9 July 2011

Supporting Virtual Research Teams - How Social Network Sites Could Contribute To The Emergence Of Necessary Social Capital

Daniel Richter
University of Munster, daniel.richter@ercis.de

SUPPORTING VIRTUAL RESEARCH TEAMS – HOW SOCIAL NETWORK SITES COULD CONTRIBUTE TO THE EMERGENCE OF NECESSARY SOCIAL CAPITAL

Daniel Richter, Department of Information Systems, University of Münster, Münster, Germany, daniel.richter@ercis.de

Abstract

Virtual Teams in enterprise contexts have been well researched. However when concerned with scientific research studies often focus on a macro level ignoring the individual perspective of scholars. I report in this paper on observations made in two case studies on research collaboration, one concentrated on a large research network and one on the situated context of IS scholars involved in collaboration. I find that the characteristics of virtual work in enterprise and academic contexts differ notably. Whereas literature on virtual teams in enterprise contexts proclaim a strong need for the support of relational and cognitive Social Capital, in academic contexts rather structural Social Capital seems to be missing. I further propose to consider Social Network Sites as a tool to support research collaboration, as this IT-artefact seems to positively affect the emergence and maintenance of structural Social Capital.

Keywords: Research collaboration, Social Capital, Social Network Sites.

1 INTRODUCTION

In the past decade we have observed a profound transformation of the organisation and practices of research: most obvious modern science is increasingly collaborative (Olson et al., 2008). Multiple indicators can be used to substantiate this. Most outstanding among these is the increasing dominance of co-author over single author publications (Glänzel, 2002; Wuchty et al., 2007). Similarly the proportion of scientific papers with international co-authors has increased (Olson et al., 2008), signifying the widespread diffusion of a collaborative culture. Olson et. al. (2008) list a number of reasons for this development: the urgency, complexity and scope of unsolved scientific problems; the need for access to new, and often expensive, research instruments and technologies; pressure from funding agencies; and information and communication technologies (ICTs) that facilitate interaction and sharing of knowledge. Despite the strong trend towards it, research collaboration should not be misunderstood as a success story yet. For example, most attempts by funding agencies to foster the creation of larger collaboration networks seem to fail. An example for this are the Networks of Excellence funded in the 6th Framework Programme of the European Commission (Bonaccorsi et al., 2008). Such collaborations experience tension from the pressure of sheer distance between educational institutions and different ways in which they are organised, their faculties rewarded and their disciplines structured (Metzger, 1999). Cummings & Kiesler (2008) identify a strong negative correlation between the number of institutes involved in a collaboration and the report of positive outcomes, with more institutes involved reducing outcomes significantly. Likewise, proximity is still a strong indicator for scientific success (Ponds et al., 2007) further indicating the problematic nature of distributed research endeavours. Increased mobility is a potential means to support even distant collaboration. However this requires extended funding, which is often not available. Consequently mostly virtual collaboration takes place. This can be compared to virtual work in enterprise contexts. Virtual work in both contexts can be described as knowledge intensive and collaboration depends on the creation of common grounds first.

Hence, these collaborations depend on the mediating potential of ICT. But until now, ICT support has not created the expected benefits. This – as could be shown in enterprise contexts (Riemer & Klein, 2008) – partly is caused by the limited potential of ICT to create a rich communication environment, but most likely also has to be attributed to the absence of a clear strategy on how ICT can mediate between scholars. Up to now little effort has been made to understand the specifics of virtual teams in academic contexts. Only in enterprise contexts a good understanding of virtual teams was created (e.g. Ciborra & Suetens, 1996; Orlikowski, 2002). Scholars argue that support for the emergence of necessary social structures is needed by such virtual teams (Riemer & Klein, 2008). Lately Social Software tools, like Wikis, Blogs and Social Network Sites (SNSs), are introduced in order to amend the problems of virtual work in enterprise contexts (McAfee, 2006). Especially SNSs thereby seem to have a high potential for supporting the emergence and maintenance of the necessary social structures (Steinfield et al., 2009). It is, however, not clear whether similar conclusions can be drawn for the academic and the enterprise context.

In this paper I present observations made in two independent case studies investigating research collaboration. I intend to characterise virtual teams in academic context in order to discuss the potential of SNSs for supporting them. Beyond that I will point out differences and similarities to virtual teams in enterprise contexts. With the latter I want to emphasise the need for additional research on virtual teams in academic contexts and that – even though I thing that the usage of Social Software bears benefits in academic contexts – findings from the discussion on Enterprise 2.0 cannot easily be transferred to academic contexts. In the first case study, we have investigated collaboration in an EU funded network of excellence, in which 42 partner universities collaborated over five years. In the second case study, the situated context of IS scholars involved in collaborative research was at scrutiny. In both cases evidence was found for specific needs of virtual teams in an academic context, for the support of social structures. Surprisingly these needs are fundamentally different from that of virtual teams in enterprise contexts. Whereas in enterprise contexts the creation of group structures allowing for smooth collaboration are most problematic (Riemer & Klein, 2008). According to the presented observations this seems to be far less of a problem in academic contexts. However a lack of

knowledge on the social network of potential collaborators seems to hinder already the initiation of virtual teams. I will draw on Social Capital Theory in order to conceptualise these observations. Furthermore, I will discuss the potential of SNSs for supporting virtual teams and match these potentials with the specific needs of virtual teams in academic contexts.

The paper proceeds as follows. In chapter two I begin by introducing relevant terms and the research methodology. In chapter three I provide an overview of the most important observations from both case studies. I will then discuss these observations against the backdrop of the current body of knowledge in chapter four. I present two sets of proposition that structure my discussion, one hypothesising on the needs of virtual teams in academic contexts towards Social Capital and one on the potential role of SNSs. I end with a short summary.

