships.

Method

In order to investigate the outsourcing relationship between Alpha Corp. and RDC an interpretive case study (Klein and Myers 1999; Walsham 1993) was performed at the organization's headquarters. The rationale behind selecting the research sites was their willingness to cooperate, the availability of multiple sources and the possibility of purposeful sampling (Peppard 2001; Yin 1989). There were two rounds of interviews carried out. The first round occurred in 2003-2004, during which we followed the initial discussions in forming the partnership between Alpha and RDC. The second phase of the study was conducted in 2006, where we revisited the organizations and followed up on the development of the partnership and explored the companies' strategies for maintaining the partnership and establishing trustful relations and the impact of technology on the organizational transformation. A follow-up phone interview was conducted with the CEO of RDC in 2008.

Data was collected by the first author and another project member through a mixture of techniques such as semi-structured interviews and document reviews (Yin 1989). Together we performed 31 interviews with people from both Alpha Corp. and RDC and visited the industrial sites where the remote monitoring technology was in use. The respondents ranged from technical staff and maintenance personnel to division managers and corporate executive officers from both organizations. The interviews had one structured part with a framework of questions concerning the partnership, the technology, and the organizational impact of the outsourcing solution and technology introduction. Moreover, there was an unstructured element with follow up questions and questions that emerged from previous interviews, documents and meetings. All interviews were recorded and then transcribed. We also examined documents and minutes from internal meetings.

The data analysis was performed in two stages. In the first stage of the analysis, the data was read through and patterns in the data and statements that could be grouped together were coded into categories. We focused on exploring preconditions for the deployment of the open innovation model and the categories that emerged concerned the technology in use, the outsourcing partnership, and the organizational strategies in creating trust and forming the interorganizational relationship. This was a way to organize the data and to prepare for the next stage of the analysis that sought to answer the questions of why and how open innovation projects develop over time. In this paper, the categories that emerged from the empirical data are thus presented in the next section and form the basis for the following discussion. In the second stage of the analysis, we drew upon the open innovation literature and used the empirical material to illustrate how issues of openness are played out in practice and why an organization chooses to turn to openness, having formerly operated in a closed environment. As a result three critical themes emerged:

interorganizational knowledge sharing, trust and risk, and the enabling role of technology. These three themes are thoroughly analyzed in the discussion section.

Some specific quotes from the interviews are used to highlight certain discussions, but for the most part, the material constitutes the overall findings from the interviews. The conclusions that are drawn are based on the patterns that emerged in the coding process. As recommended by Miles and Huberman (1994, p. 278) a preliminary copy of the results was presented to and circulated among the interview respondents to ensure credibility and authenticity of the research. All company names have been fictionalized in order to protect and respect privacy.

Alpha Corp. and RDC

Alpha Corp. is an international high-tech minerals group with mines, processing plants, and harbors in Sweden and Norway. The company has about 3500 employees. As a part of a larger reorganization strategy, Alpha Corp. has developed a strategic vision of improving service and maintenance work in order to increase production without investing in new machinery. The service and maintenance division makes up about half of Alpha Corp. Together with the production division, the two divisions host 90% of the company's employees. Alpha has decided that all service and maintenance that requires using the senses, that is smell, touch, hearing, and sight, should be performed by Alpha. Regular inspection routines are to ensure that the machines function smoothly. These are performed by operators (level one) and specific round inspectors (level two), who walk through the plants and listen, feel, and see. Some technology, for instance handheld measuring devices are used at this stage. The next two levels are, in contrast, highly dependent on technology use, and are no longer being performed by Alpha's own maintenance staff. Instead, specialized staff is to perform objective measurements, for example by using vibration analysis (level three), and on occasion other advanced measurements that are normally not done, but require advanced technology and techniques (level four). As a part of this, Alpha has increased spending on equipment monitoring and preventive maintenance from 3 million SEK to 11 million SEK and formed an outsourcing partnership with Remote Diagnostics Centre (RDC), a remote service provider that is contracted to handle levels three and four of Alpha's maintenance work. This is the first time that Alpha lets another company have access to internal process data from strategically important machines that are key to the production process. RDC was created as a joint venture between Alpha Corp. and two of its long term business partners. Alpha Corp., who initiated the establishment in 2003, owns 20% of the company and is its first customer. RDC's business concept is to provide advanced condition monitoring of machinery and equipment all over the world.

