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**SOCIAL NETWORKS, SOCIAL CAPITAL
AND
KNOWLEDGE PRODUCTIVITY**

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ABSTRACT

This paper presents a theoretical framework on the relationship between social networks, social capital and knowledge productivity within organizations. In our knowledge economy, the competitive advantage of organisations relies on the capability to adapt to the changing environment by the continuous generation and application of new knowledge (Harrison & Kessels, 2004 p. 3). This specific capability is described as knowledge productivity. In this paper and the related PhD study the construct of knowledge is described as a social process of interaction between organizational members. If we consider organizational knowledge as a ‘social process of knowing’ (Huemer, Von Krog & Roos, 1998. p. 140), social networks and social capital plus supportive theories offer a conceptual framework for studying and understanding the process of knowledge productivity. This perspective provides argumentation that the composition and relation between social networks and social capital affects the organizational ability to become knowledge productive. This paper will theoretically conceptualise that knowledge productivity can be described as a continuous learning process. Henceforth, this paper elaborates on the notion that these learning processes can only take place in a social environment in which social networks play a facilitating role. This paper explores the dynamics of these powerful learning processes within social networks that take place in a rich landscape of social capital.

KEY WORDS

Social networks, social capital, knowledge productivity, learning processes

INTRODUCTION

This paper presents the preliminary results of a theoretical study on the relationship between knowledge productivity, social networks and social capital within knowledge intensive business firms. After the introduction, a brief description of the overarching research themes is given followed by the initial problem statement and the goal of this study. Based on these insights the central questions will be addressed, the key concepts of the study and a methodology for designing a case study. The design of this case study fits in a larger Phd study.

In an economy where knowledge is dominant, daily operations in organizations should be designed to support knowledge productivity (Kessels, 2001, p. 7). This process entails identifying, gathering and interpreting relevant information, using this information to develop new skills and then to apply these skills to improve and radically innovate operating procedures, products and services (Keursten et al., 2006, p. 406). Understanding the processes of knowledge productivity and organizing a knowledge productive work environment will probably become one of the main challenges for Human Resource Development (Kessels, 2004, p. 169). Studies on organizational learning, innovation and knowledge productivity indicate that the way people actually work differs fundamentally from the way organizations are designed (Brown & Duguid, 1991 p. 40). Significant learning and innovation processes takes place within informal social networks or so-called communities of practice (Wenger et al., 2002 p. 5). The core principles of this perspective are profound and simple, and they reflect something many of us know in our bones to be true (Stamps, 2000 p. 59):

- ▼ Learning is social
- ▼ Learning happens on the job

At the same time, HRD research on stimulating learning and knowledge productivity related to social networks and social capital is relatively an uncharted territory. This study investigates the process of knowledge productivity by introducing the concepts of social networks and social capital. Studies on social networks, innovation and learning processes provide argumentation that this connection is apparent within knowledge intensive business firms (Brown & Duguid, 1991 p. 40; Huysman, 2006 p. 40; Van Der Krogt, 1998 p. 161; Van Der Sluis & De Jong, 2006 p. 17). Management literature on social networks state that within de-layered, knowledge intensive organizations, most work of importance is heavily dependent on “invisible” social networks of employees within organizations that ensure productivity and effectiveness (Cross et al., 2003; Cross & Parker, 2004). Management literature on the role of social capital stipulate this by stating that social capital is so integral to business life that without it, cooperative action and consequently productive work is not possible (Burt, 2005; Cohen & Prusak, 2001).

The process of identifying, gathering and interpreting relevant information and using this information is and individual capability which takes place within specific social networks. Each individual within this social network has a network of relations and the structure and location of the individual in the social structure provides him or her with a position (competitive advantage) to identify, gather and interpret relevant information. In this perspective social capital can be described as relationships with other players (Burt, 1992 p. 8). This does not imply that social capital is an individual asset: it is owned jointly by the parties in the relationship. If the other party in the relation ends the connection, the flow of information will stop.

If we consider organizations to be social structures and also recognize the relationship between social networks and knowledge productivity an interesting perspectives comes to light. Information exchange is a prerequisite for knowledge productivity. Herein the network of contacts is a crucial aspect (also see: Burt, 1992 p. 11). The network structure and the position of individuals holds the possibility to identify, gather and interpret relevant information and using this information to develop new skills and then to apply these skills to improve and radically innovate operating procedures, products and services. The relationship between knowledge productivity, social networks and social capital also comes to light when we realize that the process of learning can be considered as a social process.

The result of this process is knowledge. If we further elaborate on social capital, a more profound definition than the description of Burt (1992 p. 8) can be made with respect to knowledge productivity. Social capital can be described as the network of connections between individuals, based on trust, respect, appreciation, reciprocal appeal, integrity, transparency and shared norms and values (Kessels & De Jong, 2007 p. 93).

GOAL OF THE STUDY

The idea of social capital has enjoyed remarkable rise to prominence in both the theoretical and applied economical science literature over the last decade. Economists show an increasing interest in the role of social capital in relation to macro-economic development (Beugelsdijk & Van Schaik, 2005 p. 4) and micro- meso-prosperity (Burt, 1997 p. 339; Kostova & Roth, 2003 p. 297). Research on the structural element of social capital provides empirical evidence for individual career success and interunit resource exchange or product innovation (Tsai & Ghoshal, 1998 p. 464). The relational perspective of social capital facilitates the creation of intellectual capital within the organisational setting (Nahapiet & Ghoshal, 1998 p. 256). Herein, social capital influences the different types of interpersonal connections that in turn affect individual learning capabilities (Van Der Sluis & De Jong, 2006 p. 17). In this perspective, organisations are increasingly considered to be a key source of social capital, emphasising the importance of social networks, partnerships, collaboration, interaction, and knowledge sharing they provide (Kessels & Poell, 2004 p. 152). Based on these insights HRD-scholars acknowledge that social capital is a relatively under-researched field and that for better understanding of the relationship between social capital, social networks and knowledge productivity the construct of social capital should be operationalised for (e.g. Kessels & Poell, 2004 p. 154; Kostova & Roth, 2003 p. 314; Leana & Van Buren III, 1999 p. 552). The overarching goal of this research is to develop a prescriptive theory on how social networks and social capital facilitate knowledge productivity within knowledge intensive firms. Herein, this research takes a specific viewpoint upon knowledge: it focuses on the concept of knowledge as being embedded in social relationships (Kogut & Zander, 1992, p. 385) or as other scholars position themselves: knowledge and learning that is put back in the context in which it has meaning, being the work environment of social relations (Brown & Duguid, 1992 p. 47). In conclusion, this research views knowledge as an integral part of activities and interactions which takes place in social networks.

CENTRAL QUESTION

Based on the overarching goal of this study the following central question is addressed:

In what way do social networks and social capital facilitate knowledge productivity within knowledge intensive firms?

RESEARCH ACTIVITIES

This research focuses on the relational dimension of knowledge productivity, specifically the role of social networks and social capital. Furthermore, in order to improve the understanding about how social networks and social capital facilitate knowledge productivity, an integrated theoretical lens needs to be developed. In addition, a supportive methodology is required in order to be able to study the relationship between social networks, social capital and knowledge productivity in practice. These insights will provide an academic basis for HRD-practitioners who wish to improve the quality of social networks and social capital in order to stimulate knowledge productivity. In trying to answer the research question this study will initiate the following activities:

- ▼ To develop a theoretical framework on the relationship between social networks, social capital and knowledge productivity in a situated context.
- ▼ To develop a valid methodology for observing and studying social networks and social capital in practice that inhibit and facilitate knowledge productivity.
- ▼ To provide an academic basis for practitioners in order to intervene and thereby to improve the quality of social networks and social capital within professional service firms in order to facilitate knowledge productivity.