2 STUDY OVERVIEW

2.1 Research Collaboration

Scientific knowledge production has been changing over the last two decades. Besides the notion of increased collaboration (Olson et al., 2008), authors proclaim a stronger orientation towards strategic goals (Irvine & Martin, 1984) and the production of relevant knowledge (Gibbons, 1994) as discriminators of modern science. Scholars have tried to conceptualise the change scientific knowledge production is undergoing, with the most prominent concept probably being "Mode 2" knowledge production (Hessels & Van Lente, 2008). "Mode 2" knowledge production, as introduced by Gibbons (1994), is characterised by taking place in a context of application, transdisciplinarity, heterogeneity and organisational diversity as well as novel forms of quality control. However, a notable amount of critique exists towards "Mode 2" as well as its alternatives (e.g. Finalisation science or Post-normal science), most claiming a missing empirical foundation (Hessels & Van Lente, 2008; van Rijnsoever et al., 2008). A general understanding of the change that scientific knowledge creation is undergoing is still missing. When taking a look at current research articles in the field (e.g. by means of the literature review by Soeldner et al., 2010 or Bukvova, 2010) it becomes obvious that, despite an extensive number of publications, research on scientific collaboration is fragmented and often carried out as a macro level analysis (Soeldner et al., 2010; van Rijnsoever et al., 2008). Research seems to concentrate on conceptualising as well as analysing existing forms of institutionalised collaboration (Soeldner et al., 2010), vastly ignoring its emergence and the role of the individual scholar (van Rijnsoever et al., 2008). Especially the role of social structures in the emergence of collaborative research activities seems to be ignored.

2.2 Social Capital Theory

The term Social Capital is defined differently in its various fields of application. The mutual basis in all definitions is that Social Capital describes the value of social relationships for actors in reaching certain goals (Coleman, 1988; Lin, 2001). Individuals depend on Social Capital embodied in the relations and social networks they are involved in, as the basis of social interactions with other individuals and moreover for accessing resources not otherwise accessible. Hence one important factor of Social Capital is the number and strength of the social ties of an individual, i.e. their social network. This social network is the result of individual as well as collective investments in the social relations (Bourdieu, 1983). These can be conscious, dedicated investments, but especially for creating close bonding with other individuals (rich-type Social Capital) unconscious investments, in terms of genuine interest and multiple social encounters, are necessary (Riemer, 2005).

Dimension	Structural	Relational	Cognitive
Comprise:	Social relationship, Network density (group closure)	Trust, Norms, Obligations (reciprocity)	Social shared cognition, Collective goal orientation
Provide:	Opportunity	Motivation, Willingness	Ability

Table 1.   Dimensions of Social Capital (cf. Nahapiet & Ghoshal, 1998; Riemer, 2005)

Nahapiet and Goshal (1998) differentiate between three dimensions concerning different elements of Social Capital, a structural, a relational and a cognitive dimension (cf. Table 1). These can be understood as building blocks necessary for successful collaboration. First an individual needs to know potential collaborators and their area of expertise (structural level). Second individuals need to have the will to collaborate, for example created by trust and shared norms (relational level). Finally the individuals need to share a common wording that enables them to discuss even on a complex topic (cognitive level). Moreover when being interpreted on the network level, Social Capital can firstly be seen as bridging social capital, where individuals inhibit a prominent position in a network (Burt, 1992). This position, also called broker position, allows individuals to bridge between parts of the network (e.g. mediation of contact between strangers). Secondly Social Capital can be seen as bonding Social Capital, which ties together a group on the basis of trust or social norms (Coleman, 1990).

2.3   Social Network Sites

Boyd and Ellison define SNSs as "web-based services that allow individuals to (1) construct a public or semi-public profile within a bounded system, (2) articulate a list of other users with whom they share a connection, and (3) view and traverse their list of connections and those made by others within the system. The nature and nomenclature of these connections may vary from site to site" (Boyd & Ellison, 2007). Typical examples for such sites are Facebook, MySpace, XING, StudiVZ etc. Please note that some have criticized this definition as being too broad (Beer, 2008), since it might include web sites that feature the above characteristics in addition to different sets of core features. Examples of web sites that exhibit certain SNS features, but are not strictly SNSs are Youtube, Twitter or Flickr. In this paper however, I refer to SNSs as services that have the facilitation of social networking as their core purpose. SNSs are utilized by individuals in various contexts of application for the maintenance of social relationships. Starting with University and High school students as the early adopters (c.f. Lenhart & Madden, 2007), SNSs are today used by a wide audience and in a diverse set of contexts including recruiting (c.f. Thew, 2008), the facilitation of social relation between co-workers (c.f. Steinfield et al., 2009), marketing (c.f. Richter & Schäfermeyer, 2011) or communication on a certain topic (c.f. case on a SNSs for Bodybuilder in Ploderer et al., 2008), among others. Studies have found that SNSs can through such usage positively influence the Social Capital of an individual (e.g. Richter et al., 2010; Steinfield et al., 2008). I will further elaborate on this in chapter four.