A Focus on Technology

Preventive maintenance is a fairly new concept within Alpha Corp. The maintenance unit, which is responsible for keeping the machines such as mills, crushers, and conveyors up and running, previously relied on the employees' personal skills and use of the senses; their individual ability to detect and correct any errors or problems that arose. Nowadays, these machines are instead monitored through various sensors and IT-applications, which are continuously logging process data and passing it on for analysis, a trend which is visible throughout the processing industry. By using real time data logging and remote diagnostics systems one can detect current status, unusual use, and early signs of equipment failure (Han and Yang 2006; Lee et al. 2006).The use of remote diagnostics technology and its expected outcomes, such as a reduced number of unplanned production stops and a more efficient production process, are of highly strategic importance to the client organization as an increase in up-time means a competitive advantage for the organization. Moreover, unplanned maintenance stops are extremely costly and the strive is therefore to minimize them. This way of performing maintenance means that the maintenance worker no longer has to be on site to monitor equipment and changes the time frame for maintenance work. With methods such as vibration analysis, an erratic behavior can be detected months before it in fact causes a problem for the actual machine, which gives the maintenance unit ample time to prepare for a planned maintenance stop, instead of responding to a breakdown after it has happened.

Alpha is also investing a lot of money in sensor technology. In the past 20 years, they have increased the number of measuring parameters from three to 33. They have also increased the number of points of measurement from about 100 to more than 15 000. Currently, Alpha is collecting and storing data from all parts of the production process.

Various sensors are dispersed across the production line where they log machine data such as temperature, oil pressure, and vibrations. This data can be highly sensitive since it reveals all details of the production process and has therefore traditionally been kept in-house in closed systems. Some data analysis is performed, but mostly data is simply collected because the technology is available, and in the hopes that it might prove useful in the future. By turning to technology, Alpha Corp. expects to be less reliant on skilled individuals and instead gain collective knowledge which is stored within the maintenance system. Remote monitoring services can be done from a distance as long as the machines are able to transmit the collected data, and these services are increasingly being outsourced to a remote service provider that uses the client's ICT-infrastructure to access the data and perform the subsequent analysis with the aid of sophisticated software. In the case of Alpha Corp., the use of such technology has opened the door for a partnership with RDC and increased the flow of internal and external processes. Although Alpha has invested a lot in technology, they have a clear cut strategy when it comes to technology development. Basic machine knowledge should reside within the company, but developing new technology is not within Alpha's main focus. Alpha's service director says: "*We are not going to be experts at constructing these highways, we are going to be experts in using them and getting the information that we want. Sometimes we adjust the system to Alpha Corp., sometimes we adjust Alpha to the system*". By choosing to maintain a narrow view and understanding of technology, Alpha makes it possible for other actors to contribute with their expertise. This in turn is regarded as a very important strategic move: "*This is an extremely important change in the Alpha mentality. Earlier we thought that anything in-house was so special and everything had to be specifically made for Alpha because we thought of ourselves as an extremely specific organization"*.