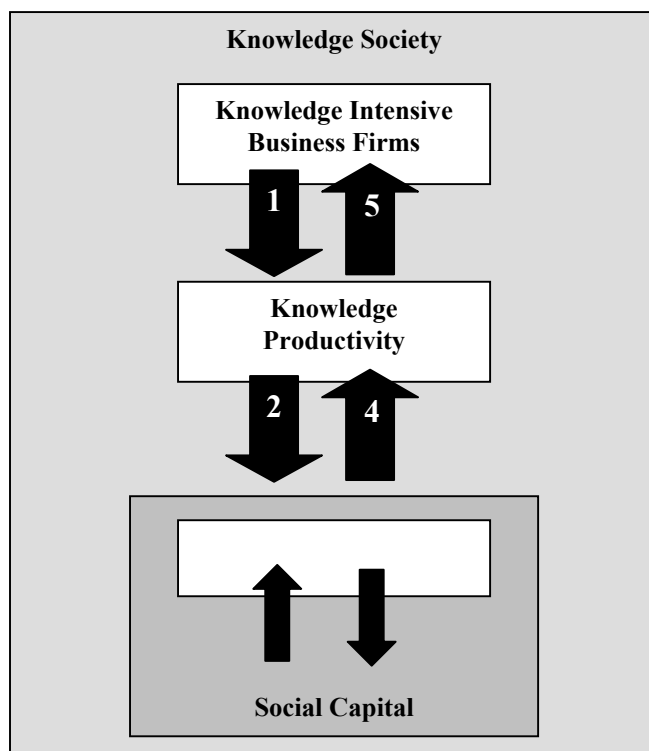
If we consider organizations to be social structures and also recognize the relationship with knowledge productivity and social capital an interesting perspective comes to light. The network structure and the position of individuals holds the possibility to identify, gather and interpret relevant information and using this information to develop new skills and then to apply these skills to improve and radically innovate operating procedures, products and services. Therefore, this process takes place in social structures. Based on this perspective, the following sub-research questions are relevant:

- ▼ *What is the relationship between social networks and social capital?*
- ▼ *What is the relationship between knowledge productivity and social networks and in what way is social capital affecting this?*
- ▼ *What factors facilitate and inhibit knowledge productivity from a social network perspective?*
- ▼ *What factors facilitate and inhibit knowledge productivity from a social capital perspective?*
- ▼ *How can HRD-practitioners adopt the findings of this study as a basis for their interventions?*

RESEARCH CONCEPTS

Based on the previous paragraph and research questions, the following general conceptual scheme is presented:

Figure 1: Conceptual scheme



1. Knowledge as an organizational resource
2. Knowledge as a social process of knowing
3. The relationship between social networks and social capital
4. Knowledge as being embedded in social networks
5. Knowledge as a competitive advantage

WHY IS THIS STUDY RELEVANT?

The concept of social capital is largely seen as a multidimensional construct, currently viewed upon as affecting economic and institutional performance (Grootaert *et al.*, 2004 p. 3) and even social well-being (Putnam *et al.*, 1993 p. 172). This paragraph provides an overview of potential scientific and practical revenues of the study.

Practical relevance

The practical relevance of social capital should become clear when stating that social capital facilitates action and cooperation for mutual benefit. The collective nature of this version of the concept is based on the fact that working together is easier in a community with a substantial stock of social capital. These new perspectives on learning processes suggest that learning is strongly linked with the social context environment and that better insight in this process is necessary (Berings, 2006 p. 72). There are assumptions that social capital plays an important role in knowledge productivity within organizations (Kessels & De Jong, 2007 p. 93). Social networks provide the landscape for learning. Descriptive theories on how social capital affects learning or innovation are hardly available, as well as prescriptive theories and instructions for HRD practitioners (Kessels & Poell, 2004 p. 153). This study also offers a better understanding of the emancipation of the knowledge worker who works and resides in specific social networks. These insights are also useful in vocational training where networked learning is getting increasing attention (De Jong & Rondeel, 2007 p. 147). In sum, this study will provide five practical arguments for relevance:

- ▼ It provides a better understanding of how knowledge workers operate in social networks;
- ▼ It provides argumentation for how learning and knowledge productivity take place on the job within social networks;
- ▼ It provides better understanding of how powerful social networks can be facilitated;
- ▼ If learning is fundamentally social and takes place on the job (Stamps, 2000 p. 59) this study will present findings what organizational aspects facilitate this for groups or teams;
- ▼ It provides better understanding of how HRD practitioners can facilitate knowledge productivity based on a social network perspective.

Scientific Relevance

A rich social structure is now considered as a major vehicle for organisations to organise work and learning that is needed to grow, or at least to survive. Social capital theory offers an interesting perspective for learning and development in a knowledge economy, as it provides assumptions on the facilitation for learning in the workplace (Kessels & Poell, 2004 p. 146). Herein, academic focus is shifting from studies on hierarchical and structural implications on learning and knowledge sharing to a relational nature of knowledge sharing (and learning opportunities). This is conceptualised in various theoretical traditions and concepts. Studies on social capital emphasise that empirical work on organisational social capital will need to begin with a refinement of its components and the development of specific measures and indicators. If social capital appears to be a useful construct, it must be operationalised and empirical indicators must be derived (Leana & Van Buren III, 1999 p. 552). In the policy arena of a knowledge economy, social capital does get ample support, but further research is needed to provide a scientific basis for some of the judging claims being made. So far, the topic of social capital has been relatively under-researched in the field of human resources development (Kessels & Poell, 2004 p. 153).

THE SOCIAL TRANSFORMATION OF OUR SOCIETY

No century in human history has experienced so many radical social transformations as the twentieth century (Drucker, 2001 p. 299). The transition to a knowledge society leads to a knowledge based economy. This revolution has fomented a shift in how value is perceived. At present innovation and flexibility have become the main drives of this value (Harrison & Kessels, 2004 p. 8). The knowledge economy is emerging with its fullest force primarily in the West, which at present is where it is having the greatest impact on business strategies, processes and practice (Harrison & Kessels, 2004, p. 5). In such a society individuals face the tremendous challenge and need for continual learning and relearning (Drucker, 2001 p. 325). Herein, formal education is pushed to the background and serves as a springboard for starting professionalisation of individuals. As complementary, lifelong learning and on-the-job learning is gaining significant importance. The previous economical shift from the agricultural to the industrial era resulted that 5% of the population farmed instead of 65% and had profound change in how we lived and perceived our world (Bertels & Savage, 1998, p. 8). The rise of the knowledge economy lead to the introduction of knowledge intensive work which in turn lead to the rise of organic structures in organizations. This has a tremendous effect on how organizations remain competitive and sustainable. A radically increasing number of organizations are changing or developing themselves into flat and flexible structures. It suggests that in today's delayed, knowledge intensive settings, most work of importance is heavily dependent on networks of employees within and across organizations (Cross et al., 2003 p. 3). The power of broad and divers patterns of relations affects the organizational ability to be competitive. Henceforth, this competitiveness relies on the capability to adapt to the changing environment by the continuous generation and application of new knowledge. (Harrison & Kessels, 2004, p. 3). The network perspective on organizations is based on the following assumptions (Van Der Krogt, 1998 p. 162):

- ▼ A network is made up of tactically operating actors;
- ▼ Every organization is a social network;
- ▼ The environment of the organization is a network;
- ▼ Network structures come about as the result of the actors' actions and vice versa.