2.4   Methodology

I present interpretive research and hence will derive plausible explanations in the form of propositions, which might in future studies be used to form testable hypotheses. Consequently, my research does not aim to present results that are generalizable in a statistical sense, but to generalise in a theoretical sense: from data about phenomena to general explanations of the phenomena in the form of propositions. Such generalisation is typical for qualitative research (Mason, 2002), and the aim ultimately is to ensure plausibility and transferability of results (Bryman & Bell, 2007). Input to my research are the findings of two independent case studies (cf. Table 2) investigating research collaboration in an EU sponsored Network of Excellence (NoE) and the situated context of IS scholars engaged in collaboration. Both case studies have in parts already been published elsewhere (Richter, 2011; Riemer et al., 2008). I report here on observations concerning the characteristics of virtual teams in academic contexts towards the need for Social Capital. Thus I utilize the case studies to derive an understanding of how scholars form virtual teams for the purpose of collaboration, e.g. on a paper. Based on this understanding I reason how the use of SNSs could support the emergence of social structures fostering collaboration. The usage of Social Software and SNSs in particular is intensively discussed in connection to enterprise contexts. Thus I differentiate virtual teams in academic and enterprise contexts in order to emphasis on the need for a separated discussion of the potentials of Social Software in academic contexts. Beyond that I want to, however, point out were similarities exist that such research could build on.

The political science NoE Garnet consisted of 42 research institutes from 17 European countries and was active between 2005 and 2010. It was organised in nine work packages, in the first of which I was responsible for the development and introduction of the collaboration platform. Generally, the NoE aimed at increasing the communication between its members by financing visits, conferences and collaborative publications. The core element of the collaboration platform used is a knowledge management system in which information resources are organised in tree-like structures. Furthermore, chat rooms, newsgroups and wikis are provided by the system for communication purposes. Extended user profiles and search functionality allows the built-up of an expert database and several tools are available for organising the process of information generation, such as a messaging and a calendar system. We conducted a Log File Analysis and a Social Network Analysis in order to analyse the intensity of collaboration and the connectedness of scholars engaged in Garnet (Riemer et al., 2008). Our findings indicated a lack of collaborative activity within the Garnet network as well as a misfit between the existing network structures, the resulting requirements for supporting inter-personal processes in the network, and the positioning of the platform. To elaborate on the individual reasons for the observed inefficiencies, I conducted guided interviews with twelve members of Garnet (three senior scholars, six Ph.D. and post-doctoral students and three coordinators). I first asked the participants how they perceived collaboration within Garnet in general concerning intensity and outcome. Further I asked for the role of the participant in the project and also how and how often they used the collaboration platform. Finally I asked for their experience with e-collaboration outside Garnet, with a focus on the perceived benefits and problems. The interviews have been transcribed and qualitatively coded. The case Garnet poses ample possibilities for reflecting on scholarly practices – e.g. the influence of funding regulations on the formation of project consortia – such discussion is, however, not in the focus of this paper and left to further research.

	Case A	Case B
Subject of analysis	Closed research project including 42 partners from 17 countries	Single scholars
Disciplin	Political Science	Information System Science
Research Methods	Log File Analysis Social Network Analysis Guided Interviews	Open Interviews
Interview question blocks	Collaboration within Garnet Role within Garnet Collaboration platform E-collaboration outside Garnet	Professional history Contexts of interaction Usage of tools in these contexts Different types of contacts Social software

Table 2.   Overview of the two cases

In the second case study, I conducted nine open interviews with IS scholars in order to develop an initial understanding of the situated contexts of IS scholars engaged in collaborative research (Richter, 2011). I started by asking for the professional career of the scholar in order to be able to suitably interpret the later statements. In the main part of the interview, I asked for contexts of interaction and collaboration with other scholars, tools that are used therein, and practices of usage. Further topics were the differentiation of various types of contacts and the general usage of tools, especially Social Software. My interview participants were three Ph.D. and post-doctoral students, three early stage scholars (a Senior Lecturer, an Associate Professor, and a full Professor with less than five years work experience) and three senior scholars. I chose this constellation in order to get an overview on the development of scholarly collaboration over time. The interviews have been transcribed and qualitatively coded.

3 PRESENTATION OF RESULTS

3.1 Case 1: The Garnet Network of Excellence

I will start by briefly sketching the main results from the Log File and the Social Network Analysis (for a detailed description see Riemer et al., 2008). I will then give a detailed description of the insight gained from the guided interviews.

The Log File Analysis revealed little usage of the collaboration platform for the purpose of research collaboration. The platform is used intensively; however usage seems to concentrate on organisational tasks, such as reporting and similar. Likewise, the communication functionalities are seldom used. These observations match those from the Social Network Analysis: The analysis of the social structures reveals that only few individuals in the network are well connected and hence have the necessary social influence and access to resources that is necessary to work efficiently. Further analysis leads us to single out the following three findings, which are suitable for explaining the reasons for the lack of observed collaboration:

1) Only few individuals in the network are well enough connected to initiate new cooperation.

2) Only one third of the scientists in Garnet are connected in a way that makes them member of a scientific cooperation of three or more individuals.

3) Young scientists (Ph.D. and post-doctoral students) are generally only poorly connected.

(1) Initiation of new cooperation can generally be done in two ways: Either one or more of the future cooperation partners initiate the contact (internal initiation) or an outside person triggers the cooperation without further participation (external initiation). For internal initiation of new cooperation, a high direct social influence (i.e. many direct relationships to other individuals) is necessary as the future cooperation partners need to know each other. At least this needs to be true for one of them. However, we found the potential for internal initiation to be low for most individuals.[1] The network mainly seems to depend on a handful of mediators to externally initiate new cooperation. Moreover, we found that only about four per cent of the individuals to have a high potential for external mediation with 94% having very little to none.[2] We conclude that the structure of the Garnet social network neither holds significant potential for internal nor for external initiation of new cooperation.

(2) Not surprisingly, the low potential for creating new cooperation is reflected in the number of existing ones. We could identify eleven cliques of three to four members that qualify as a collaboration group. However, only two of the identified cliques qualify as virtual teams as their members are geographically distributed.

(3) The social network observed is in general characterized by a relativeley low number of relationships, with the network of junior faculties being even less densely connected. Hence, junior faculty members seem to have a very low potential for initiating cooperation.

