Paper to be presented at the

DRUID Society Conference 2014, CBS, Copenhagen, June 16-18

How Social Capital Mitigate Collaboration Challenges in

University-Industry Research Alliances: A Longitudinal Case Study

Marianne Steinmo
University of Nordland
Bodø Graduate School of Business
marianne.steinmo@uin.no

Abstract

Universities and public research organizations (PROs) are valuable knowledge sources for firms in innovation development. However, differences in goals and approaches between firms and PROs create tensions and lead to challenges in achieving fruitful collaborations. This paper explores how the development of cognitive and social capital can mitigate such challenges between firms and PROs in research alliances and facilitate effective collaboration over time. By comparing one well-established and one emerging research alliance, I find that it take time to build successful collaboration between firms and PROs and that the success highly depends on cognitive and relational social capital. Common goals and understanding about the collaboration as well as creation of personal relations between firms and PROs mitigates collaboration challenges and thereby lead to better collaboration performance over time. Moreover, it appears necessary that at least one of the social capital dimensions is present when entering a research alliance for a fruitful collaboration to be developed.

How Social Capital Mitigate Collaboration Challenges in University-Industry Research Alliances: A Longitudinal Case Study

Abstract

Universities and public research organizations (PROs) are valuable knowledge sources for firms in innovation development. However, differences in goals and approaches between firms and PROs create tensions and lead to challenges in achieving fruitful collaborations. This paper explores how the development of cognitive and social capital can mitigate such challenges between firms and PROs in research alliances and facilitate fruitful collaboration over time. By comparing one well-established and one emerging research alliance, I find that it take time to build fruitful collaboration between firms and PROs and that the success highly depends on cognitive and relational social capital. Common goals and understanding about the collaboration as well as creation of personal relations between firms and PROs mitigates collaboration challenges and thereby lead to better collaboration performance over time. Moreover, it appears necessary that at least one of the social capital dimensions is present when entering a research alliance for a fruitful collaboration to be developed.

Key words: University-industry collaboration, tensions, social capital, research alliances

1.0 Introduction

Universities and research organizations (PROs) are important knowledge sources for firms to get access to new ideas and resources in development of innovations because they add relevant expertise which enrich and expand the firms' technological resource base (Dahlander and Gann, 2010). Although many firms recognize the importance of collaborating with PROs in innovation development, they are often reluctant to use these external knowledge sources because they find it challenging to achieve a well working collaboration. Differences in organizational structures, management, goals and approaches towards problems between firms and PROs sometimes makes collaboration between academic and commercial activities challenging and tensions may occur (Ambos et al., 2008).

When conducting common R&D projects commercial firms are often driven toward short-time innovation outcomes in a way that advantageous their customers, whereas academics are mainly driven towards publication reputation in international competing areas, as it is

important for their academic success (Becker and Trowler, 1989). Firms in general tends to rank PROs relatively low as sources for innovation, however the firms that actually do collaborate with PROs are much more innovative than firms with no links to PROs (Howells et al., 2012). To release the potential of PRO collaboration, more knowledge is needed on how firms are able to build and sustain a fruitful collaboration (Spithoven et al., 2011, Zahra and George, 2002, Inkpen and Tsang, 2005). This paper builds theory on how firms can facilitate fruitful collaboration between firms and PROs in research alliances. Different dimensions of social capital is shown as crucial for successful collaboration between firms and PROs; structural social capital reflects on the formal structure of social networks firms have towards actors, whilst cognitive and relational social capital, which this study concerns, focuses on the content of the formal structure (Nahapiet and Ghoshal, 1998, Adler and Kwon, 2002). Previous literature has mainly explored the formal structures of social capital. I study the content of social capital and the interrelations among them which previous study calls for (Nahapiet and Ghoshal, 1998, Inkpen and Tsang, 2005, Rass et al., 2013).

Recently, studies have called for in-depth research on university-industry collaboration in research alliances over time (Lind et al., 2013, Smith, 2012). I add to the literature on university-industry collaboration by exploring how firms and PROs manage to collaborate well in research alliances over time, by exploring specifically the role of relational and cognitive social capital as sources to mitigate challenges between firms and PROs and as facilitators for collaborative capabilities. Hence, I propose the following research question: How do firms and PROs create viable and fruitful collaboration in research alliances over time?

To answer my research question I build theory on a longitudinal case study on two research alliances in different phase of development; a well-establish research alliance and an emerging research alliance. My purpose is to draw on insights from the research alliances in order to understand whether and how dimensions of social capital facilitate viable and fruitful collaborations between firms and PROs. By studying innovation projects conducted within the two research alliances, I was able to draw on insights from both the collaborating firms and the PROs for a better understanding of firms' tensions towards PROs and the development of social capital. Both research alliances have received support from a public support scheme and have objectives to pursue environmental improvements in order to solve specific challenges in the industry.

This paper extends prior research on the use of external knowledge sources by clarifying how firms can build cognitive and relational social capital towards PROs to mitigate tensions and build fruitful collaboration over time, which is a fundament for firms' ability to accumulate

knowledge and thereby increase research alliances innovation performance. The implications is that cognitive and relational social capital should not be seen as a characteristics of one organization, but rather a capability that is built over time in the relationships between organizations. I observe the importance of building both cognitive and relational social capital towards PROs early in the collaboration. Common goals and understanding about the collaboration as well as creation of personal relations between firms and PROs in the starting point will mitigate tensions and thereby lead to better collaboration performance over time. Hence, cognitive and relational social capital in university-industry collaboration might be seen as a way to overcome collaborative barriers and enhance fruitful collaboration with PROs over time.

Moreover, this study contributes to a better understanding of the interplay between cognitive and relational social capital. Cognitive social capital leverage relational social capital as it is easier to create personal relations between firms and PROs when they agree on the collaborative fundament. Contrary, relational social capital plays a role in building cognitive social capital for firms lacking common understanding and goals towards collaborative PROs. The way of reaching common understanding and shared goals towards collaborative PROs was clearly depended of the level of relational social capital. These findings have important implications for firms collaborating with PROs, illustrating that at least one of the social capital dimensions should be developed while entering collaboration.