Studies on the contrast between hierarchical firms in the twentieth century and today's service-based and knowledge-intensive organizations reveal an interesting perspective. Industry meant repeatedly carrying out standard, well-defined tasks and workers were seen metaphorically as part of a machine. Progress in this respect could be made when social networks and relationships of individuals were ignored or even discouraged (Cohen & Prusak, 2001 p. 17). Knowledge in this perspective is portrayed as a lever for control, in which the assumption was made that given good information and communication processes, it is possible to acquire perfect knowledge and embody it in organisational design, roles and tasks that can then be used to regulate organisational life and human performance (Harrison & Kessels, 2004 p. 122). The apparent problem with this perspective is that work in today's knowledge firm is anything but repetitive or mechanical. It requires productive working relations in order to be innovative and sustainable. In order to focus on the relationship between social networks, social capital and knowledge productivity organizations are neither perceived as machines, nor as an unorganized organization. Organizations are perceived as social organisms of people willingly engaged in a joint enterprise (also see: Cohen & Prusak, 2001 p. 17).

WHAT DO WE TALK ABOUT WHEN WE TALK ABOUT KNOWLEDGE?

Our world is moving towards a knowledge economy: an economy in which the application of knowledge replaces capital, raw materials, and physical labour as the main means of production (Kessels, 2001 p 165). This transition to a knowledge economy demands a reprogramming of the organizational environment where learning and development of individuals will take a dominant role (Van Der Sluis & De Jong, 2006 p. 17). In a knowledge economy the number of institutions and individuals which create meaning and knowledge in society has increased heavily (Venzin, Von Krogh & Roos, 1998, p. 34). Nowadays individuals draw on different sources when they interpret events, and by doing so, create knowledge. Based on epistemological distinctions of knowledge this paper presents a brief overview of categories of knowledge (based on: Venzin, Von Krogh & Roos, 1998, p. 48):

Figure 2: Categories of knowledge

References	Knowledge	Explanation
Polanyi (1983)	Tacit	A person knows more that he can express in words. This category explores the development of knowledge as well as knowledge transfer relative to the interaction of explicit and tacit knowledge.
Nonaka & Takeuchi (1995)	Embodied	Knowledge in this category results from experiences of physical presence. The emphasis lies on the process of knowledge development.
Blackler (1995)	Encoded	Knowledge that remains in the company without employees. Such as notebooks, databanks, codified rules, itineraries, etc.
Argyris & Schön (1978)	Embrained	This category of knowledge depends on the cognitive abilities of individuals which allow of the recognition of underlying patterns, the reflection of basis assumptions and double learning.
Berger & Luckman (1966)	Embedded	The emphasis lies on the process of knowledge construction. Knowledge is here embedded in a variety of contextual factors and not objectively pre-given.
Venzin, Von Krogh & Roos (1998)	Event	This category describes knowledge of events but also trends within and outside the organization.
Zander & Kogut (1995)	Procedural	Contrary to the knowledge of evens, this category encompasses knowledge of processes as opposed correlations. Examples include 'if... then' scenarios.

In our previous industrial era, sources for the creation of meaning were scarce and often controlled in some way by for instance limited individual freedom or borders of communities in which people lived. Nowadays, globalization and technology creates formal and informal networks throughout the world. As the creation of meaning nowadays is 'set free', we move away from controlled 'production' of meaning towards a pluralistic, self-referential and context sensitive way of meaning creation (Venzin, Von Krogh & Roos, 1998, p. 34; Harrison & Kessels, 2005 p. 131). This tells us that knowledge can be perceived in different ways. This study describes organizations as self-organized networks composed of relationships. Organizations are seen as networks and knowledge is a state in a system of interconnected individuals (Venzin, Von Krogh & Roos, 1998 p. 40), thus knowledge is described as being embedded in social relationships (Kogut & Zander, 1992 p. 385).

Understanding the environment in which knowledge productivity takes place

If knowledge is to be considered a process of social interaction embedded in social relations this has consequences for designing work processes and understanding knowledge productivity. In this perspective knowledge does not take its form through an objective product, but is to be considered as a social process of knowing (Huemer, Von Krogh & Roos, 1998 p. 140). In order to relate knowledge productivity with social networks and social capital this paper presents five dispositions of a productive working environment (based on: Kessels & De Jong, 2007 p. 94).

1. Knowledge as a collective social process

Knowledge productivity is primarily perceived a social process and not an individual process of collecting and processing information. Knowledge is formed through meaningful interaction between individuals. Such as social learning process will be more powerful when participants feel invited to participate and are respected and appreciated for their share and commitment. The ability to reach this level of safety is bigger when the goals of cooperation are transparent and the motives to participate are known.

2. A safe learning environment

Exploring enthusiasm, interest and passion of individuals is vital in creating a knowledge productive work environment and can only take place in a safe learning environment. Personal commitment will have a positive effect on learning motivation and on the investigative attitude that is necessary for knowledge productivity. When the learning environment is not safe, individuals will be reluctant to showing personal commitment and preference for specific content or collaboration.

3. Making room for initiative

Knowledge productivity can be actively promoted by encouraging employees in taking initiative in tackling urgent questions and hereby inviting colleagues to participate. By making room for initiative, entrepreneurship and forming informal networks of 'shared believers', the process of knowledge productivity will increase.

4. An appreciative environment

Instead of emphasizing formal structure, tasks, hierarchical positions and obedience, knowledge productivity will prosper in an environment in which individuals feel welcome and are invited to participate. An appreciative environment entails a working environment in which you receive and gain trust for who you are and what you find important as a professional.

5. Social skills

Working in a knowledge productive work environment demands a high level of social and interactive skills in order to create a sustainable, stimulating and safe working environment. It demands to be critical on content, while at the same time respecting and appreciating individual differences. This entails a high developed level of providing feedback and the ability to ask questions that invite to further exploration and participation.

SOCIAL CAPITAL AS A LEARNING LANDSCAPE

The previous mentioned characteristics of a safe working environment have a strong overlap with what some authors refer to as social capital (for instance: Cohen & Prusak, 2001 p. 3; or on social learning systems: Wenger, 1999 p. 10; or on networked learning: De Laat & Simons, 2002 p. 3). Bourdieu defines social capital as: “the sum of resources, actual or virtual, that accrue to an individual or group by virtue of possessing a durable network of more or less institutionalized relationships of mutual acceptance and recognition” (Bourdieu, 1986 p. 248). The concept of social capital was not widely discussed until fifteen years ago when Professor Robert Putnam of Harvard University in 1993 introduced it with tremendous impact in the United States. Social capital, Putnam writes, refers to “features of social organizations such as networks, norms and social trust that facilitate coordination and cooperation for mutual benefit” (Putnam, 1993 p. 21). The definition of this paper tries to underline the exploration of what social capital looks like in terms of knowledge productivity, and what organizations and individuals can expect from it:

Social capital can be described as the network of connections between individuals, based on trust, respect, appreciation, integrity, transparency and shared norms and values.
(Kessels & De Jong, 2007 p. 93)

The most important relationship between social capital and knowledge productivity is based in the aforementioned notion of knowledge development as a social process of learning. The process of learning preferably takes place in an environment in which it is attractive to connect to others in order to be knowledge productive. In such an environment, trust, safety, shared values and norms, integrity and transparency play a dominant role. The current debate and clarifications on social capital theory lead to the suggestion that social capital, as a concept, is rooted in social networks and social relations, and hence, must be measured relative to its root. Social capital can be defined as the resources embedded in a social structure, these resources are accessed and/ or mobilised in purposive actions (Lin, 2001 p. 20; Lin *et al.*, 2001 p. 6). By this definition, social capital contains three ingredients:

- (1) resources embedded in a social structure;
- (2) accessibility of such social resources by individuals;
- (3) and the use or mobilisation of such social resources by individuals.