Consequently, the observations from both analyses lead us to the conclusion that collaboration on an individual level takes place within Garnet to a very limited degree only. This is further signified by a low ratio of co-authored publications that were created in the project. For example, only close to 15% of the working papers (main format for publications in Garnet) are co-authored. From the guided interviews I found the specific reasons for the observed lack of collaboration to be manifold. Three areas of explanation however did stand out:

1) Project and Platform design do not harmonise with the cultural properties of the discipline.

2) Usage of a project specific platform for collaborative work is unlikely.

---

[1] Based on an analysis of the outdegree of degree centrality (c.f. Breiger 2003; Friedkin 1991).
[2] Based on an analysis of the betweeness centrality (c.f. Friedkin 1991).

3) Not the collaboration itself, but the initiation of collaboration warrants attention.

(1) Garnet was concerned with matters of political science mostly. Based on the statements of my interview participants in political science, single author papers seem to be much more appreciated then co-authored papers. This seems to be especially true for Ph.D. and post-doctoral students that have to create a reputation in the scientific community first. Whereas senior scholars do have some interest in collaboration on a paper for different reasons, all Ph.D. and post-doctoral students stated that they are interested in discussion but rather not in collaborating on a paper. However, Garnet does not seem to facilitate the contacts needed for discussion. Multiple of my participants mentioned that Garnet as a closed network does exclude too many experts from the discussion as they are not members of the project. Besides the reduced number of potential collaborators, the exclusion of scholars from other geographical regions is perceived as problematic.

(2) The interviews indicate that an intensive usage of a project specific collaboration platform is rather unlikely. Especially senior scientists are involved in multiple networks at a time, most of which have an electronic platform of their own. They state that it is not possible to be actively involved in all platforms at a time. Moreover, most of them only log onto a platform in case something is time critical or an important event (like a conference) is due. Interest in the electronic platform mainly exists concerning organisational tasks, such as reporting or conference organisation. Besides the general aversion against such a platform, most participants stated that they rather tend to collaborate with well-known partners with whom they share a history of collaboration. As one issue trust was mentioned, which seems to be missing in a large network like Garnet, where most partners did not know each other in the beginning of the funding period.

(3) As described above, active collaboration could rarely be observed on the collaboration platform, but intensive collaboration generally seems an exception. Eventually, scholars participated in the project in order to extend their social network. Senior scholars in the sample stated that an interest to get into contact with other scholars in their field and create relationships that can be used for collaboration in the future motivated their participation in Garnet. They further perceived the need for a platform for "starting things". This should facilitate information on potential collaboration partners (academic and contact information for example) and hence support the process of identifying a potential collaborator. Most of the participants stated that a social relationship allowing for collaboration is easily created once the initial contact is established.

3.2   Case 2: The situated context of IS scholars

Table 3 states some core properties of my participants by listing the current position, country, number of former home Universities and for each participant the number of visits to other Universities (of three months or longer, separated by semicolon). I categorise my participants into three groups based on the stage in their career. In the following, I will describe observations about the emergence of social relations. In this I will briefly sketch the importance of certain contexts of interaction (for a detailed description see Richter, 2011).

Group	Current Position	Current Country	# Former Home Univ.	# Mobility
Ph.D. and Post Doc.	Ph.D.; Post Docs (x2)	Ireland; Germany; Liechtenstein	0; 1; 1	0; 0; 1
Early stage scholars	Senior Lecturer; Associate Professor; Prof. [< 5 years]	Australia (x2); Liechtenstein	1; 1; 1	1; 2; 2
Senior scholars	Prof. [> 10 years]; Prof. [> 20 years] (x2)	Germany; USA; Switzerland	2; 2; 3	0; 2; 3

Table 3.   Characteristics of participants

I observed that the structure and dynamic of one's social network is perceived differently by scholars in different career stages (see Figure 1). The social network of Ph.D. and post-doctoral students is basically limited to co-located contexts, namely the home University. They might collaborate with other scholars outside the University bilaterally but most of these contacts seem to be mediated by their supervisor. Apart from mediation by brokers, the only other thing to help with the emergence of contacts for collaboration is extensive mobility. Early stage scholars have a strongly growing social network reaching into various contexts of interaction. Their former home University thereby seems to play a vital role in the development of social structures since (often rich) Social Capital created during co-location can be used for on-going collaboration later on. Further peers that have moved away from their University often are the starting point for developing an international network. Moreover, mediation by brokers (e.g. former supervisors) is a major source for extending one's social network. Senior scholars report a relatively stable – core – social network containing befriended scholars that they interact with in various contexts. They, in contrast to the other participants, do not differentiate by contexts but rather by individuals. Bilateral relations are mostly strong ties and, despite geographical distance, many such ties turn into friendships. Scholars with whom a positive history is shared are the preferred choice whenever partners are needed for any kind of institutionalised collaboration (e.g. in funded projects). However, research projects seem to play a very minor role for scholars. They are rarely mentioned as a context of interaction and only if asked.

In general, two observations stand out for all participants that seem to foster the evolution of individual social networks:

1) The high impact of mediation by brokers.

2) The ease of finding a common base for working with other scholars.

Most contacts seem to be (1) mediated by supervisors or colleagues from the former or current home University. Participants also reported on other scenarios for the emergence of active ties: e.g. participation in the same track of a conference (with papers that complement each other) or belonging to the same community. However, especially for Ph.D. and post-doctoral students but also early stage scholars the mediation of contacts to potential collaboration partners by brokers seems to be essential. In most cases, engaging in collaboration seems to be relatively easy (2) once contact has been established. Some contacts end soon after having emerged, but the rest often become medium and even strong ties in a relative short time span. Occasionally, meeting at social events (e.g. at conferences) seems to be sufficient to foster this development. Three major reasons for this have been stated by the participants:

1) Outside of the department the choice of contacts is not restricted by any organisational issues. Hence, collaboration partners seem to be chosen mainly based on sympathy besides a general compatibility of research interests.