This paper is organized as follow. Section 2 presents my theoretical framework. Section 3 presents the methodological approach that I conduct. Section 4 presents my findings and derives my propositions. Finally, Section 5 contains my conclusions and presents implications for further research and practice.

2.0 Theoretical framework

2.1 Collaboration between firms and PROs in research alliances

Although collaboration is important for learning and innovation many firms faces significant challenges when collaborating with PROs. Challenges are mainly rooted in tensions between firms and PROs which can be defined as *"two co*-existing contradictory forces with *conflicting goals"* (Fang et al., 2011p. 774). A common tension between firms and PROs are often related to dissimilarities between academic and commercial activities (Ambos et al., 2008). PROs perform fundamental research, whereas commercial firms deals with the cost activities of innovations. This makes firms more oriented on short-term and applied research

which provides solutions to problems, whilst PROs are more long-term oriented (Spithoven et al., 2011). Moreover, different routines and cultures, and lack of trust between firms and PROs are factors which make university-industry collaboration challenging (Smith, 2012).

There is a large, mainly quantitative, literature that examines the factors that determine firms' ability to source in external knowledge from R&D alliances and the consequences of such knowledge sourcing on the firm's innovative and economic performance. This research is however quite silent on how firms can actually benefit from external knowledge sourcing, especially when the dissimilarity between a focal firm and its PRO alliance partner is high. In that case, qualitative research can give a deeper understanding on the collaborative process (Smith, 2012). Still, some firms are able to overcome this challenge of collaboration and recognize, assimilate, and apply novel information from actors that are dissimilar. This dilemma is likely to be particularly prominent in the relationship between industrial firms and PROs where the dissimilarity can be considered as high due to the tension between academic and commercial activities (Ambos et al., 2008). Collaborative tensions and barriers between firms and PROs has been acknowledge in the literature (Bruneel et al., 2010). However, few scholars have respond to the call of studying factors that mitigates barriers (Hall et al., 2001). This study tries to narrow this gap by looking at social interaction mitigating challenges and enhancing fruitful collaboration between firms and PROs in research alliances by exploring the concept of social capital.

2.2 Social capital

Social capital can be defined as *"the aggregate of resources embedded within, available through, and derived from the network of relationships possessed by an individual or organisation"* (Inkpen and Tsang, 2005, p. 151). Social capital is important for inter organizational collaboration as it facilitates interaction and trust between collaborative partners (Inkpen and Tsang, 2005). Social capital can be seen from a bridging perspective or a bonding perspective. The bounding view of social capital focuses on the internal characteristics of collective actors, where the boarder can reflect organizations, communities or nations. The bridging view, which this paper builds upon, relates to social capital as a source to enhance network tying with external relations (Adler and Kwon, 2002). This study follows the content of networks ties and thereby the dimensions of cognitive and relational social capital (Nahapiet and Ghoshal, 1998).

Mutual lack of understanding about working practices and expectations is found to be a barrier in university-industry collaboration (Bruneel et al., 2010), and building cognitive social capital may be a way to overcome this challenge. Cognitive social capital refers to shared interpretations and systems of meanings (Cicourel, 1974), common language and codes (Monteverde, 1995), and shared narratives (Orr, 1990) among parties. When organizations have shared visions and systems it is easier to learn from each other (Hult et al., 2004). Cognitive social capital have been divided in two categories; shared goals or shared culture (Adler and Kwon, 2002). Shared goals refer to common understanding and approach concerning the network tasks (Inkpen and Tsang, 2005), and common perspectives about goals (Masiello et al., 2013). Previous research shows that successfully collaboration between firms and PROs highly relates to similar competencies and capabilities (Petruzzelli, 2011). Shared culture refers to rules and norms that determine appropriate behavior in the network. When actors within a network have cultural linkages it is easier to collaborate (Inkpen and Tsang, 2005). However, firms that are too cognitive similar may reduce the creation of innovation in inter-organizational collaboration as there is found an inverted U-shape relationship between cognitive social capital and innovation in collaborative performance (Cowan et al., 2007).

Relational social capital focuses on relational closeness and trust and refers to: *"Those assets created and leveraged through relationships"* (Nahapiet and Ghoshal, 1998). It describes personal relationships trough prior contacts (Granovetter, 1992) and concerns mutual respect and friendship, expectations and reputations (Adler and Kwon, 2002). Collaboration experience is found to lower barriers in university-industry collaboration (Hagedoorn and Schakenraad, 1994). Petruzzelli (2011) found that the existence of previous collaborations promotes trust between academic and industrial partners, illustrating the usefulness of building personal relations for development of technologies. Relational social capital is found to be the most important dimension of social capital as a driver for university-industry collaboration given the effect of trust (Van Wijk et al., 2008). As university-industry collaboration often involves collaboration between unknown partners and thereby high level of uncertainty (Bruneel et al., 2010), building trust trough personal relations can reduce uncertainty among collaborative partners and increase their willingness to be open and share information and resources (Adler and Kwon, 2002, Tsai, 2000). Moreover, building trust with collaborative partners may reduce risk of opportunistic behavior (Putnam, 1993). Conversely, (Yli-Renko et al., 2001) argue that when trust reaches a very high level it can be detrimental for inter organization collaboration. Perceiving actors need to control decreases as well as the level of conflicts and information persuade which may diminish the creation of new knowledge (Masiello et al., 2013).

Summing up, tensions in university-industry collaboration may be harmful for successful collaboration for firms and PROs in research alliances. However, we know little about how the tensions may be mitigated (Hall et al., 2001). I ask the question whether social capital dimensions can mitigates challenges between firms and PROs in research alliances over time by building personal relations and common understanding. Further, this question is explored through a longitudinal case study of two research alliances.

3.0 Methodology

3.1 Research design

To provide insight into complex relationships and interaction processes I conducted a qualitative research approach (Stake, 1994). A longitudinal case-study design was used to examine how firms and PROs collaborate in research alliances and the process on how social capital dimensions was developed over time to enhance fruitful collaboration between them (Yin, 2009). A multiple-case study is conducted to build relevant theory as extension to existing theoretical framework (Yin, 2009).