Therefore, there are three elements intersecting structure and action. The social structure in which resources are embedded, the access of these resources within a social structure and the use and mobilisation of them (Lin, 2001 p. 20):

- ▼ Structure (embeddedness)
- ▼ Opportunity (accessibility)
- ▼ Action oriented (use)

When focussing on social capital relating to knowledge productivity, an number of interesting facts come to light. Organizations benefit from their social capital through better knowledge sharing, due to established trust relationships, common frames of reference, and shared goals (Cohen & Prusak, 2001 p. 10). Social capital facilitates the exchange and creation of intellectual capital (Nahapiet & Ghoshal, 1998 p. 248). Besides this, there is empirical evidence that social capital facilitates the creation of human capital (Bourdieu, 1988 p. 30).

ASPECTS OF SOCIAL NETWORKS

The central argument on social networks and knowledge productivity is that the quality of a network of relationships of employees has an important consequence for success or failure in developing new knowledge. The extent to which people are engaged in social activities in a community is not only crucial for the development of the individual but also for the larger collective (Putnam, 1993 p. 21). The potential application of a social network approach to organizations is tremendous. The full spectrum of organizational phenomena that network thinking can illuminate extends across from micro to macro and includes topics such as organizational behaviour, relational processes, and organizational theory (Kilduff & Tsai, 2003 p. 4). Networks exist not only as sets of recognition inside the heads of individuals in organizations, but also as structures of constraint and opportunity between interacting individuals (Kilduff & Tsai, 2003 p. 5). In this perspective, the formal organizational chart does not capture how work gets done in an organization. Networks have for a great deal to do with (personal) productivity, (organizational) learning and career success (Cross & Parker, 2004 p. 3). A way to make these intangible relations tangible is by means of social network analysis, that provides a rich and systematic method of assessing informal networks by mapping and analyzing relationships among people, teams, departments, or even entire organizations (Cross *et al.*, 2003 p. 212). The social network approach is premised on the importance of several concepts that include embeddedness, structural holes, centrality and closure (Kilduff & Tsai, 2003 p. 26). This chapter will elaborate on these topics in order to further theoretically develop the relationship between social networks and knowledge productivity.

Embeddedness

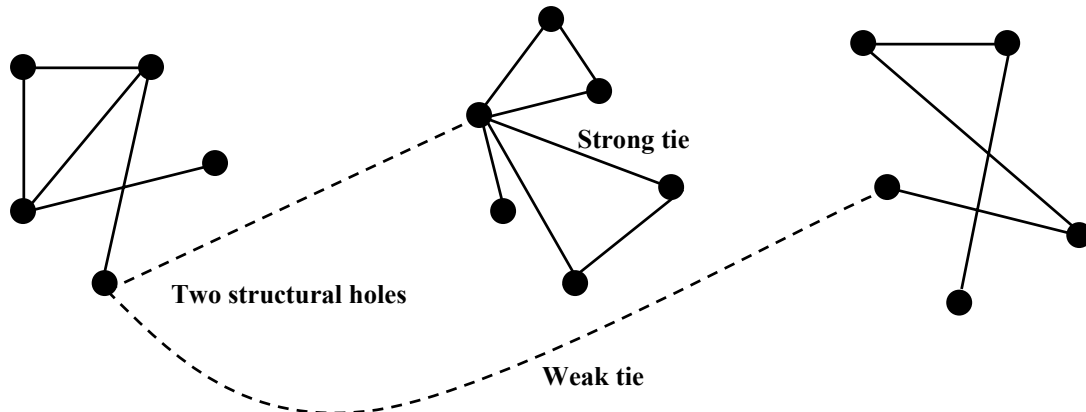
According to the embeddedness argument, work related transactions tend to overlap with patterns of social relations (Granovetter, 1985 in Kilduff & Tsai, 2003 p. 26). Thus, business is largely embedded in social networks and patterns of transactions within and between firms, an observation that differs from what might be expected from a pure hierarchical, economic perspective.

Structural holes

Discontinuities in social structure, or gaps in the social world in which there are no current connections, but that can be connected by 'entrepreneurs' in the network who thereby control over the flow of information across gaps are called structural holes (Burt, 1992 p. 27). Every social network has certain gaps between clusters of relations. A project group on topic A may not be aware of another project group on topic B in the same organization. Those are holes in the structure of information flow and are called structural holes.

The potential value of structural holes is that they separate nonredundant sources of information, sources that are more additive than overlapping (Burt, 2005 p. 16). This entails that specific knowledge resides in specific clusters of social connections and that individuals can find new knowledge when making bridging connections to other clusters. Figure 3 presents a graphic view of two structural holes and two weak ties (Burt, 1992 p. 27). Weak ties present the ability to connect across groups. People who are connected across groups are more familiar with alternative ways of thinking and behaving. Brokerage across these structural holes between groups provides a vision of options otherwise unseen, which is the mechanism by which brokerage becomes capital (Burt, 2004 p. 349).

Figure 3: Structural holes



Centrality and centralization

The following aspects of centrality and centralization are discussed:

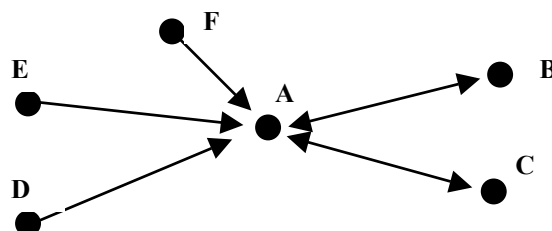
Figure 4: Aspects of centrality and centralization

Centrality	Centralization
▼ Local centrality	▼ Structural centre
▼ Global centrality	▼ Absolute centre
▼ Betweenness centrality	▼ Eccentricity

Centrality

The idea of centrality of individuals (and organizations) in their social networks was one of the earliest to be pursued by social network analyst. The immediate origins of this idea are to be found in the sociometric concept of the 'star' – that person who is the most 'popular' in his or her group or who stands at the centre of attention (Scott, 1991 p. 82). In figure 5 for example, person A is the recipient of friendship choices from all the other members of a group, yet A gives reciprocal friendship choices only to persons B and C and is therefore the star of attraction within the group (Scott, 1991 p. 10).

Figure 5: centrality



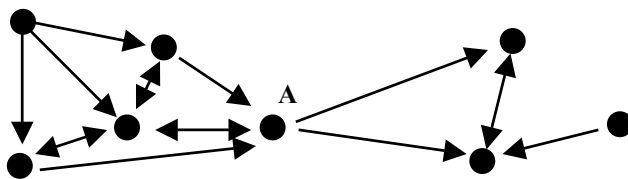
Local and global centrality

Scott (1991) focuses on the difference between local and global centrality. An individual in a network is locally central if he or she has a large number of connections with other individuals in its immediate environment. Local centrality is concerned with its relative prominence of a focal point in its environment. An individual is globally central when it has a strategic position in the overall structure of the network. A third concept of centrality is described as betweenness. This concept measures the extent to which a particular point lies 'between' the various other points in the social network (Scott, 1991 p. 86). This approach is built upon in the concept of local dependency.

Betweenness centrality

An individual is dependent upon another if the paths which connect to the other points pass through this point (Freeman, 1979). If we assume that all connections in a social system are reciprocated, the actor who links the most different parts of a network together has the highest level of betweenness centrality. Centrality in social networks is implicit in any discussion of social capital or structural holes (Kilduff & Tsai, 2003 p. 30). That means, it is always there. Burt (1992) has described this in terms of structural holes. A structural hole exists where two points are connected at a distance via two connections, but not via one connection (Scott, 1991 p. 87). In figure 5, individual A is a go-between for those actors who are not directly connected to each other. These individuals (e.g. A) tend to bridge between structural holes and have the highest betweenness centrality.