The Outsourcing Partnership

RDC was formed in 2003 as a joint-venture between Alpha Corp., Equip, a world leading manufacturer of drilling and excavation machinery, tools and service for the mining and construction industries, and Re-Tech, a leading global supplier of products, solutions and services in the area comprising rolling bearings, seals, mechatronics, services and lubrication systems. The three companies own 20%, 12.5%, and 67.5% of RDC respectively. Alpha Corp. had several reasons for forming RDC and establishing an outsourcing partnership. In recent years Alpha has made an extensive maintenance make-over and focused on systematic, preventive, and structured maintenance. The main reason came from a need to focus and stay focused and by letting someone else handle data monitoring and analysis they saw an opportunity to reduce complexity and structure the maintenance organization. They also saw the possibility of saving time, cutting costs, and getting to know the plant better through monitoring and subsequent analysis of data. Instead of limiting themselves to internal maintenance processes, Alpha decided to use the potential embedded in its relationship with its two major business partners, Equip, who had delivered a lot of the equipment used in Alpha's mines and processing plants and Re-Tech, who had developed an advanced solution for condition monitoring. Together, they were all expecting to gain from the partnership. Equip would get access to equipment data and advanced measurements that could be used for development purposes. Re-Tech were provided with the opportunity to put their condition monitoring system to use and develop methods and technology while trying them out in a real setting. Alpha, were at the receiving end, getting both better equipment and advanced technology to better the maintenance work. In return, Alpha opened up its organization to RDC and gave them full access to the machines and technological infrastructure.

The creation of RDC is viewed as an added-value project, a partnership that brings new job opportunities to the region, and increases revenue for Alpha. To have the condition monitoring focused in one organization such as RDC means that the collective knowledge will be high. It also makes it possible to specialize in this area, which could not be done, when the competence resided within individuals spread across the different production units at Alpha. Alpha's service director notes: "*Someone who also has to focus on other things can never excel in any one given area*". Thus, by moving the competence from the internal organization to the external service provider, several Alpha employees argue that the level of competence has increased. Another benefit is that RDC's staff is constantly available with access to backup. Initially, Alpha was RDC's only customer, but the company was set up on the premises that it should actively seek other customers as well, and that has also been the case in later years. Alpha has encouraged this planned expansion as they have hoped that it would lead to shared costs, but also an increased level of competence as RDC learns from other organizations and brings that knowledge back to Alpha. This could not have been done, had RDC been created as an internal service division within Alpha. Using an external partner has proven beneficial in other ways, as Alpha has discovered that RDC's opinions and analyses have more leverage with

Alpha's own maintenance staff than internal directives. In addition, several division maintenance managers state that they use RDC reports to exert pressure on their own organization, to ask for more money and to inspire their staff.

A Strategic Move Toward Trust

When RDC was formed, Alpha recruited some of their own maintenance staff and transferred them to the new company. A trusted member of the group was made CEO. This was also a strategic step towards establishing interorganizational trust as it is considered easier to trust someone you already know. This also becomes apparent while talking to Alpha's service director. In describing RDC's CEO, he says: *"[He] is in such control… he will surely make more money than we have imagined*". Not all, but the majority of RDC's employees had previously worked for Alpha. This picture has changed somewhat today, but there are still very close ties between the two organizations. There was also a strict business contract written to regulate the partnership, and Alpha has a designated person who is in charge of the contract with RDC and who is to ensure that they deliver what they have promised. However, Alpha's service director states that it was impossible to cover all aspects and claims the decision to trust simply had to be made as he says: "*We have to stay focused, so we just have to trust*". Both organizations stress that it is fundamental that there is trust between them in order for the partnership to work. This trust incorporates both trust in people and trust in technology. The data that RDC is allowed access to reveals Alpha's business secrets and should not end up in the wrong places. Both Alpha and RDC employees view interpersonal relations as very important. Alpha staff stress that their contact person from RDC has to be someone one can talk to, who will stop and have a cup of coffee, and who can explain the technology in use. One maintenance worker expresses: "*We are a bit suspicious… however as long as they are here, we don't believe there will be problems; we can discuss matters directly with them*". An RDC technician states: "*You have to have some sort of personal contact. Attitudes don't work!*" In addition, RDC is expected to have an inspired and engaged workforce, with vast knowledge of Alpha Corp. A constant dialogue, availability, and visibility are regarded as being very important in furthering the relationship.