2) Similar theoretical backgrounds provide a common wording.

3) When engaging in new projects scholars tend to choose collaboration partners with whom they share a positive history of collaboration.
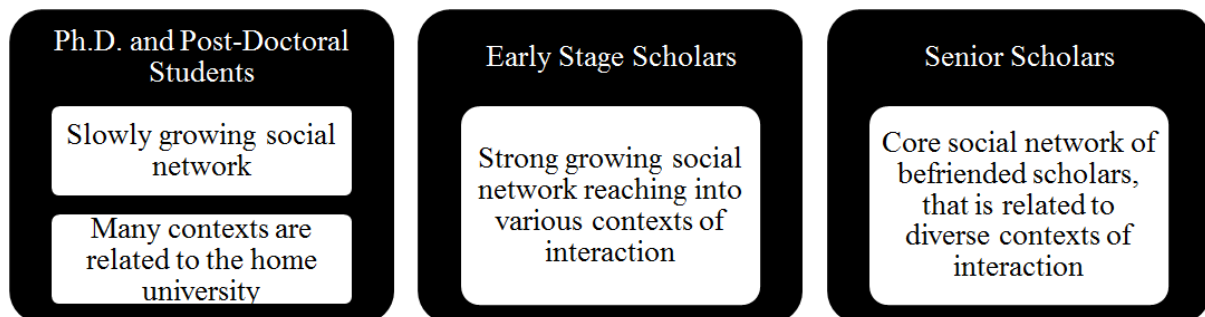

Figure 1. *Changing perception of the social network over time*

4   DISCUSSION

Despite the different setting in the two cases (cf. Table 2), I could observe strong similarities in the properties of social relations and also the role and position of scholars in different stages of their career. In the following, I will discuss the observed phenomena concerning the social networks in both cases and whether the usage of SNSs can have a positive impact on scientific collaboration.

4.1   Social Capital and virtual teams in academic contexts

Research on collaboration among scholars or networks among universities and research organisations is rather limited (Riemer et al., 2008). But the phenomenon of virtual organisation of work is not new. In enterprise contexts – in contrast to academic contexts – an extensive body of literature exits on virtual teams (e.g. Ciborra & Suetens, 1996; Malhotra et al., 2001; Orlikowski, 2002). Collaboration is often characterized by a strong need for intergroup Social Capital, but at the same time confronted with a distributed and virtual environment that hinders the very emergence of such capital. Especially the emergence of social structures in distributed groups is often a problem (Riemer & Klein, 2008), with severe consequences particularly for collaboration among knowledge workers (Davenport, 2005). Here, the creation of relational and cognitive Social Capital in virtual teams as a basis for effective collaboration is seen as a major problem (Riemer & Klein, 2008). Similar problems can be anticipated in scientific research. Networking on the institutional level seems to work fine, however, the creation of social structures on the individual level is problematic (Barber et al., 2006). These problems can easily be compared to those of virtual organisation in enterprise contexts. Scientific research is extremely knowledge intensive and collaboration depends on the creation of a common ground first. The collaborative part of paper writing, for example, is mostly that of discussing the theme and story line of the paper (Kraut et al., 1988; Richter, 2011). Collaborators depend on a common wording to enable a precise and hence effective communication about complex problems. The need for relational and cognitive Social Capital (cf. Table 1) enabling such communication is comparable to that in enterprise contexts. Moreover, complementing experts need to be identified in order to form a virtual team, which requires a good knowledge about potential candidates in form of structural Social Capital. This leads me to my first proposition that I will further specify in sub-propositions grounded in my data:

Proposition 1: The requirements of scientific collaboration in an academic context are comparable to those of knowledge intensive virtual teams in enterprise contexts. Social Capital on a structural, relational and cognitive level is needed.

As described above, the participants stated that they can create common grounds for collaboration with nearly any other IS scholar with relative ease. Similarly, the participants from Garnet stated that once a relationship with a scholar is established, a basis for collaborative work can be created without much effort. This observation is in contrast to observations made in enterprise contexts and despite the knowledge intensive nature of research. This can potentially be explained by the fact that scholars starting to collaborate usually share a common theoretical background in contrast to virtual teams in enterprise contexts. For example, participating IS scholars mentioned that a basic understanding is shared with most other IS scholars due to the similar educational background. Moreover, scholars can negotiate the usage of a specific wording by agreeing on literature. Consequently, occasional meetings at a conference seem to be sufficient to create the necessary relational and especially cognitive Social Capital for a successful collaboration. In addition, the intrinsic motivation for creating and publishing research comes into play as well. Hence, I formulate the following proposition:

Proposition 1a: The necessary relational and cognitive Social Capital for a successful collaboration can be created with more ease in academic contexts, compared to enterprise contexts, due to a similar education and the agreement on foundational literature and theory.