3.2 Case selection

The research question is examined using data collected from two research alliances in Norway; one well-established research Alliance (Alliance 1) and one emerging research Alliance (Alliance 2). To understand how the collaborative process evolves in the research alliances I draw on insight from three firms in each alliance. The research alliances is selected from a population of research centres that received support from a public support scheme (Table 1) and have both objectives related to creation of environmental innovation in collaboration with firms and PROs.

Table 1

Characteristics of the research alliances

Research alliances	Objective	Participants	Funding	Establishment
1 Well-established	Pursue environmental improvements and to increase the technological qualifications of the employees within the industry.	All firms within the business sector and their external R&D partners as participants and as hosts for each projects (mainly universities and public research organizations)	Research grants from The Research Council of Norway (30-50%) and by participation fees from member companies.	Established by the industry in 1989
2 Emerging	High international research in long-time in order to solve specific challenges in	A university, university collage or a research organization as hosts for each projects and includes firm-partners	Research grants from The research Council of Norway and by	Established by research organizations in 2009

the energy industry and new innovative solutions.	covering large parts of each branches value chain, and sometimes-other research organizations	financing from the member companies and research partners.	

The two research alliances is selected based on theoretical codes (Eisenhardt, 1989); research suggesting university-industry collaboration as driver for innovation (Dahlander and Gann, 2010). Both the research alliances support firms with aims to innovate trough long-term research and development activity in research alliances with PROs. The main differences relates to the establishment of the alliances (Table 1).

As a first step in selecting the cases I conducted initial interviews with some of the projects hosts, started with some prior personal contacts in both the alliances (Yin, 2009). This was done to secure the opportunity to collect information about the research alliances, get advises on relevant firms and research partners to contact and to get hand on the subjects that I addressed in depth in the following interviews.

3.3 Data collection

Annual reports and secondary data like evaluation reports was collected and read the in both of the studied research alliances to be prepared to the interviews and to design good questions before entering the interview process (Yin, 2009).

Table 2

Informants interviewed

Research alliances	Secondary sources	Informants interviewed		
		2011	2013-2014	Sum
1	Firm presentations	14 firms	8 firms	32
Well-established	Annual reports	4 PROs	5 firms	
		1 industry federation		
2	Annual reports	4 firms	4 firms	27
Emerging	Evaluation reports	8 PROs	8 PROs	
		2 interest organizations	1 interest organization	
		33	26	59

A research team collected the data with minimum 2 interviewers in each of the interviews. In research Alliance 1 we started as observer at a seminar arranged by the research alliance where projects was presented and discussed. Moreover, we interviewed in total 59 informants (Table 2), of which 32 represented the Alliance 1 and 27 represented the Alliance 2. The interviews

were conducted in two periods; the first were collected during 2011 with additional interviews in the period September-December 2013.

The interviews aimed to get an in-depth understanding of how the innovation process and interaction among the collaborative partners was unfolded in each of the research alliances. The research team followed semi-structured interviews to enhance a fluid rather than rigid interviewing situation (Rubin and Rubin, 2011). As an overall interviewing guide, we aimed to understand the interaction among the participant within the research alliances retrospective as it is a viable methodology (Miller et al., 1997). We started in chronological order with the background of the initiation of the research alliances, then the planning of the projects within them of which the rate of involvement and the expectation of the collaboration, and finally the experienced outcome achieved. To secure relevant information we started the interviews by expressing that we aimed to understand the process of the collaboration within the research alliances between firms and PROs. This avoided the informants to talk about technical issues beyond our understanding. In opposite way, we did not refer to theoretical concepts. When interviewing we add following up questions like "why did you do that?" "who was involved?" "How did you experienced that?" The questions was asked to motivate them to reflect on their experiences related to events that came op during the interview and to enrich our understanding on how the process of interaction in the collaboration was unique in all of the cases. We were at least two researchers conducting the interviews, and the interviews was recorded and transcribed as part of the data analysis process (Yin, 2009).

3.4 Data analysis

The analysis is based on cross-case comparison with aim to search for cross case patterns (Eisenhardt, 1989). Based on search from theoretical dimensions (Eisenhardt, 1989) from the data, critical characteristics and events that influenced how social capital was identified and developed during the collaboration between firms and PROs. First, challenges regarding the collaboration was mapped. Then, Inkpen and Tsang (2005) distinguishing between cognitive and relational social capital was followed in relation to the start, the process and in the ending of the collaboration by considering how the different level of social capital facilitated better collaboration between the partners over time and helped overcome collaboration challenges. The transcribed data was read and reared to find similarities and differences across the cases

(Yin, 2009). After analyzing propositions was developed to be tested quantitative in future research (Yin, 2009).

4.0 Results and discussion

First, the overall findings related to the firms involvement and experienced outcome in the research alliances is presented. Then, key findings regarding why some firms enables better collaboration with PROs relying on the social capital concept is presented. The findings and discussion below integrate the case findings with scholarly literature.

4.1 Firms involvement and the outcome from the research alliances

Table 2 outlines how involved the case firms are in the research alliances, their influence on working objectives and their experienced outcome of the alliance.

Table 3
Involvement, influence and outcome of the collaboration in the research alliances

Firm	Involvement	Influence	Outcome
AL1F1	The firm is very involved in the research alliance. *"We have always been involved in the [collaboration, and have become even more involved in it"* *"The [Firm] are very involved in several of the projects"*	High level of influence. *"It has been a very good process…we* have avoided conflicts about the project tasks because, I believe, the [PROs] are very pragmatic"	The firm has experienced an increase in knowledge due to the collaboration. *"The cooperation within the* [collaboration] and between the [PROs] partners]is very good and has resulted in *many important projects… from which we* have gained important knowledge" *"I have seen the value of participating in* the [collaboration] and the value of the knowledge crated in the [collaboration. We *have used it in our operations"*
AL1F2	The firm is very involved in the collaboration. *"We are very involved in the things that the [collaboration] work with"* *"We are opening up our production* plant and will therefore gain more *information"*	High level of influence. *"Yes, we* have a great influence on the *alliance"* *"We are active in stating the* premises for the objects we should *work on"* *"We clearly sets the frame of* condition for the projects"	The firm experience a high level of outcome from the collaboration and has implemented results based on the outcome of the collaborative projects. *"You exchange knowledge and come up* with new ideas which gain the project, but in the long run the firms gain benefits from *the ideas"* *"It would have been difficult, if not* impossible to solve the problems with the answers we have found together with the [PROs]"
AL1F3	The firm is very involved in all aspects of the projects within the collaboration. They initiates projects and works effectively within them. Over time the firm have became even more engaged and spend more resources to work with the collaborative projects.	High level of influence. *"We are more engaged in influencing* the project topics to assure the *relevance"* (Researcher) *"It is very important to be engaged in* an early phase to influence with our *interest"*	The firm experience a high level of outcome from the collaboration and has implemented results based on the outcome of the collaborative projects. *"We aims to be world leading in our field,* then the collaboration with the [PROs] are *very important"*