Figure 6: Betweenness centrality



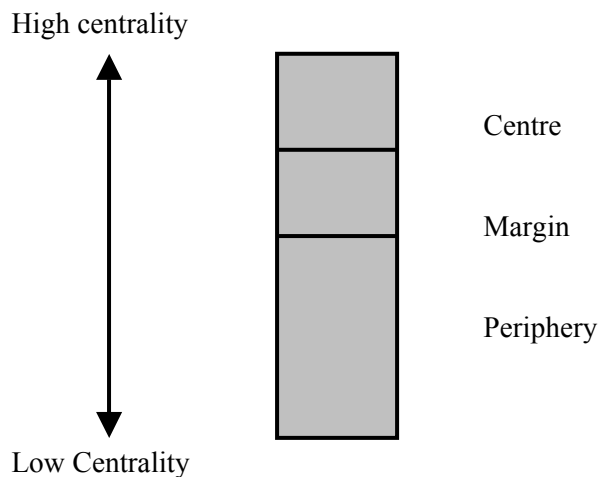
Centralization

The general procedure involved in any measure of a social network is to look at the differences between the centrality scores of the most central and those of all other points. Centralization, then, is the ratio of the actual sum of differences to the maximum possible sum of differences. Assessing the centralization of a graph around a particular focal point is the starting point for a broader understanding of centralization. Measures of centralization can tell us whether a network is organized around its most central points, but they do not tell us whether these central points comprise a distinct set of points that cluster together in a particular part of the graph (Scott, 1991 p. 90). The most used way of measuring centrality is pretty simple and based the Bonacich approach in UCINET. It argues that actors who have more connections are more likely to be powerful because they can directly affects more other actors.

Structural centre

The structural centre of a graph is a single point or a cluster of points that, like the centre of a circle or sphere, is the pivot of its organization (Scott, 1991 p. 90). An approach to defining the structural centre is to define the set of points with the highest point centrality and put them at the centre of the network. A way of presenting this is to map the network as centre, margin and periphery as figure 7 tries to visualize.

Figure 7: Structural centre



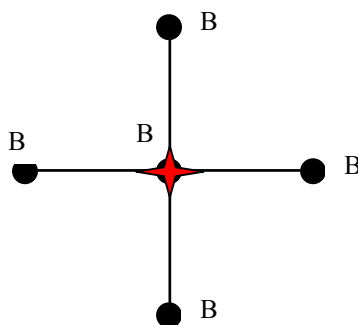
Absolute centre and eccentricity

The absolute centre of a network is closely connected to the idea of the centre of a circle or sphere. It is the focal point around which the graph is structured. The structural centre, as a set of points, does not meet this criterion. The absolute criterion or centre must be a single point (Scott, 1991 p. 92). In practice this is difficult to operationize, instead the absolute centre could also be the minimum distance: that point which is the closest to all the other point in term of path distance.

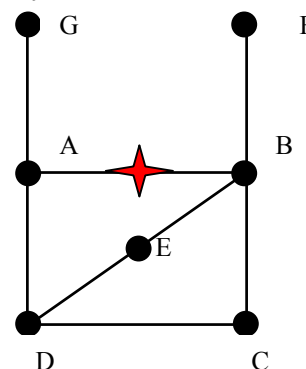
In conceptualizing and computing the absolute centre a first step can be measuring the closeness and then the absolute centre of the graph. Based on these insights the separation or eccentricity of a point can be determined: the length of the longest geodesic incident to it (Scott, 1991 p. 92).

Figure 8: Absolute and imaginary centre of a social network

The absolute centre of a social network



The “imaginary” centre in a social network



The point with the lowest eccentricity is the absolute centre. In other graphs, however, there may be no single point with minimum eccentricity. If there are a number of points with equally low eccentricity, a second step is needed. This second step in the identification of the absolute centre involves for an imaginary point that has the lowest possible eccentricity for the particular graph (Scott, 1991 p. 92). Thus some graphs will have a unique absolute centre, while others will have a number of absolute centers.

What does this tell us?

When identifying the centrality and centralization of a social network this study can examine the specific relation between social networks, social capital and knowledge productivity based on the following arguments:

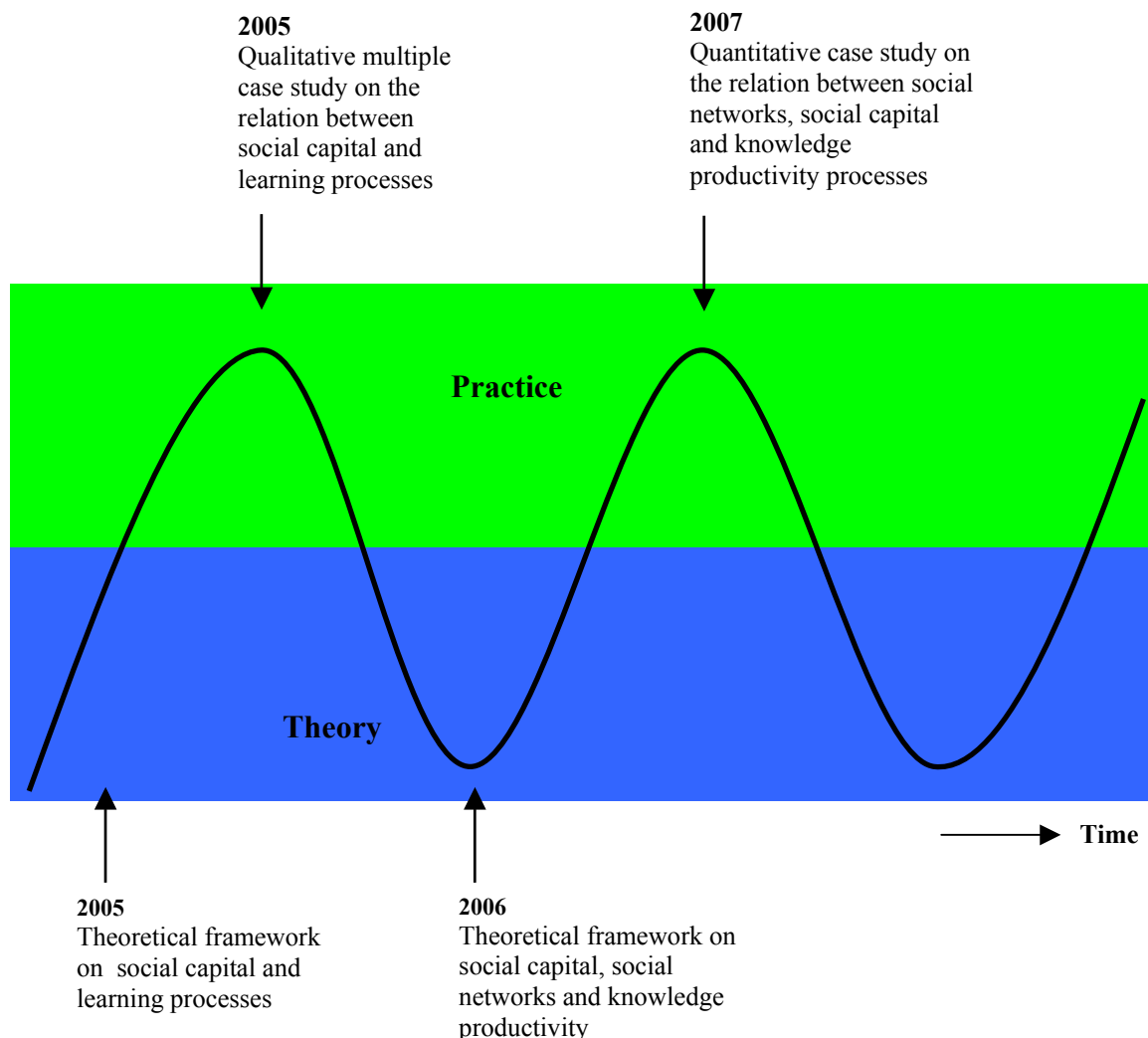
- ▼ It provides better understanding of specific social relations in relation to aspects of social capital such as trust and norms of reciprocity;
- ▼ It provides visualization of social networks in relations to knowledge productivity;
- ▼ Based on the visualization of the social networks in depth interviews can be held in order to answer questions such as: when, how, under what condition, where, does knowledge productivity take place.
- ▼ It provides empirical findings how indicators of social capital are connected to specific social relations that affect knowledge productivity;
- ▼ Through measuring centrality and centralization this study can follow up on the qualitative study and design hypothesis that offer a more profound understanding of the relation between social networks, social capital and knowledge productivity.