RDC is seen as a potentially positive influence on Alpha's staff as the company helps put the focus on preventive maintenance and can show how the use of technology can improve maintenance work. It is the collection and analysis of data that is at the heart of condition monitoring, and this is done by the use of information technology. Both Alpha and RDC staff argue that it is personal trust that creates trust in technology. However, once established, trust in technology stands on its own. There are regular meetings between Alpha and RDC where common business is discussed. One of the more recent discussions has focused on judging risks, a topic closely associated with the use of technology. The ability to collect and analyze data over time makes it possible to see ongoing trends and make predictions about the future. RDC uses this methodology to follow up on problems with bearings, which eventually will cause equipment failure. The tricky part is judging the risk; once an error has been detected, how long should the actual machine be kept up and running before maintenance is performed? There are no definite answers to that question, but RDC uses a combination of probability and consequence to judge risk. The general idea is that if the probability of a breakdown occurring is low, but the consequences of such a breakdown are severe, the risk could still be considered high and RDC would alert Alpha who will probably chose to take action. Similarly if the probability of a machine breakdown is high, but the consequences are minimal, the situation might be considered low risk. Alpha would still be alerted, but would probably not do anything with the information. When making correct predictions, RDC establishes trust in technology, if not they risk not only technology distrust, but also personal distrust. Interesting to note in light of this, is that even though they can actually perform a lot of the work from a distance, using remote technology, an RDC technician needs to show up on site regularly in order to be considered trustworthy. An RDC technician notes: "*If you have a problem with someone once and it turns out you are the one mistaken, it takes a very of a long time to repair that relationship*". Accurate error detection is not enough.

In the beginning some of Alpha's maintenance staff was highly skeptical of the technology that RDC uses to monitor the machines. They were used to using their senses to detect any errors; to do regular inspection rounds to see if anything looked, smelled or sounded wrong. The methods used by RDC are on the other hand so sophisticated that they can predict a machine breakdown a year before it actually takes place. Many Alpha workers did therefore not initially believe in RDC's reports and listen to their warnings, as the machines appeared to be working fine the

last time they walked by them. However, with the support of Alpha's maintenance managers, RDC has had the chance to prove that their analyses have been on target, by letting a machine run until it breaks down and then picking it apart and analyzing the cause. An Alpha division manager states: "*I have seen so many examples of them [RDC] finding errors, so now I trust them*". RDC has also spent a lot of time on site, talking to Alpha's staff, showing up for coffee and discussing technology. An Alpha maintenance worker expresses: "*What is important is personal contact, that you can discuss things. You have to get to know each other and improve your relationship. Just sending us monthly reports and e-mail is not the same thing at all*". Moreover, they have provided some courses on vibration analysis, which is the main method they use to detect errors, and made a conscious effort to show curves and diagrams on the computer screen and explain what they indicate. This strategy has been very successful and has gradually built up trust in both people and technology. Both Alpha and RDC state that this has been crucial in strengthening relations between the two organizations. Although the partnership is regulated with contractual control measures, mutual trust has proven to be very central to the success of the relationship. As trust has been established, staff members from both organizations have tended to work more as a team instead of as separate entities, which has led to more cooperation and collaboration and a higher level of knowledge sharing.

Discussion

As the importance of innovation grows, so does the need for a better understanding of this process. Reviews of literature concerning the adoption of innovation demonstrate that successful adoption requires the management of ideas, practices, behaviors, and structures, with the aim of bringing these different aspects of organizational and program structures into alignment (Rogers 1995; Van de Ven 1986). In our research we have used the trust aspect of open innovation to guide research and analysis. Much of this trust aspect is drawn from Giddens' (1990) descriptions of the ways in which trust is shaped or framed by social institutions and enacted by organizational members. He observed that over time, people have used many resources, including technologies, to build trust. In this section we argue that the adoption of the open innovation model is grounded in developing organizational environments that are conducive to innovation, including expertise in creating a culture for knowledge sharing, building a trustful environment, and a resourceful use of interaction technologies.