			" So if we are curious about the results of one of the R&D-projects, we assemble an industrial project where the aim is to *implement the results"*
AL2F1	Low involvement. *"We don`t prioritize using much resources into the [collaboration]"*	Low level of influence. PROs decides the working tasks. *"The initiative comes from the [PROs] and we do not have much benefit of the output"*	Experience low level of outcome form the research alliance. *"We do not have much benefit of the output"*
AL2F2	Low involvement in the beginning of collaboration. *"We didn't have the time and the resources to involved much in the [collaboration]"* Increased involvement during the collaboration. "We have understood that we have to engage more in the [collaboration], demanding, and try *to set the strategies"*	Low level of influence. PROs decides the working tasks. *"The initiative mostly comes from the PROs]"* After collaborating some time the PROs have stated that they want the firms to influence the research tasks.	The firm expected more results at the collaboration start. *"We had had wrong expectations when we entered the collaboration, we don`t get direct results, but a direction and some interesting things we can further develop"*
AL2F3	Low involvement in the beginning of the collaboration. Did not prioritize time and resources to the collaboration. Gradually, the firm got more involved as they understood that the outcome had potential to become better. *"I could have been more involved in the [collaboration], but I am not sure how much input they were searching from me…it is a possibility but it in that case, it is something I have overlooked in all my daily firm tasks"*	Low level of influence in the beginning. After some time they required more from the PROs. *"Actually, we should have been positioned to have influence…I remember I asked the [collaborative PROs] to work on a special task relevant for us. They answered that it was interesting, but had to be considered the next year. But that was never done"*	Low level of experienced outcome from the collaboration start. *"We had high expectation of the [collaboration from the beginning. It took long time before the work within the [collaboration] started and we were very frustrated. It [the collaboration] didn`t went very well"* Over time, the firm understood that they need to become more involved for achieving benefits. *"We are no "baby birds" which sits with an open throat waiting to get feed by the [PROs]. Actually, we have to do something to get use of the [collaboration]".*

A clear distinction in the two group of firms related to the involvement and the level of the output they experienced from the PRO collaboration is observed. The firms within Alliance 1 are very involved in the collaboration with the PROs and expressed high experienced outcome of the collaboration: *"We wouldn`t had* increased our knowledge so much *if it hadn't been for the collaboration"*. Several of these firms also stated that the collaboration is essential in building the industries total knowledge base: *"If we look back to the achieved knowledge the last 15 years, it is obvious that it comes from the collaboration"*. I observe that the firms within Alliance 2 do not experience high rate of outcome through the PRO collaboration as it is not given them the whished rate of innovations. *"One always get* new ideas on meetings which keeps us "awake" but it very little focus on our core activities"*

The Alliance 2 firms are not much involved in the research alliance and does not priority meeting with them: *"They doesn't show up, they don`t priori*ty using a day to come and discuss things with us and the other partners". Some of the Alliance 2 firms reasoning their low level of outcome with low level of involvement in the collaboration: *"What we gain out of it [the* collaboration] relies on our own contribution. If we manage to structure our time in such a way *that some of it contains the work with [the collaboration] we may gain much more out of it"*.

To increase the understanding on why the firms within Alliance 1 experience better outcome and are more involved in the research alliance than the firms within Alliance 2 I further explore the social capital concept.

4. 2 How firms collaborate in research alliances

How the case firms collaborate with PROs in the research alliances is explored through the development of cognitive and relational social capital over time (Table 4).

Table 4
Cognitive and relational social capital

Firms	Cognitive social capital	Relational social capital
AL1F1	The firm started with different understanding towards the PROs, but achieved better understanding and the firm experience shared goals toward them over time. *"It have been very good communication and teamwork from the beginning"* *"The cooperation with them (PROs) has worked very well, and good projects and clarifications have come out of it"*	Previous acquaintances between firms employees and some of the collaborative PROs, and over time they have got to know the PROs. *"We know the [PROs] very well"* *"Compared to other research partners and collaborations with people we do not know or have not worked with before this collaboration function very well"*
AL1F2	Common understanding and shared goals towards the collaborative PROs. *"It is not complicated talking with the researchers. We understand each other. Of course, there are some very specialized people, they are not the one we meets"* *"We have a common goal and are clear on what to examine…All of us drags in the same direction and sets the condition for the collaboration"*	The firm and the collaborative PROs knows each other very well. *"We are like a family"* *"Acquaintances are important, and to have personal relations to rely on"* *"We have close contact with them [PROs]"*
AL2F3	Common understanding and good communication towards the collaborative PROs. Sometimes mitch match in goals, but solves it trough good communication. *"We have to be very clear at an early stage on what we want to achieve towards the [PROs], to reduce the risk of letting the researchers work on things they find interesting, but which may not be interesting for us. If the working premises are based in their [the PROs] manner it is not good for none of us"* *"Usually, we have the same goals as the [PROs], regarding the development of the industry, but sometimes different long term goals and strategies to reach the goals..it depends on close interaction with the industry, and that we work on projects in accordance with the industry"*	The firm and the collaborative PROs knows each other very well. *"We have become closer and more able to communicate in a general way"* *"We know each other [talking about the PROs] very well, and that makes the collaboration easy"* *"When we needs specialized research we have people which know about our industry and about our challenges"*
AL2F1	Different goals between the firm and the PRO partners. *"The [PROs] are working to finish publications. That is good as it builds competence, but it is too little industry contact"* *"There is gap between our goals"* *"I have understanding for the [PROs] goal, but I am not sure that they understands our goal…The [PROs] have lost the industry contact"*	Acquaintances between the firm and the PROs *"I know them [the PROs] very well and know how the [PRO] system function..I have been working there for 15 years"*. *"Should have been closer contact between the firms and the [PROs] within the [research centre]"* Over time and after feedback from the industry the PROs have become more involved in engaging the firms in the collaboration. *"They [the PROs] has become much more proactive in involving the industry partners"*
AL2F2	Different understanding and bad communication in the beginning of the collaboration. After feedback from the firm, the PROs have become better: *"We have pushed the [PROs]* to be shorter when presenting, something they have improved *by becoming more "to the core""*. *"The challenge have been bad communication between us* and the [PROs],	Acquaintances between the firms and the PROs. *"The trust* has always been there, we are used to work with PROs, and *they are used to work with us"* *"We have had previous projects with them [the PROs]"*