Nevertheless, problems of distributed scientific collaboration seem to exceed those observed in enterprise contexts. In both case studies I could observe severe problems concerning the formation of collaborative work groups. In enterprise contexts, there are brokers (supervisors) that force the formation of work groups and should have a good knowledge, in form of structural Social Capital, of

the experts that are working under their supervision. In academic contexts, individuals with a high potential for brokerage exist as well. However, these brokers rather introduce scholars than force the formation of a collaborative work group. Hence, in the end, scientific collaboration has to be initiated by the scholars willing to collaborate. No higher instance exists – as opposed to enterprise contexts – that forces the formation of work groups. The formation of work groups hence has to take place in a market situation rather than a hierarchy. Consequently, a detailed knowledge of the social network of potential collaboration partners in form of structural Social Capital (cf. Table 1) needs to exist in order to enable a scholar to collaborate. Especially in the case of Garnet I could observe a lack of structural Social Capital. This observation also held for the second case study, where there was little structural Social Capital present among early stage scholars and even less among Ph.D. and post-doctoral students. Moreover, anecdotal evidence, reports on other Networks of Excellences, and scientific collaboration networks in general (c.f. Barber et al., 2006; Bonaccorsi et al., 2008) as well as the prevalent strong influence of proximity in scientific research (Ponds et al., 2007) indicate that a dense social network between scholars, which would inhabit such structural Social Capital, does often not exist. I therefore proceed with the following proposition:

Proposition 1b: The most severe problems for scholars interested in collaboration stem from a lack of structural Social Capital.

The described problems are especially relevant for Ph.D. and post-doctoral students. They do not yet have an established social network of potential collaborators and nearly no contact to scholars outside the own department. This is of course not surprising in light of the limited time they are present in the community. Only few chances exist for these young scholars to meet potential collaborators. They often do not attend as many conferences as senior scholars, and are not yet visible in communities or associations. Consequently, they heavily rely on the mediation by their supervisors for finding collaboration partners. Multiple studies indicate that the availability of help has a significant positive influence on the scholar's potential for future collaboration (Bukvova, 2010). Moreover, Boardman and Corley (2008) find, that a scholar's affiliation to active research centres indicates a high level of collaboration in the future. However, even if a young scholar obtains access to a lot of potential collaborators by means of mediation, the lack of further occasions for meeting other scholars seems to be still problematic as can be observed in the case of Garnet. Ph.D. students do often not feel to have the opportunity to liaise with experts in their research domain. By relying on mediation, the emergence of the professional social networks of scholars seems to be partly predefined by the social network of their supervisors. This potentially hinders a knowledge exchange beyond the borders of existing working communities. A quote by Bullinger et. al. (2010) further signifies the problem: "The second big thing that happened was when I finished my PhD, I discovered two other doctoral students who worked on the same problem for three years and we had never discovered or heard about each other". Hence, especially the network activity of young scholars warrants attention (van Rijnsoever et al., 2008). This leads me to the following proposition:

Proposition 1c: The emergence of structural Social Capital in the case of Ph.D. and post-doctoral students and partly also early stage scholars relies heavily on mediation. Hence, contact to scholars outside the existing working communities is seldom established.

4.2   Means for supporting the emergence of structural Social Capital

From the above descriptions I hypothesise that supporting the emergence of structural Social Capital should improve a scholar's potential for initialising cooperation. SNSs have proven that they can support the emergence of Social Capital (c.f. Steinfield et al., 2008; Thew, 2008). In enterprise contexts it is already tried to take stock of this potential (c.f. Richter & Riemer, 2009). However, SNSs mostly seem to affect the structural level of Social Capital and not the relational or cognitive level (Richter et al., 2010). Hence the properties of SNSs seem to better match the needs of virtual teams in academic contexts, as described above, than that of virtual teams in enterprise contexts. I consequently formulate the following proposition that I will further specify in sub-propositions grounded in my data:

Proposition 2: Means that help the emergence of structural Social Capital, such as Social Network Sites, hold the potential to support the emergence of collaborative research groups.

The positive impact of SNS usage on the emergence of Social Capital is best documented in the case of students (Richter et al., 2010). Students especially seem to profit from the usage of SNSs in the process of integrating into the new social environment of the University (Ellison et al., 2007). Studies indicate that an intensive usage of SNSs in the early years of study enables individuals to draw on notably more Social Capital in later years (Steinfield et al., 2008). Steinfield, Ellison and Lampe (2008) argued that especially the chance to explore the social neighbourhood (Social Searching) contributes to the emergence of structural Social Capital. Social Searchers utilize SNSs to find out more about their offline social network in browsing the profiles and friends lists of new offline contacts (Lampe et al., 2006). In doing so, context information is gathered and awareness is created that improves the ability of an individual to act in this social network. Young scholars likewise have to integrate into a new social environment. The possibility to gather context information about new colleagues and other scholars could improve their potential to act in this new social network as well. Hence it is reasonable to suggest that young scholars could benefit from SNSs in a similar way to students making the transition from College to the University. This leads me to formulate the following proposition:

Proposition 2a: The usage of Social Network Sites, in the sense of Social Searching, could support young scholars in the transition from student life into the scientific community.

Moreover, Social Browsing behaviour most likely holds potential in academic contexts. Social Browsing describes the search for individuals with the intention to initiate contact (Lampe et al., 2006). Rarely observed in private contexts, evidence exists that such behaviour is often executed in enterprise contexts such as recruiting (Thew, 2008). Such behaviour could facilitate contact between scholars with similar academic interests who otherwise would not meet. Furthermore, functionality exists, that reveals the shortest (social) path between two individual, in form of: You do not know David, but your friend Ben knows Mary who again knows David. Hence the identification of the shortest social path, e.g. to connect with David, who is part of your extended social network, can support the identification of potential brokers, namely Ben and Mary in this case. These could then act as brokers and mediate contact. In both cases I found mediation to be one of the most important means to establish contact with potential collaborators. In this, often (former) supervisor act as mediators. This creates access for scholars, e.g. Ph.D. students to the social network of their supervisor. However, the reach is limited to the direct social network of their supervisor(s). Engaging in Social Browsing behaviour, also individuals from the extended social network could be target to mediation, like illustrated above. Moreover such functionality does not depend on a certain tie quality. Thus the mediation potential inhabited in weak ties could be utilized as well. Drawing on the typology by Bullinger et al (2010), especially research directory sites – that focus on the identification of scholars according to certain criteria – and research awareness sites – that keep the user informed on news in the network or their field of research – are sites that can support the emergence of structural Social Capital. I hence derive the following proposition:

Proposition 2b: Exploring the larger social network of an individual by means of Social Network Sites could build grounds for utilizing the bridging Social Capital that is owned by brokers even for facilitating contact in the extended social network of an individual.