Openness and Interorganizational Knowledge Sharing

The open innovation paradigm as described by Chesbrough (2003, 2006) focuses on the purposive flow of internal and external knowledge between organizations. Ideas are insourced and outsourced with the aim of setting the stage for technological innovation. The basic premise for this business model is that organizations benefit through collaboration and openness. Innovation is not restricted to products, it also includes techniques and processes (King et al., 1994), and as projects grow in complexity knowledge cannot and should not be restricted to what is available in-house. As a consequence, innovation value networks are formed. As noted by Van de Ven: "*Technological innovation is fundamentally a collective action process of building an infrastructure that reduces the time, costs, and risks for each participating member […]Developing and commercializing these new products and services require resources that are beyond the capabilities of any one firm*" (Van de Ven 2005, p. 373). In the case of Alpha Corp. the innovation network consists of Alpha and two of its partners, Equip and Re-Tech and is embodied in the creation of RDC. All of these organizations are in turn linked to other organizations in various network constellations. Under the auspices of partnership outsourcing, interorganizational knowledge sharing and technological innovation have been enabled. RDC uses remote diagnostics technology to monitor Alpha's equipment. This is a new way of condition monitoring as it was previously based on the technician's use of the senses. By engaging in the innovation network, Alpha gets access to new tools and techniques but also provides a forum for technology development and innovation. Equip, the equipment provider, learns about their own products by taking part of RDC's analyses and reports and are able to use that information for product development. Re-Tech in turn, has a unique opportunity to try out new technology in a real setting over a long period of time. This could have been just another case of organizational collaboration. However, we claim that this is something more than that. This is an example of open innovation, based on a deliberate and strategic move to include both internal and external knowledge flows. It is based on the premise of engaging in mutually beneficial behaviors. And it has a twist, in the form of RDC, a company that exists only because of this innovation network, but which stands on its own, bringing new methods and techniques into the mix, as well as an adjacent network of other customers.

As organizations turn to each other in order to create possibilities for innovation, network management becomes a key concern. Simard and West (2006) make a distinction between formal and informal, and deep and wide ties. They state that formal ties, that are based on formal contracts between organizations also lead to the formation of informal ties, often in the form of friendships between company staff, and vice versa; informal friendships can lead to more formal collaboration. Deep ties refer to strong ties between organizations, often enhanced by geographical proximity and dependent on trust. Wide ties may be weak, but may join disparate networks and form a growing ground for innovation. The outsourcing partnership between Alpha Corp. and RDC is based on formal ties as there is a formal contract regulating the partnership, but the relationships that have emerged between company workers are classified as informal. The ties between Alpha, Equip, Re-Tech, and RDC are deep, and there is an intentional move to establish trust. At the same time, all organizations exist within other networks and other arenas, thus bringing with them wide ties that may or may not be beneficial to this particular venture. These four types of ties co-exist within an innovation network and it is a mix of them that produces innovation. They also have to be understood and managed and should be included in an analysis of an open innovation network.

The organizations in our case study have specific and straightforward roles within the network. Equip provides the equipment, Re-Tech the technology, and Alpha the location where it all comes together. In addition, RDC provides the methods and techniques that are essential for technology development and innovation. We find that this clear-cut division of responsibilities effectively counteracts the repercussions of dividing activities across organizational boundaries as described by Hui et al. (2008). In their research, they state that outsourcing structures where owner firms do not maintain high levels of dominance will pose control and coordination challenges and lead to poor project performance. They thus favor a hierarchical approach to collaboration where the customer firm maintains strict control. Based on our research, we can agree that there needs to be structure and strategy and that network relations have to be amply managed. On the other hand, we also see that their framework is based on a closed innovation paradigm, where firms are believed to be best off if all activity takes place in-house and outsourcing is seen as a "not-so-necessary evil" used mainly for speed, cost reduction or improved efficiency and effectiveness, for which the company pays with a lack of control and coordination. This echoes the traditional view of outsourcing. The outsourcing relationship between Alpha Corp. and RDC is however based on a partnership, where both parties are mutually responsible for its outcomes. Reciprocity, trust, and mutual dependency are key aspects of the relationship. Such an outsourcing relationship does not fit into the narrow description provided by Hui et al. (2008). Instead it opens new doors for knowledge transfer and added value.