	"The understanding have become better during the collaboration"	
AL2F3	Different goals from the beginning of the collaboration. The firms expected that the PRO should be engaged in the things the firm wanted to develop, but they were unengaged.	Some acquaintances between the firm and the PROs. Several of the firm representative in the collaboration was previous employees at the main collaborative PRO.
	*"I don`t* believe that they don`t want to have common goals as us. It is all about their ability to complete things. That is *the case for us too. It is about time"*	

4.2.1 Cognitive social capital

When mapping the firms' cognitive social capital towards collaborative PROs a clear distinction between the firms within research Alliance 1 and 2 is observed. First, looking at shared goals (Adler and Kwon, 2002) all of the firms within Alliance 2 experienced tensions related to different goals between them and the collaborating PROs. The PROs are mainly attentional on publishing, whereas the firms are driven towards short time value and innovative outcomes (Becker and Trowler, 1989). The tension between the collaborative partners is frustrating for many of the Alliance 2 firms: *"I think it is very little focus on product* development in [the collaboration]. There are mainly focus on research only for the sake of research. The focus should have been much more commercial oriented and rooted in the *industry".* This illustrates lack of common fundamental goals for the collaboration within research Alliance 2 and common understanding between them. Although the PROs mainly focus on research and publishing, some of them are conscious about the missing industry focus: *"Many* of the firms are not that interesting in the concepts [talking about research] the researchers want to use. They are interested in products they can sell and earn money on*".*

The firms within Alliance 1 is also concerned on short times outcomes like the firms within Alliance 2 but have manage to take both their own and the collaborative PROs goals in consideration when collaborating which have given them a common fundament for collaborating: *"It is important that we manage to see all the partners requirements".*

Sometimes disagreements between the firms and the PROs in Alliance 1 arises regarding the projects objectives where the firms think that the PROs are too academic oriented, like one of the firm representative quoted: *"There are some fundamental conflicts between the* industry and academia. The industry wants direct and applied results and development of the industry, whereas, the academia are more scientific oriented and have to leverage articles. There are many discussions about that, bu*t we always comes to agreement".*

Both the alliances stands towards common challenges related to the projects' objectives where the PROs and firms try to drag in somewhat different directions. However, the firms

within Alliance 1 seem to figure it out through good communication: *"Sometimes when working with them [PROs], we get unsurprisingly results and acknowledge on things we already knows. Then we see the potential to become better..and we have to turn them [the PROs] towards better result orientation"*, and *"We are always seen and heard by the [PROs]"*. Although there sometimes is tension between the firms and the PROs, the Alliance 1 firms seem to understand the importance of collaborating within the research alliance: *"Industry and research are like a symbiosis which is mutually dependent. We just have to find solutions through dialog"*.

The firms and the PROs within Alliance 2 seem to lack the fundamental understanding for each other, which often leads to the PROs decides what to work with in the research alliance. I argue that the understanding might have been increased if the Alliance 2 firm were more involved in the collaboration from the beginning (Table 2). In addition, if the PROs invited the firms more into the collaboration. Hence, too little firm involvement leads to lack of cognitive social capital, which in turn makes it harder and timely to develop new innovations in the research alliance, rather than for research alliances that have built cognitive social capital. However, after collaborating a period the understanding have become better when the Alliance 2 firms understood that they had to involve more in the research alliance and give the PROs clear feedback: *"We [the firm] have pushed them hard which they have taken into account…They have become better, and more to the core"*.

Another aspect of cognitive social capital is related to common culture (shared rules and norms) (Inkpen and Tsang, 2005). Both groups of firms have different cultures towards their collaborative PROs, where the main difference is related to different planning horizons perspectives. The firms have short time perspectives and need to handle quickly on operating activities, whereas the PROs have a long-term perspective and not seeking much for exploitations as the firms. It seems, however, like the Alliance 1 firms are more aware of the differences between them and the collaborative PROs than the Alliance 2 firms, which helps the firms to know how they can board the PROs in a direction serving the firms` interests.

In sum, the firms within Alliance 1 have more cognitive social capital towards the PROs compared with the firms in Alliance 2. It is not surprisingly taking into account the amount of time the research Alliance 1 has existed. However, the firms within Alliance 2 have over the time achieved more understanding about the nature of the collaboration within the research alliance (Bruneel et al., 2010), and thus, achieved higher cognitive social capital towards PROs. Although the Alliance 2 firms have developed a better level of collaboration with the PROs over time, they might learn from the success of the firms within Alliance 1 by focus on building cognitive social capital at a greater level. It would be nearly impossible to achieve common

goals and cultures between firms and PROs because of fundamental organizational differences, but increased consciousness about each other goals and cultures as the firms within Alliance 1 have managed, it will help the firms within Alliance 1 to build a more viable and fruitful collaboration with the PROs over time. Thus, I propose:

> Proposition 1: Firms with higher level of cognitive social capital towards PROs are better able to mitigate challenges in research alliances compared to firms with lower level cognitive social capital.