Further SNSs are widely used for the management of weak ties (Schaefer, 2008; vom Brocke et al., 2009). In the sample of IS scholars about half the participants used SNSs for this purpose. The functionality of some SNSs to store a history, for example stating the date of the last meeting, was perceived as especially helpful. But, more significantly, the other half stated that managing weak ties is problematic to them. In this keeping track of individuals once meet and moreover the context in which the meeting took place was mentioned as problematic. Hence weak ties for these individuals usually turn into dead ties soon after having established. By maintaining weak ties, such ties as are, for example, created by a one-time meeting on a conference, scholars can more easily create a large social network of potential collaborators they can draw on later. I hence conclude with the following proposition:

Proposition 2c: Social Network Sites hold the potential to support the maintenance of weak ties and hence enable a scholar to create a large social network of potential collaborators.

5   CONCLUSION

In this paper I have interpreted observations made in two case studies on virtual research collaboration in an academic context, with special emphasis on the necessity of Social Capital emergence and maintenance in supporting such collaboration. I further reasoned how Social Network Sites (SNSs) could benefit scholars in creating and managing a professional social network. I found evidence that the need for Social Capital in academic contexts is very different compared to that of virtual teams in enterprise contexts. Instead of a lack of relational and cognitive Social Capital, I rather observed a lack of structural Social Capital in the academic context. Despite the existing trend to utilize SNSs in enterprise contexts, there is no evidence that they can significantly help the emergence of relational and cognitive Social Capital. However, multiple studies indicate that SNSs can have a notable positive influence on the emergence of structural Social Capital. Hence I propose to further investigate the potentials of SNSs for usage in academic contexts. Research on this subject is still in its infancy. Special research attention is warranted for investigating the specific needs of scholars for using SNSs in the context of research collaboration. I hope that my paper can motivate others to investigate the characteristics and needs of virtual work in academic contexts in more detail.

References

Barber, M. J., Krueger, A., Krueger, T. and Roediger-Schluga, T. (2006) *Network of European Union–funded collaborative research and development projects*, Physical Review E, 73 (3).

Beer, D. (2008) *Social network(ing) sites...revisiting the story so far: A response to danah boyd & Nicole Ellison*, Journal of Computer-Mediated Communication, 13 (2), pp. 516-529.

Boardman, P. C. and Corley, E. A. (2008) *University research centers and the composition of research collaborations*, Research Policy, 37 (5), pp. 900-913.

Bonaccorsi, A., Horvat, M., Maimets, T. and Papon, P. (2008) *Expert Group on the Future of Networks of Excellence - Final Report*, (Ed, Commission, E.).

Bourdieu, P. (1983) *Ökonomisches Kapital, kulturelles Kapital, soziales Kapital,* In Soziale Ungleichheiten. Soziale Welt, (Sonderband NR 2/1983), Vol. 2 (Ed, Kreckel, R.) Schwartz, Göttingen, pp. 183-198.

Boyd, D. and Ellison, N. (2007) *Social Network Sites: Definition, History, and Scholarship*, Journal of Computer-Mediated Communication, 13 (1), pp. 210-230.

Breiger, R. L. (2003) *The Analysis of Social Networks,* In Handbook of Data Analysis (Eds, Hardy, M. A. and Bryman, A.) SAGE Publications, London, pp. 505-526.

Bryman, A. and Bell, E. (2007) *Business research methods,* Oxford University Press, USA, Oxford.

Bukvova, H. (2010) *Studying Research Collaboration: A Literature Review*, Sprouts: Working Papers on Information Systems, 10 (3).

Bullinger, A. C., Hallerstede, S. H., Renken, U., Söldner, J.-H. and Möslein, K. M. (2010) *Towards Research Collaboration – a Taxonomy of Social Research Network Sites*, In Proceedings of the 16th AMCIS, Lima, Peru.

Burt, R. S. (1992) *Structural Holes: The Social Structure of Competition,* Harvard, Cambridge.

Ciborra, C., U. and Suetens, N. T. (1996) *Groupware for an emerging virtual organization,* In Groupware and teamwork: invisible aid or technical hindrance? John Wiley \& Sons, Inc., Chichester, pp. 185-209.

Coleman, J. S. (1988) *Social capital in the creation of human capital*, American journal of sociology, 94 (S1), pp. 95.

Coleman, J. S. (1990) *Foundations of Social Theory,* Harvard University Press, Cambridge.

Cummings, J. N. and Kiesler, S. (2008) *Who collaborates successfully?: prior experience reduces collaboration barriers in distributed interdisciplinary research*, Proceedings of the 2008 ACM conference on CSCWACM, San Diego, CA, USA.

Davenport, T. H. (2005) *Thinking for a Living,* Harvard, Boston.

Ellison, N., Steinfield, C. and Lampe, C. (2007) *The Benefits of Facebook "Friends:" Social Capital and College Students' Use of Online Social Network Sites*, Journal of Computer-Mediated Communication, 12 (4), pp. 1-26.

Friedkin, N. E. (1991) *Theoretical Foundations for Centrality Measures*, The American journal of sociology, 96 (6), pp. 1478-1504.

Gibbons, M. (1994) *The new production of knowledge: the dynamics of science and research in contemporary societies,* Sage Publications Ltd, London.

Glänzel, W. (2002) *Coauthorship patterns and trends in the sciences (1980–1998): A bibliometric study with implications for database indexing and search strategies*, Library Trends, 50, pp. 3.