Knowledge flows are crucial and essential for open innovation. It has been shown that knowledge flows more readily to closer entities (Jaffe et al. 1993). Creating knowledge clusters in a specific geographical location is therefore an integrated part of open innovation. This has also been a deliberate strategy at Alpha Corp. who has stated in the contract with RDC that the service provider cannot move its headquarters from the current location. Geographical proximity brings new job opportunities to the region, and contains knowledge. Wide ties, on the other hand, ensure that the knowledge does not become stale and static. Simard and West (2006) point to the difficulty of measuring knowledge flows that are created through informal ties. Alpha Corp.'s maintenance division has been highly dependent on skilled individuals, that is, workers with experience and vast knowledge of Alpha's business processes. With the creation of RDC specific knowledge was at first transferred from Alpha to the new company, but with the introduction and use of new technology new knowledge was also created both internally and externally. In an attempt to insource knowledge, Alpha has contracted RDC to give courses on vibration analysis, the predominant monitoring method used. They have also stressed the importance of visibility, making sure that RDC-technicians and Alpha staff meet regularly, although informally, so that knowledge exchange can take place. Nevertheless, whether knowledge is aptly circulated or not boils down to a question of trust. In the words of Kim and Mauborgne (1998, p. 323): "*Without individual's voluntary will to cooperate, firms cannot effectively build their collective wisdom that is critical to succeed in this knowledge economy […] Trust and commitment are essential attitudes here. In their absence, the behavior of voluntary cooperation is hardly obtainable*". In light of this, we shall therefore delve deeper into the concept of trust.

Openness, Trust and Risk

According to Sztompka, trust and risk are intrinsically associated; without risk, there is no need to trust (Sztompka 1999). Sztompka's definition of trust reflects the intrical relationship between trust and risk: "*trust is a bet about the future contingent actions of others*" (Sztompka 1999, p. 25). "The others" in Sztompka's case might be individuals, organizations, or technologies. Defining trust in this way provides a means for us to understand the important link between the concept of trust and the challenges associated with living in a risk society. The notion of the risk society builds on the argument that modern societies encounter many more risks than previous ones (see e.g. Giddens 1990; 2002). While traditional societies encountered risks from potential natural disasters, modern society – due to the advances of modern technologies - has many more risks in addition to these found in nature. In addition, modern societies are built upon the notion of the disembedding of social relations, where relations are lifted "*from local contexts of interaction and their restructuring across indefinite spans of time-space*" (Giddens 1990, p. 21) This creates an element of uncertainty and points to the necessity of trust, which is seen as a fundamental property of disembedding: "*All disembedding mechanisms […] depend upon trust*" (Giddens 1990, p. 26) Giddens (1990, p. 88) distinguishes between trust in abstract systems and trust in persons. The former takes the form of a faceless commitment "*in which faith is sustained in the workings of knowledge of which the lay person is largely ignorant*". Trust in persons is a facework commitment "*in which indicators of the integrity of others are sought*". System trust becomes localized through personal relations in the form of access points which tie actors into trust relations. Although Giddens' analysis concerns the structures within modern society as a whole, we find that it can be applied to the case of open innovation, which is contingent upon the restructuring of social relations across time and space. In our research we find that as the organizations seek new ways of innovation, they allow for the outflow of internal processes, which in turn leads to the relinquishing of control and the placing of trust in an abstract system, i.e. the open innovation network. The way they go about doing this is by establishing personal trust, embodied by the close relationship between Alpha and RDC, the latter which serves as the access point for the three owner organizations. A key factor in the success of the network between Alpha, Equip and Re-Tech is the centrality of RDC, a physical place with real people where the network comes to life. Dialogue, availability, and visibility are the means by which trust is created and upheld.