> Proposition 2: Higher level of involvement in a research alliance increases firms' cognitive social capital towards PROs and thereby increases the outcome of the research alliance compared to firms with lower level of involvement.

4.2.2 Relational social capital

All of the firms within Alliance 1 have personal relations to the collaborating PROs, which rooted in old acquaintances like time of studying or previous employments. Several of the PRO representatives have worked in the industry before and many of the firm representatives involved in the research alliance have worked as researchers before. A contributing factor for the personal closeness might be that this industry is a relatively small group in Norway where many of the people know each other, as a PRO partner stated: *"At some point in time, we have all been either classmates or colleagues.* During a long-standing close contact between the collaborating partners in Alliance 1, the firms and the PROs have managed to build trust and openness to each other over time *"We trust each other"*. Through the high level of trust and openness, this group of firms manages to overcome barriers related to communication with the PROs. If they run into misunderstandings or conflicting ideas related to working tasks, the firms within Alliance 1 mange to solve it quickly: *"It is easier to come to agreements when we know* each other and have worked together for y*ears"*. This evidence clearly shows that collaborative challenges is decreased through previous collaboration (Lhuillery and Pfister, 2009).

The firms within Alliance 2 have some level of prior contacts before starting collaborating with the PROs but have not manage yet to achieve the closeness to the collaborative PROs as the Alliance 1 firms. Some of the Alliance 2 firms experiences low level of trust towards the collaborative PROs, as stated by one of them: The [PRO] need to do *something to build trust towards their partners"*. A risk of low level of trust may be that the

Alliance 2 firms lack important knowledge on how to make the research alliance successful (Inkpen and Tsang, 2005). It is likely that because of low involvement in the collaboration from the Alliance 2 firms' side they are unable to achieve trustful personal relations to the PROs. The Alliance 1 firms are more committed to the collaboration and invests many resources into collaboration in the research alliance (Table 4), whereas the firms within Alliance 2 do not invest enough resources into the collaboration. A reason for this difference may be that the firms within Alliance 1 are active and sets the framework conditions for the projects they should work on. As having close personal relations to the PROs, the Alliance 1 firms seem to know how they should get influence on their interests: *"They* [the PROs] know we end the collaboration if they don`t attention on our interests*"*. The Alliance 2 firms have fewer opportunities to set the framework conditions for the research alliance as the PROs have already stated the overall working tasks before starting the collaboration. By building relational social capital towards PROs the Alliance 2 firms might increase their ability to influence the objectives of collaboration.

Moreover, low involvement of the firms before the collaboration may turn into expectation tensions as observed in several of the Alliance 2 firms (Bruneel et al., 2010). These firms expected short-term innovation outcome, whereas the PROs had a long-term orientation: *"*Our and the [PROs] expectations have been somewhat different. I had expected more directly flows of results from the [collaboration]*"*. The Alliance 1 firm have built very high level of relational social capital towards the PROs over time, which have taught them what to expect from the collaboration. *"A* large part of the R&D results are impossible to implement. The importance of these results is that they build knowledge, which, again, can generate good *ideas"*. Through relational social capital over time, the Alliance 1 firms have obtained the knowledge needed to be able to take both their own and the PROs interests in account (Bjerregaard, 2010). The Alliance 2 firms and the PROs might need to strengthen their relational social capital to understand each of the collaborative partners' expectations, and thus, frame working objects that meets both the firms` and the PROs' expectations in best way. Following that argument the PROs should take a role in building trust towards the firms very early in the collaboration through involving the firms more and take their needs in consideration. Moreover, they should highly communicate to the firm partners what a research alliance is and how it will be run. In sum, increasing relational social capital may prevent the PROs to only focus on their long-term goals, and reduce the risk of opportunism behavior (Putnam, 1993). Thus, I propose:

Proposition 3: Firms with higher levels of relational social capital towards PROs experience less opportunistic behavior from PROs in research alliances compared to firms with lower level of relational social capital.

Proposition 4: Higher level of initial relational social capital help firms influencing the objectives of projects in research alliances and thereby reduces the collaborative challenges compared to firms with lower level of relational social capital.

Proposition 5: Higher level of involvement in a research alliance increases firms' relational social capital towards PROs and thereby increases the outcome of the collaboration compared to firms with lower level of involvement.

4.2.3 Interplay of the social capital dimensions

When looking at interplay between dimensions of social capital there is found an interdependency between shared understanding and language (cognitive social capital) and personal relations (relational social capital) (Ashforth and Mael, 1996). However, more studies on the interplay between different dimensions of social capital has been called for (Rass et al., 2013, Lee, 2009). The firms within Alliance 1 have built cognitive social capital towards the PROs through relational social capital during the collaboration. Through trustful relations towards their collaborative partners the Alliance 1 firms have over time mange to achieve more common understanding about the working objectives within the research alliance and thereby increased the outcome from the research alliance. Some of the Alliance 2 firm started with lower level of relational social capital, but they have managed to increase the level of relational social capital towards the PROs when they have become more involved in the research alliance.

Over time, some of the PROs in Alliance 2 acknowledge that they had to interact more with the collaborative firms: *"You have to interact with the industry in practice, not just write the things to do on a paper. You must simply pick up the phone and be in regular contact with them [the firms]"*. When the firms and the PROs have become more known the firms have seen the value of involvement and that it helps them to sets the framework conditions for the collaboration: *"Over time, we have understood it…especially after the midterm evaluation, that we have to engage more in the [research alliance] to influence the strategy"*. Some of the firms in Alliance 2 started with trustful relation, and thereby built common understanding over time: *"The trust have always been there, but the understanding on how to collaborate have become*

16

better over time". Another representative from an Alliance 2 firm stated that: *"The process which runs at this time is more prudent in ensuring the firms requirements"*. I thus argue that interaction among firms and PROs is fundamental in building cognitive social capital over time in research alliances.