In these five arguments centrality and centralization are dominant factors. They provide insight in the specific composition of a social network. The compositions of a social network provides detailed information on where, why and how knowledge productivity takes place. In working with centrality and centralization the design of the study can take the specific flow and creation of knowledge as a starting point for the questionnaire.

MEASURING KNOWLEDGE PRODUCTIVITY IN SOCIAL NETWORKS

This paragraph elaborates on the conceptual framework of the study in order to design a methodological step in empirically studying the relation between social capital, social network and knowledge productivity. Figure 9 presents a visualization of the first phases in this process.

Figure 9: Overarching research phases



The overriding focus of this study is to deepen the understanding how social networks and social capital facilitate knowledge productivity within knowledge intensive firms. Two network structures are argued to create social capital: network closure and structural holes (Burt, 2001 p. 31). Based on the theoretical assumptions sketched in the previous paragraph the following principles are to be considered:

- ▼ Organizations are seen as social entities;
- ▼ Learning is considered to be a social process;
- ▼ The individual who acquires new knowledge participates in a social process;
- ▼ Organizational members learn differently from different (inter) personal connections.

The network approach can determine whether the pattern of network ties in a particular social world is related to the process of knowledge productivity, a process that entails the process of identifying, gathering, and interpreting relevant information, using this information to develop new skills and then to apply these skills to improve and radically innovate operating procedures, products and services. Learning lies at the heart of this process (Keursten et al., 2006 p 406). The previous mentioned principles and the theoretical framework imply that determining and analyzing the social structure and networks in an organization should focus on the following determinants:

- ▼ Embeddedness
- ▼ Structural holes
- ▼ Closure
- ▼ Centralization

The popularity and frequent use of the concept of social capital has not yet eventuated in unanimity of the way it should be defined, nor on how it should be measured and empirically assessed (Van Schaik, 2002 p 8). These debates and clarification lead to the suggestion that social capital, as a concept, is rooted in social networks and social relations, and must be measured relative to its root. Lin (2001 p. 29) proposed that social capital, as an investment in social relations with an expected return in the marketplace, should be defined as resources embedded in a social structure that are accessed and/or mobilized in purposive actions. In this definition, three critical components present themselves for further analysis:

- ▼ Structure (embeddedness)
- ▼ Opportunity (accessibility)
- ▼ Action oriented (use)

In this perspective a first step is determining the relationship between a social structure and knowledge productivity incorporating the relation with social capital. Aspects of social capital than must be taken into account are then based on the definition: "Social capital can be described as the network of connections between individuals, based on trust, respect, appreciation, integrity, transparency and shared norms and values" (Kessels & De Jong, 2007 p. 93). Previous studies on processes of knowledge productivity and social networks indicate that a rich social landscape in which individuals bond, bridge and link is crucial (Van Der Sluis & De Jong, 2006 p 17). For preserving or maintaining resources, denser networks may have a relative advantage. For preserving and maintaining specific organizational knowledge, it would be better to have a closed network so that the resources can be preserved and reproduced. Studies in social networks has stressed the importance of bridges in networks in facilitating information and influence flows (Burt, 1992 p. 27). To argue that closure or density as a requirement for social capital should in addition add the value of bridges, structural holes or weak ties (Lin, 1999 p. 34). Rather than making the assertion that closed or open networks are required for knowledge productivity, it would be theoretically more viable to study what outcomes and under what conditions a denser or more sparse network might generate radical innovation (knowledge productivity). On the basis of this reasoning, this paper will propose a few hypotheses for further empirical examination.

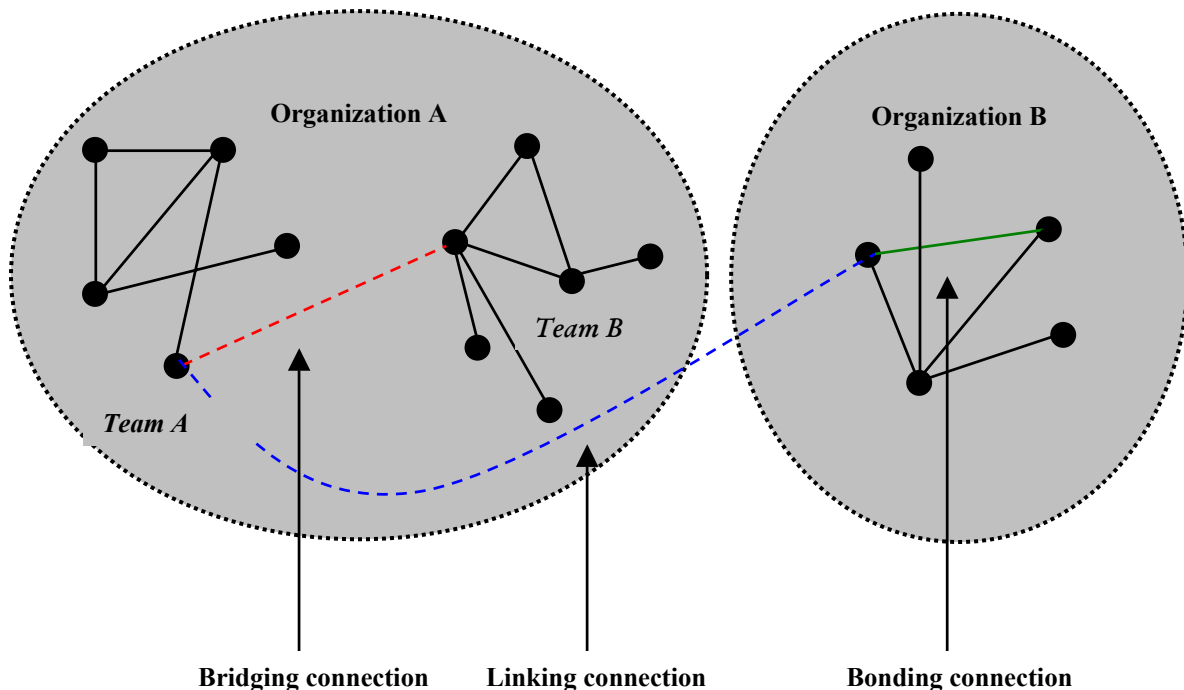
Engagement in the wider social context

In opposite the mainstream of educational perspectives on leaning, social capital underlines the individuals' active engagement in the wider social context. For this reason this study aims at combining three different types of interpersonal connections that individuals may maintain within their organizational social context:

- ▼ Bonding connections
- ▼ Bridging connections
- ▼ Linking connections

Within organizations, the three different types of interpersonal connections, are likely linked to different types of social structures and social capital. Figure 10 depicts these different types of connections (Van Der Sluis & De Jong, 2006 p. 7).

Figure 10: Bonding, bridging and linking connections



It is argued that social capital promotes the learning processes that enable knowledge productivity. Yet learning is not solely a simple by-product of social connections. Individuals also bring their existing skills and knowledge to their connections (Field, 2005 p 30). A previous multiple case study, offers evidence that the bridging, bonding and linking connections relate to different effects on learning and its related characteristics. Figure 11 present the main findings (Van Der Sluis & De Jong, 2006 p 17).