Hessels, L. K. and Van Lente, H. (2008) *Re-thinking new knowledge production: A literature review and a research agenda*, Research Policy, 37 (4), pp. 740-760.

Irvine, J. and Martin, B. R. (1984) *Foresight in science: picking the winners,* Pinter, London.

Kraut, R., Egido, C. and Galegher, J. (1988) *Patterns of contact and communication in scientific research collaboration*, ACM Press New York, NY, USA, pp. 1-12.

Lampe, C., Ellison, N. and Steinfield, C. (2006) *A face(book) in the crowd: social searching vs. social browsing*, Proceedings of the 2006 20th anniversary conference on Computer supported cooperative work, Banff, pp. 167-170.

Lenhart, A. and Madden, M. (2007) *Social Networking Websites and Teens: An Overview*, (Ed, Project, P. I. a. A. L.).

Lin, N. (2001) *Building a Network Theory of Social Capital,* In Social Capital - Theory and Research (Eds, Lin, N., Cook, K. and Burt, R. S.) Walter de Gruyter, Inc, New York, pp. 3-29.

Malhotra, A., Majchrzak, A., Carman, R. and Lott, V. (2001) *Radical innovation without collocation: a case study at Boeing-Rocketdyne*, The Mississippi quarterly, 25 (2), pp. 229-249.

Mason, J. (2002) *Qualitative researching,* Sage Publications Ltd, London.

McAfee, A. P. (2006) *Enterprise 2.0: The dawn of emergent collaboration*, MIT Sloan Management Review, 47 (3), pp. 21-28.

Metzger, N. (1999) *Science Policy: Interdisciplinary Research: From Belief to Reality*, Science, 283 (5402), pp. 642.

Nahapiet, J. and Ghoshal, S. (1998) *Social capital, intellectual capital, and the organizational advantage*, Academy of Management Review, 23 (2), pp. 242-266.

Olson, G. M., Zimmerman, A. and Bos, N. (2008) *Scientific collaboration on the Internet,* MIT Press, Cambridge.

Orlikowski, W. J. (2002) *Knowing in Practice: Enacting a Collective Capability in Distributed Organizing*, Organization science, 13 (3), pp. 249-273.

Ploderer, B., Howard, S., Thomas, P. and Reitberger, W. (2008) *"Hey World, Take a Look at Me!": Appreciating the Human Body on Social Network Sites*, Lecture Notes in Computer Science, 5033, pp. 245.

Ponds, R., Van Oort, F. and Frenken, K. (2007) *The geographical and institutional proximity of scientific collaboration networks*, Papers in Regional Science, 86 (3), pp. 423-443.

Richter, A. and Riemer, K. (2009) *Corporate Social Networking Sites–Modes of Use and Appropriation through Co-Evolution*, Proceedings of the 8th ACIS International Conference on Computer and Information Science, Melbourne, pp. 722-732.

Richter, D. (2011) *Analysing research collaboration on the micro level – the perspective of individual scholars in the IS discipline*, Pacific Asian Conference on Information Systems (PACIS), Brisbane.

Richter, D., Riemer, K. and vom Brocke, J. (2010) *Social Transactions on Social Network Sites: Can Transaction Cost Theory contribute to a better understanding of Internet Social Networking?*, Proceedings of the 23rd Bled eConference, Bled.

Richter, D. and Schäfermeyer, M. (2011) *Social Media Marketing on multiple services - the case of a student driven organisation*, ECIS, Helsinki, Finnland.

Riemer, K. (2005) *Sozialkapital und Kooperation,* Mohr Siebeck, Tübingen.

Riemer, K. and Klein, S. (2008) *Is the V-form the next generation organisation? An Analysis of Challenges, Pitfalls and Remedies of ICT-enabled Virtual Organisations based on Social Capital Theory*, J INFORM TECHNOL, 23 (3), pp. 147-162.

Riemer, K., vom Brocke, J., Richter, D. and Große Böckmann, S. (2008) *Cooperation Systems in Research Networks - Case Evidence of the Network (mis)fit and adoption challenges*, Proceedings of the 16th ECIS Galway.

Schaefer, C. (2008) *Motivations and usage Patterns on Social Network Sites*, Proceedings of the 16th European Conference on Information Systems, Galway, pp. 2088-2099.

Soeldner, J. H., Bullinger, A. and Moeslein, K. (2010) *Social Software for Research Collaboration - A Systematic Literature Review*, European Academy of Management - Conference 'Back To The Future', Rome, Italy.

Steinfield, C., DiMicco, J. M., Ellison, N. and Lampe, C. (2009) *Bowling online: social networking and social capital within the organization*, Proceedings of the fourth international conference on Communities and Technologies, University Park, pp. 245-254.

Steinfield, C., Ellison, N. B. and Lampe, C. (2008) *Social capital, self-esteem, and use of online social network sites: A longitudinal analysis*, J APPL DEV PSYCHOL, 29 (6), pp. 434-445.

Thew, D. (2008) *LinkedIn a user's perspective: Using new channels for effective business networking*, Business information review, 25 (2), pp. 87-90.

van Rijnsoever, F., J., Hessels, L., K. and Vandeberg, R., L. J. (2008) *A resource-based view on the interactions of university researchers*, Research Policy, 37 (8), pp. 1255-1266.

vom Brocke, J., Richter, D. and Riemer, K. (2009) *Motives for using Social Network Sites (SNSs) - An analysis of SNS adoption among students*, Proceedings of the 22nd Bled eConference, Bled, pp. 40-56.

Wuchty, S., Jones, B. F. and Uzzi, B. (2007) *The increasing dominance of teams in production of knowledge*, Science, 316 (5827), pp. 1036-1039.