Inherent to trust is the notion of risk, and while personal trust creates system trust, the opposite also holds true: when the system fails, personal trust is damaged. In the case of Alpha and RDC we note that when making correct predictions, RDC establishes trust in technology, if not, they risk not only technology distrust, but also personal distrust. However, making correct predictions is not enough to uphold trust over time if there is a lack of personal trust. This again shows the significance of access points, and the vulnerability associated with them. A lot of focus has been put on the risk of potential knowledge-drainage as organizations engage in outsourcing partnerships where knowledge is moved from within the organization to an external partner. There is also the risk of actual knowledge loss as Alpha turns to technology instead of relying on individual's skills and use of the senses. An Alpha division manager notes: "*We trust technology, but sometimes you can take it too far. There is a danger of having less engaged and informed staff members; if you trust technology too much, you stop walking around the processing plants*". As equipment is being continuously monitored through the use of remote diagnostics systems, the objective is to minimize the number of unplanned stops. This might however lead to an over-confidence in the system, and a decrease in personal knowledge and responsibility as Alpha's maintenance staff will be exposed to fewer machine break-downs. Another division manager states that: "*The things that give us the most trouble are the ones that we know the most about. The worst case scenario from a knowledge perspective is when things work. Then no one will know what to do when there is a problem*". This risk must be handled by the reciprocity of the partnership, where the involved parties have a responsibility to give something back to one another. Knowledge, in this sense, has been transferred from the internal Alpha staff to the external RDC staff, but as it still exists within the network, it can come all actors to gain. In an effort to recycle knowledge, RDC, with the support of Alpha's maintenance managers, has had the chance to prove that their analyses have been on target, by alerting Alpha of an error, but then letting the machine run until it has broken down in order to be able to pick it apart and analyze the cause. RDC has also spent a lot of time on site, talking to Alpha's staff, explaining their methods and discussing technology. This has made staff members of both organizations work more as teams instead of separate entities. Our research thus provides support for Lee et al.'s (2008) claim that interorganizational knowledge sharing requires mutual trust. Furthermore we find that maintaining trust is a way to contain risk.

Openness and the Enabling Role of Technology

When organizational members engage in interactions with others, be they members of the same organization or people from the outside, they are enacting their firm's affiliations within constrained environments, and using ICTs as interaction technologies are a fundamental part of these communications and exchanges. Whether as a situated individual or a larger group, the social actor may be simultaneously representing that self, or the larger organization, depending on which affiliations pertain. As organization members, people routinely perform socially embedded actions, and interaction technologies are increasingly enabling these interactions.

Sztompka argues that when we say we trust a technology, we are really saying that we trust the people behind the technology: "*Intuitively we feel that trust must be vested in people, rather than natural objects or events. Even if we seemingly conferred trust on objects, such as saying 'I trust Japanese cars,' or 'I trust Swiss watches,' or 'I trust French rapid trains,' we in fact refer to humanly created systems and indirectly we trust the designers, producers, and operators whose ingenuity and labour are somehow encrypted in the objects*." (Sztompka 1999, p. 20)

Although trust in technology is important for the running of contemporary organizations, the people behind the technology remain key agents in establishing that trust. This has also been the case with Alpha Corp. as RDC's staff members have come to serve as access points through which faceless commitments are re-embedded, creating trust in the abstract technologies that were at first regarded with skepticism. In doing so, RDC becomes the guarantor of the quality of the technology, and as such assumes the role of and the trustworthiness accredited to designers, producers and operators. In such an environment where trust is crucial, the interactions that organizational members engage in produce a situation where these members no longer only represent themselves or the organization, they also represent the people behind the tools and techniques they are using. This multitude of roles and their possible consequences is something that should be taken into consideration when engaging in a partnership based on trust.

This case study further shows that interactions occur on many levels. Giddens (1990) makes the distinction between system trust, sometimes labeled as trust in abstract principles, and trust in persons. These two trust constructs are in constant interplay. As we examine the case of Alpha Corp. and its partners, we find that this division can be applied in various ways. First we have the network level, where Alpha Corp., Equip, and Re-Tech have formed an open innovation network. RDC becomes the access point for the network. System trust in this sense is trust in the structure of the network, and personal trust is trust in the individual organization, in this case RDC. However, when we move down to the organizational level, and examine the relationship between Alpha Corp. and RDC, the system trust is the trust placed within the individual organization and the technology that is put in use, and the personal trust pertains to the individual staff members. It is important to keep these different levels of analysis in mind when discussing open innovation and the networks that are formed. Open innovation has previously mostly been analyzed at the level of the innovating firm (Vanhaverbeke 2006). Using trust as a framework, we can expand that analysis to include the network level as well.