Figure 11: Social capital and its effect on learning

Types of social capital	Possible effects on learning	Characteristics
<p>1) Network-oriented: bridging</p> <ul style="list-style-type: none"> - Mutual attractiveness and reciprocal appeal plays a dominant role - Level of trust plays a dominant role - Norm of reciprocity is limited - Moderate degree of shared vision 	<p><i>Intra contact learning: level α</i></p> <ul style="list-style-type: none"> - Free exchange of skills (exchange of experiences) - Knowledge exchange is limited 	<ul style="list-style-type: none"> - Instable connections - Bridging enables individual access to a 'new' social network - Level of reciprocity is unstable
<p>(2) Relation-oriented: bonding</p> <ul style="list-style-type: none"> - Dense and bounded network - Homogeneity of membership - High interpersonal norms - High level of interpersonal trust 	<p><i>Intra contact learning: level β</i></p> <ul style="list-style-type: none"> - Free exchange of information and knowledge - Skills exchange is limited 	<ul style="list-style-type: none"> - Stability - Group think - Strong norms of reciprocity - Limited access to new skills and knowledge
<p>(3) Cross-oriented: linking</p> <ul style="list-style-type: none"> - Loose and open-ended network - Based on urgency and relevance - Reciprocity and trust is context dependent 	<p><i>Inter contact learning: level γ</i></p> <ul style="list-style-type: none"> - Connections outside the organisational paradigm - Leveraging a wider range of resources 	<ul style="list-style-type: none"> - Provides a rich set of additional meaning and sense making to actors - Re-balance the existing inter-relationships - Facilitates the process of reflection

DESIGNING A SOCIAL NETWORK ANALYSIS

Following on the research findings as presented in Figure 9 the next step in the research process is to conduct a social network analysis on different individuals in an organization in order to validate the relationships between the bonding, bridging and linking connections with knowledge productivity. This paragraph presents the various steps in this process.

There are two approaches to conducting a social network analysis: personal (egocentric) and group (bounded) networks assessments (Cross & Parker, 2004 p. 243). The personal network approach requests a person to identify other people who are important for a given function or task (e.g. learning or information) and then answer a set of questions regarding each of these people. The group (bounded) network approach, first defines a network of interest, such as a critical function in an organization or a group of people who are integral part of a core process (Cross & Parker, 2004 p. 243). Using the bounded network approach can be time-consuming for large groups, and more importantly, it does not account for all the connections (specifically the linking connections between organisation A and B) each person has. Given the importance the linking connection appeared to obtain in the previous multiple case study on individual learning processes (Van Der Sluis & De Jong, 2006 p. 17), it is proposed to combine both group and personal network approaches when conducting the network assessment.

Based on the previous study and the insights offered by the literature study the forthcoming quantitative case-study aims at exploring and possibly answering the following sub-research questions. Based on these findings a next case study can be designed that focuses on validating and / or reframing research methods.

Figure 12: Sub-research questions and focus

Sub-research question	Research focus
<i>What is the relationship between knowledge productivity and social networks and in what way is social capital affecting this?</i>	Formulating hypotheses and testing these by means of a social network analysis
<i>What factors facilitate and inhibit knowledge productivity from a social network perspective?</i>	Analyzing the social network findings and combining these insights with interviews and group-reflections
<i>What factors facilitate and inhibit knowledge productivity from a social capital perspective?</i>	Analyzing the social network findings/results and combining these insights with interviews and group-reflections

Based on the qualitative findings of the research by Van Der Sluis and De Jong (2006), the quantitative network study aims at exploring and possibly testing the following nine hypotheses.

Bonding connections

- ▼ H0: Trust is positively associated with the exchange of new information and knowledge
- ▼ H1: Trust is not positively associated with the exchange of new information and knowledge

- ▼ H0: Norms of reciprocity are positively associated with the exchange of new information and knowledge
- ▼ H1: Norms of reciprocity are not positively associated with the exchange of new information and knowledge

- ▼ H0: Bonding connections facilitate access to new skills of bonded individuals
- ▼ H1: Bonding connections do not facilitate access to new skills of bonded individuals

- ▼ H0: Bonding connections facilitate the process of reflection
- ▼ H1: Bonding connections do not facilitate the process of reflection

Bridging connections

- ▼ H0: Trust is positively associated with the exchange of new information and knowledge
- ▼ H1: Trust is not positively associated with the exchange of new information and knowledge

- ▼ H0: Norms of reciprocity are positively associated with the exchange of new information and knowledge
- ▼ H1: Norms of reciprocity are not positively associated with the exchange of new information and knowledge

- ▼ H0: Bridging connections facilitate the exchange of specific new individual skills
- ▼ H1: Bridging connections do not facilitate the exchange of specific new individual skills

- ▼ H0: Bridging connections facilitate the process of reflection
- ▼ H1: Bridging connections do not facilitate the process of reflection

Linking connections

- ▼ H0: Trust is positively associated with the exchange of new information and knowledge
- ▼ H1: Trust is not positively associated with the exchange of new information and knowledge

- ▼ H0: Norms of reciprocity are positively associated with the exchange of new information and knowledge
- ▼ H1: Norms of reciprocity are not positively associated with the exchange of new information and knowledge

- ▼ H0: Linking connections facilitate the exchange of specific new individual skills
- ▼ H1: Linking connections do not facilitate the exchange of specific new individual skills

- ▼ H0: Linking connections facilitate the process of reflection
- ▼ H1: Linking connections do not facilitate the process of reflection

Knowledge, information and individual skills

Knowledge productivity is primarily perceived a social process and not an individual process of collecting and processing information. Knowledge is formed through meaningful interaction between individuals. Based from a social constructivistic approach to learning this entails three overarching constructs related to knowledge productivity:

- ▼ Structure (embeddedness)
- ▼ Opportunity (accessibility)
- ▼ Action oriented (use)

In making a distinction between knowledge, information and skills. This paper.

From hypotheses to methodology

The following steps are based on conducting and interpreting social network analysis that focus on knowledge intensive business firms (Cross & Parker, 2004 p. 144; Kilduff & Tsai, 2003 p. 137; Scott, 2001 p. 146, Burt, 1992 p. 115).

Step 1: Identifying a strategically important group

The first step in conducting a network analysis is to identify a network in which effective collaboration and knowledge productivity is important for an organization. In this proposed case study the findings should incorporate a number of in depth case studies followed by a cross case analysis. In other words, the study should facilitate comparing two organizations and studying each organization in depth. The work of Cross & Parker (2004 p. 145) urge researchers to consider groups in which effective collaboration yields strategic and operational benefits for an organization. Besides this, Cross & Parker state that looking for groups that cross functional, hierarchical and physical boundaries. Based on these insights four steps need to be taken in identifying a strategically important group:

Figure 13: Checklist in step 1

Checklist in step 1: Identifying strategically important groups
▼ Two knowledge intensive organizations, that have
▼ Formally designed departments or teams, in which
▼ Collaboration is a strategic and operational driver, and where the
▼ Departments or teams cross functional, hierarchical and physical boundaries

Step 2: Assess meaningful and actionable relationships

This steps entails collecting information that is needed to map the relationships. The relationships must meaningfully reveal a group's inner working. With inner working, this study focuses on the quality and characteristics of specific social relations in a social structure. Focussing on the communication network alone does not provide enough detail. Overarching, the focus lies on the relationships that reveal collaboration in a social network. Assessing some combination of relationships is often important because they characterize how work gets done in knowledge intensive setting and thereby offers a more profound understanding of relationships (Cross & Parker, 2004 p. 147). The following constructs are to be considered in making social relations explicit (Cross & Parker, 2004 p. 148):

- ▼ Relationships that reveal collaboration in a network
- ▼ Relationships that reveal information sharing potential of a network
- ▼ Relationships that reveal rigidity in a network
- ▼ Relationships that reveal well-being and supportiveness in a network

Based on the four constructs that are to be consider in making social relations explicit, figure 14 serves as a checklist for step 2:

Figure 14: Checklist in step 2

Checklist in step 2: Assessing meaningful and actionable relationships
▼ Visualizing the formal structure of the department or team, then
▼ Determining the constructs that can determine knowledge productivity in social networks, based on this combining the
▼ Egocentric approach and a bounded network approach, in order to
▼ Design the social network analysis survey, and finally
▼ Collecting the data with UCINET software

Step 3: Visually analyze the results

Once the data of the two case studies are collected, the data will be analyzed with the software package UCINET. In the social network analyses the focus will lie on bonding, bridging and linking connections. The network software UCINET uses a step-by-step mathematical process to draw the network diagram. The algorithms usually place the people with the most ties in the center of the network and those with the least ties on the outside. Based on the choice of using UCINET to visually analyze the results figure 15 presents a brief checklist.