Moreover, when firms agree on the collaborative fundament and have shared goals and expectations of the research alliances objectives, like the Alliance 1 firms do, it is easier to develop relational social capital. The Alliance 2 firms and the PROs had different goals from entering the collaboration that made it difficult for them to engage more in the research alliance. Over time when the Alliance 2 firms become more engaged in the research alliance, they were also more able to interact with the collaborative PROs and thus increased the relational social capital. It is likely that lack in both cognitive and relational social capital is a reason why some firms in Alliance 2 have dropped out of the research alliance. Hence, firms should build at least one of the social capital dimensions to further develop the next dimension and thereby the likelihood for mitigating challenges and achieving fruitful collaboration within research alliances increases. I thus propose:

Proposition 6: Firm with higher level of initial relational social capital are more able to develop cognitive social capital towards PROs in research alliances over time compared to firms with lower level of initial relational social capital.

Proposition 7: Firm with higher level of initial cognitive social capital are more able to develop relational social capital towards PROs in research alliances over time compared to firms with lower level of initial cognitive social capital.

Proposition 8: Firms with either cognitive social capital or relational social capital are more able to develop fruitful collaboration with PROs in research alliances compared to firms that lack both these social capital dimensions in the beginning of the collaboration.

5.0 Conclusion and implications

This study is a novel attempt to reveal how firms and PROs achieve trustful collaboration in research alliances. As such I extend university-industry research by taking the cognitive and relational social capital perspective to explore how firms can mitigate tensions

and collaborate well with PROs in research alliances, which previous studies have been calling for (Spithoven et al., 2010, Hall et al., 2001). By studying two research alliances, I developed propositions outlining the importance of building cognitive and relational social capital between firms and PROs early in the collaboration. Common goals and understanding about the collaboration as well as creation of personal relations between firms and PROs at the starting point will lead to better collaboration performance over time. The firms within the well-established research alliance manage to overcome tensions towards PROs because of common understanding and good communication built through long-standing close relationships. These firms engage in an open dialog with the collaborative PROs characterized by high level of trust and shared understanding. My data therefore confirm the assumption of commitment, previous collaborative links, effective communication and trust as influencing the success of university-industry collaboration (Mora-Valentin et al., 2004).

However, my key contributions are linked to the interplay between the dimensions of social capital which is poorly understood (Rass et al., 2013). Cognitive social capital leverage relational social capital as it is easier to create personal relations between firms and PROs when they agree on the collaborative fundament. Contrary, relational social capital plays a role in building cognitive social capital for firms lacking common understanding and goals towards collaborative PROs. The way of reaching common understanding and shared goals towards collaborative PROs was clearly depended from the level of relational social capital. This has important implications for firms collaborating with PROs, illustrating that at least one of the social capital dimensions should be developed when entering the collaboration. Thus, contradicting previous findings which have found relational social capital as the strongest driver for inter-organizational collaboration (Van Wijk et al., 2008), this study observes that cognitive social capital act as an equal strong driver. However, my study shed light on various functions of cognitive and relational social capital. Cognitive social capital function as a facilitator for increased shared understanding and goals between firms and PROs, whilst relational social capital function as an interaction facilitator important to achieve trustful relations. Hence, cognitive and relational social capital in university-industry collaboration might be seen as a way to overcome collaborative challenges and enhance fruitful collaboration with PROs over time.

5.1 Limitations and implications for further research

Although the findings on research alliances might be transferable to other research alliances, one cannot argue that they are valid for all. Future research should test my findings using larger samples to explore whether my findings are transferrable to other research alliances. The research alliances I study collaborate mainly on environmental research projects. Future research should include research alliances collaborating on other issues, to explore whether and how the context is affecting the collaborative process. Moreover, I see a need for future research to study collaborative processes in research alliances over time in similar stage of development.

5.2 Implications

My findings indicates that firms should build cognitive and relational social capital towards collaborative PROs to enhance viable and fruitful collaboration in research alliances have important implications for the development of policy as well as for the firms. At the policy level, the most important implication is the need to engage firm partners early in the phase of establishing research alliances trough firm-partner involvement as a policy requirement. The policies should be formulated to include a preliminary project where partners from the industry and PROs sets the condition of framework for the collaboration to ensure common understanding and shared goals before entering the collaboration. An alternative solution might be that the deadline of applications should be expanded. A preliminary project or expanded applications date may lead to better firm influence on the project topics within research alliances and prevent firms to drop out because of low industry focus.

Moreover, the PRO partners should be motivated by the government to act proactive regarding contact with firm-partners as it will foster personal relations and trust necessary for long-term effectively collaboration within research alliances. As this study shows the timely process of develop effectively collaboration between partners within research alliances; the policy makers should design public support research projects with a long-term orientation, and show public patience related to development of new technologies. Further, my study implicates that the government should clarify how they define expected innovations from public research projects, and specify that the outcomes could be either incremental or radical. It may reduce expectation tensions between the collaborative partners. Following that argument, I suggests that there should be different partners hosting research projects depending of the projects aim.

19

When the aim is development of incremental innovations, firm-partner should be hosting the research projects, as they are more concerned on applied research and it will stimulates them to become more involved in the projects. Where the aim is radical innovation development, PROs should be hosting the projects, as they are more concerned on basic research.

On the firm level, my study implicates that the firms' need to understand how to manage their social relationships towards collaborative PROs in order to achieve benefits from participating within research alliances. Firms should develop personal relations and common understanding towards PROs by active engaging in research alliances from entering the collaboration. Although it would be a costly strategy by high involvement within research alliances, firms likely will acquire larger benefits on invested resources over time in line with their interest.

References

ADLER, P. S. & KWON, S.-W. 2002. Social Capital: Prospects for a New Concept. *The Academy of Management Review,* 27**,** 17-40.

AMBOS, T. C., MÄKELÄ, K., BIRKINSHAW, J. & D'ESTE, P. 2008. When Does University Research Get Commercialized? Creating Ambidexterity in Research Institutions. *Journal of Management Studies,* 45**,** 1424-1447.

ASHFORTH, B. E. & MAEL, F. A. 1996. Organizational identity and strategy as a context for the individual. *Advances in Strategic Management,* 13**,** 19-64.

BECKER, T. & TROWLER, P. R. 1989. Academic tribes and territories: Intellectual inquiry and the culture of disciplines. *UK*.