With the intention to increase transparency between the organizations, Alpha has set out to create a common platform where information is shared so that knowledge is recycled back to Alpha from RDC. In return, RDC is given full access to Alpha's machinery, maintenance system, and technological infrastructure which they can use to try out new technology and develop their methods of analysis. There is a strive for informed decisions based on data analysis: "*Condition monitoring in itself is not going to help anyone, that is, that one simply measures. When one measures, and knows, and has the time to do something about it, then one can take calculated risks*." Both organizations believe that investment in ICT will increase interaction and provide a basis for improved co-operation. ICT is present not only in the remote diagnostics technology that is used to collect data, but also in the new maintenance system where data is stored and readily accessed, and in the computer programs that are used for data analysis. By turning to technology, Alpha Corp. expects to be less reliant on skilled individuals and instead gain collective knowledge which is stored within the maintenance system. This may seem as a rational decision, but what will it mean to have a technology driven development whilst not keeping the own organization updated on technology as those skills are relocated to the external organization? An Alpha project manager discusses this is some detail and states: "*We have to constantly and continuously raise the level of education of our staff members.*

The problem is not educating people and having them leave. The problem is having the uneducated people stay". Alpha needs to keep a close watch on their technology strategy so that they do not end up with a high-tech organization, but low-tech workers.

Conclusions

The specific underlying question that this study sought to answer was: Why and how and do open innovation projects develop over time? In order to answer this question we performed a case study at Alpha Corp. as it formed an outsourcing partnership with RDC in an open innovation project together with Equip and Re-Tech. By focusing on preconditions we have added to the existing discussion on open innovation and its possible outcomes. Furthermore, we have focused on the process industry and applied the open innovation model to a setting formerly unexplored by open innovation researchers. More specifically, our conclusions are threefold:

First, our findings show how the idea of openness has a positive influence on interorganizational knowledge sharing. Our case illustrates the ways in which the organizations continuously seek to find new arenas in which knowledge exchange can take place. The open innovation model is centered around the notion of purposive internal and external knowledge flows. To this end it is critical to examine network ties and trust constructs in order analyze open innovation and its relation to interorganizational knowledge sharing at both the organizational and the network levels.

Second, our findings illustrate how trust and risk are intrinsically associated, and in particular how open innovation projects tend to increase their co-dependencies. We found that interorganizational knowledge sharing requires mutual trust, and that maintaining trust is a way in which the organizations can contain risk.

Third, our findings show how information technology can be an enabler for social action, and to this end any openness in the organizing practices has to be successfully enabled by technology. ICT as enabling technologies are a fundamental part of the communications and exchanges taking place in and between organizations. ICT will interact closely with systems of trust and these systems will have significant implications for the adoption, understanding, and use of the technology. Trust in technology as an enabler of social action is important for the running of contemporary organizations, but the people behind the technology remain key agents in establishing that trust. This paper shows how the trust aspect can push researchers to consider ICT use within complex organizational settings, enabling insights that may not have been possible with other organization-level models. We argue that trust is a key precondition for openness in organizational life and must be understood better if we are to understand the promises and perils of open innovation.

Taken together the aforementioned conclusions – related to the ways in which the idea of openness is expressed in relation to interorganizational knowledge sharing, in relation to trust and risk, and in relation to the enabling role of technology – presents us with critical preconditions for open innovation projects. Our findings show that adoption of the open innovation model is grounded in developing organizational environments that are conducive to innovation, including expertise in creating a culture for knowledge sharing, building a trustful environment, and a resourceful use of interaction technologies. Open innovation projects can develop over time if and only if these preconditions are considered.

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