Figure 15: Checklist in step 3

Checklist in step 3: Visually analyze the results	
▼	Importing the data in UCINET
▼	The absolute and primary centre of the social network
▼	The structural centre, margin and periphery of the social network
▼	Determining the betweenness centrality and structural holes
▼	Determining local and global centrality
▼	Determining bonding, bridging and linking connections

Step 4: Quantitative analysis of the results

Quantitative analysis is especially important for large networks. Typical quantitative analyses look at both the group as a whole and at how people are embedded in the network. In such analysis of the results the various aspects of the social network as described in this paper will get the primary focus (see also Cross & Parker, 2004 p. 157). Quantitatively analyzing the results of the data collection will focus on the group as a whole and simultaneously at how individuals are embedded in the social structure. Based on this specification, figure 16 and 17 present individual measures and group measures.

Figure 16: Individual measures

In-degree centrality	The number of incoming ties a person has for a given relationship (such as trust or reciprocity)
Out-degree centrality	The number of outgoing ties a person has for a given relationship (such as trust or reciprocity)
Betweenness centrality	The extent to which a particular person lies 'between' the various other people in the network.
Closeness centrality	The extent to which a person lies at short distances to many other people in the network.
Brokerage measures	Cross & Parker (2004 p. 157) focus on four measures here: individuals who broker connections within the same group (coordinators), those who broker connections within their own group and other (representatives and gatekeepers), and those who broker connections between two different groups (liaisons)

Figure 17: Group measures

Density	The number of individuals who have a given type of tie with each other, expressed as a percentage of the maximum possible connections
Cohesion	The average of the shortest paths between every pair of people in the network
Degree centrality	Comparing the number of incoming connections with the number of outgoing connections in a scatter plot. This indicates sources and seekers of information, indicates the reliance of persons with information and it can be useful in comparing individuals' centrality scores in two networks (e.g. trust with reciprocity).

Step 5: Creating reflective feedback sessions

Although network analysis is an extremely useful way to understand the relationships between people in a particular group, it does not necessarily reveal why certain relationships are present or absent, or even what is effective or ineffective in a group (Cross & Parker, 2004 p. 160). To get a better of te dynamics behind the network, after the network analysis several interviews with a select number of individuals will be conducted. Besides these interviews the network analysis will reveal the specific network structure in relation to knowledge productivity. Based on these insights multiple group sessions will be conducted in order to get a profound perspective in what way the social relations (bonding, bridging and linking connections) played a role. Based on these reflective feedback sessions, figure 18 presents a checklist.

Figure 18: Checklist in step 5

Checklist in step 4: Creating reflective feedback sessions
▼ Develop a key summary of the network analysis results
▼ Determining key players based on the positions that individuals have in the social network
▼ Organize group sessions based on the outcomes of the analysis
▼ Analyzing the results based on the environmental aspects of a knowledge productive working environment

Step 6: Assess progress and effectiveness

A network analysis of a group or team offers information on the level of connectivity only at a certain point in time. Repeating this process after six to nine months can reveal whether there has been a change in the network. This step is meant to reflect on the findings and to investigate if repeating the analysis is productive.

CONCLUSION AND DISCUSSION

The focus of this paper was to describe a theoretical framework on the relationship between social networks, social capital and knowledge productivity. Based on the insights of this theoretical reflections and the results of a previous multiple case study (Van Der Sluis & De Jong, 2006) a methodology is proposed for collecting more specific and quantitative data in order to validate the qualitative findings of the previous multiple case study. Developing on these insights and a further exploration of literature a next case study on the interaction between social networks, social capital and knowledge productivity will be proposed.

Theoretical viewpoints

Knowledge productivity takes place within specific social networks. Such social networks are built upon specific social relations, and the structure and quality of these relations determine the ability of individuals to learn and consequently be knowledge productive. Herein the concept of social capital offers a useful insight into why and how individuals are knowledge productive. Different social relations facilitate different learning outcomes. More specifically three different connections, bonding (within teams) and bridging (between teams) and linking connections (between organizations) offer a more profound understanding of how social relations provide learning possibilities. This study describes social capital as the network of connections between individuals, based on trust, respect, appreciation, integrity, transparency and shared norms and values (Kessels & De Jong, 2007 p. 93). The overarching goal of this study is to develop a prescriptive theory on how social networks and social capital facilitate knowledge productivity within knowledge intensive firms. This study views knowledge as an integral part of activities and interactions which takes place in social networks on the job.

The relevance of this study is underlined by the radical social transformation of the twentieth century, in specific the development of a knowledge economy that has a tremendous effect on how organizations remain competitive and sustainable. Social networks and social capital as levers for knowledge productivity form crucial aspects in these developments. This study adopts a network perspective that is built upon the viewpoint that organizations are social organisms of people willingly engaged in a joint enterprise (Cohen & Prusak, 2001 p. 17; Van Der Krogt, 1998 p. 162; Van Der Sluis & De Jong, 2006 p. 17):

- ▼ A network is made up of tactically operating actors;
- ▼ Every organization is a social network;
- ▼ The environment of the organization is a network;
- ▼ Network structures come about as the result of the actors' actions and vice versa.

This study takes a specific viewpoint upon knowledge: it focuses on the concept of knowledge as being embedded in social relationships (Kogut & Zander, 1992, p. 385). When knowledge is to be considered a process of social interaction embedded in social relations five dispositions for a productive work environment are to be considered (Kessels & De Jong, 2007 p. 94):

- ▼ Knowledge as a collective social process
- ▼ A safe learning environment
- ▼ Making room for initiative
- ▼ An appreciative working environment
- ▼ Social skills

The central argument on social networks and knowledge productivity is that the quality of relationships within the network determines the succes or failure of the development of new knowledge. Within organizations three different types of interpersonal connections are likely linked to different types of social structures and social capital:

- ▼ Bonding connections, within teams
- ▼ Bridging connections, between teams
- ▼ Linking connections, between organizations

Empirical viewpoints

Figure 19 shows the main research steps in conducting two quantitative cases studies:

Figure 19: Case study research steps

Step 1	Identifying a strategically important group
Step 2	Assess meaningful and actionable relationships
Step 3	Visualizing the analyzed results
Step 4	Quantitative analysis of the results
Step 5	Creating reflective feedback sessions
Step 6	Assess progress and effectiveness

The study will lever between theory and practice in order to provide a more profound understanding of the bonding, bridging and linking connections. Based on these insights a larger multiple case study in the end of 2007 will be designed (also see Figure 9). The design of the second multiple case study will focus on combing a personal and group network assessment. Based on these findings the structural holes within and between different social networks will be identified (bridging and linking connections). Simultaneously centrality and centralization of the social network will be addressed (bonding connections). Based on these findings additional interviews and group sessions will be conducted in order to focus on the specific characteristics and composition of the different connections. Guided by nine postulated hypotheses focussing on trust, norms of reciprocity and knowledge productivity the study will aim at providing a better understanding of the bonding, bridging and linking connections based on quantitative data, analysis and interpretation.

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