BJERREGAARD, T. 2010. Industry and academia in convergence: micro-institutional dimensions of R&D collaboration. *Technovation,* 30**,** 100-108.

BRUNEEL, J., D'ESTE, P. & SALTER, A. 2010. Investigating the factors that diminish the barriers to university–industry collaboration. *Research Policy,* 39**,** 858-868.

CICOUREL, A. V. 1974. Cognitive sociology: Language and meaning in social interaction.

COWAN, R., JONARD, N. & ZIMMERMANN, J.-B. 2007. Bilateral collaboration and the emergence of innovation networks. *Management Science,* 53**,** 1051-1067.

DAHLANDER, L. & GANN, D. M. 2010. How open is innovation? *Research Policy,* 39**,** 699-709.

EISENHARDT, K. M. 1989. Building Theories from Case Study Research. *The Academy of Management Review,* 14**,** 532-550.

FANG, S.-R., CHANG, Y.-S. & PENG, Y.-C. 2011. Dark side of relationships: A tensions-based view. *Industrial Marketing Management,* 40**,** 774-784.

GRANOVETTER, M. 1992. Problems of explanation in economic sociology. *Networks and organizations: Structure, form and action***,** 25-56.

HAGEDOORN, J. & SCHAKENRAAD, J. 1994. The effect of strategic technology alliances on company performance. *Strategic management journal,* 15**,** 291-309.

HALL, B. H., LINK, A. N. & SCOTT, J. T. 2001. Barriers inhibiting industry from partnering with universities: evidence from the advanced technology program. *The Journal of Technology Transfer,* 26**,** 87-98.

HOWELLS, J., RAMLOGAN, R. & CHENG, S.-L. 2012. Innovation and university collaboration: paradox and complexity within the knowledge economy. *Cambridge Journal of Economics,* 36**,** 703-721.

HULT, G. T. M., KETCHEN, D. J. & SLATER, S. F. 2004. Information processing, knowledge development, and strategic supply chain performance. *Academy of Management Journal,* 47**,** 241-253.

INKPEN, A. C. & TSANG, E. W. K. 2005. Social Capital, Networks, and Knowledge Transfer. *The Academy of Management Review,* 30**,** 146-165.

LEE, R. 2009. Social capital and business and management: Setting a research agenda. *International Journal of Management Reviews,* 11**,** 247-273.

LHUILLERY, S. & PFISTER, E. 2009. R&D cooperation and failures in innovation projects: Empirical evidence from French CIS data. *Research Policy,* 38**,** 45-57.

LIND, F., STYHRE, A. & AABOEN, L. 2013. Exploring university-industry collaboration in research centres. *European Journal of Innovation Management,* 16**,** 70-91.

MASIELLO, B., IZZO, F. & CANORO, C. 2013. The structural, relational and cognitive configuration of innovation networks between SMEs and public research organisations. *International Small Business Journal*.

MILLER, C. C., CARDINAL, L. B. & GLICK, W. H. 1997. Retrospective reports in organizational research: A reexamination of recent evidence. *Academy of management journal,* 40**,** 189-204.

MONTEVERDE, K. 1995. *Applying resource-based strategic analysis: Making the model more accessible to practitioners*.

MORA-VALENTIN, E. M., MONTORO-SANCHEZ, A. & GUERRAS-MARTIN, L. A. 2004. Determining factors in the success of R&D cooperative agreements between firms and research organizations. *Research Policy,* 33**,** 17-40.

NAHAPIET, J. & GHOSHAL, S. 1998. Social Capital, Intellectual Capital, and the Organizational Advantage. *The Academy of Management Review,* 23**,** 242-266.

ORR, J. E. 1990. Sharing knowledge, celebrating identity: Community memory in a service culture. *Collective remembering,* 169**,** 189.

PETRUZZELLI, A. M. 2011. The impact of technological relatedness, prior ties, and geographical distance on university–industry collaborations: A joint-patent analysis. *Technovation,* 31**,** 309-319.

PUTNAM, R. D. 1993. The prosperous community. *The american prospect,* 4**,** 35-42.

RASS, M., DUMBACH, M., DANZINGER, F., BULLINGER, A. C. & MOESLEIN, K. M. 2013. Open Innovation and Firm Performance: The Mediating Role of Social Capital. *Creativity and Innovation Management,* 22**,** 177-194.

RUBIN, H. J. & RUBIN, I. S. 2011. *Qualitative interviewing: The art of hearing data*, Sage.

SMITH, P. 2012. Where is practice in inter-organizational R&D research? A literature review. *The Journal of the Iberoamerican Academy of Management,* 10**,** 43-63.

SPITHOVEN, A., CLARYSSE, B. & KNOCKAERT, M. 2010. Building absorptive capacity to organise inbound open innovation in traditional industries. *Technovation,* 30**,** 130-141.

SPITHOVEN, A., CLARYSSE, B. & KNOCKAERT, M. 2011. Building absorptive capacity to organise inbound open innovation in traditional industries. *Technovation,* 31**,** 10-21.

STAKE, R. E. 1994. Case Studies. *In:* DENZIN, N. K. L., Y. S (ed.) *Handbook of Qualitative Research.* Thousand Oaks SAGE Publications.

TSAI, W. 2000. Social Capital, Strategic Relatedness and the Formation of Intraorganizational Linkages. *Strategic Management Journal,* 21**,** 925-939.

VAN WIJK, R., JANSEN, J. J. P. & LYLES, M. A. 2008. Inter- and Intra-Organizational Knowledge Transfer: A Meta-Analytic Review and Assessment of its Antecedents and Consequences. *Journal of Management Studies,* 45**,** 830-853.

YIN, R. K. 2009. *Case Study Research - Design and Methods*, Sage Publications.

YLI-RENKO, H., AUTIO, E. & SAPIENZA, H. J. 2001. Social capital, knowledge acquisition, and knowledge exploitation in young technology-based firms. *Strategic management journal,* 22**,** 587-613.

ZAHRA, S. A. & GEORGE, G. 2002. Absorptive Capacity: A Review, Reconceptualization, and Extension. *The Academy of Management Review,* 27**,** 185-203.