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**THREE DIMENSIONS OF SOCIAL CAPITAL
WITHIN TECHNOLOGICAL COOPERATION:
THE CASE OF A REGIONAL STRATEGIC NETWORK**

Competitive paper

by

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ABSTRACT

Innovation does not only demand new ideas, financial resources, and knowledge of supplier and user systems, but also social capital as a crucial determinant for interaction in business networks. However, social capital is often vague, at times described as a “catch-all notion”. In this paper an operational definition of social capital is suggested to support the management of innovation in networks. Three dimensions of social capital are applied in a case study of a regional strategic network – the socio-economic, the structural and the actor-oriented dimensions with a focus on the latter one. Data were collected at two points in time, at the start of a regional strategic network in 2004 and at the end of the project in 2010. The application of the concepts and the comparison between these two points in time highlight the influence of social capital and how it can be used to promote innovation processes.

Keywords: social capital, bridging, bonding, actor-oriented dimension, innovation, strategic networks

INTRODUCTION

Globalization and the spread of market economy as a dominant governance structure increase the need for innovative business behavior (Dosi, 1982; Carlsson & Stanhiewicz, 1991; Cooke, Asheim, Boschma, Martin, Schwartz & Tödtling, 2011). This requires knowledge both about the use of tangible and intangible resources, not least the management of business-to-business relationships (Ford & Håkansson, 2006; Gummesson, 2008; Kelly & Scott, 2012) and network cooperation between firms. Building on previous theoretical research on social capital we investigate the concept of social capital as it is used in network management and to what extent the concept is operational and useful for innovation management. The conceptual framework is applied to a case study of a regional strategic network.

Social capital is a concept that captures the impact of human relations on economic activity (Barnes, 2001; Bathelt & Glückler, 2003; Boggs & Rantisi, 2003; Hauser, Tappiener & Walde, 2007). Camisón and Forés (2011) propose that the social capital approach generates new theoretical development regarding the knowledge process in firms and industrial districts. Huber (2009) makes a similar claim and points out that the role of social capital for regional innovation has been highlighted by several studies of the knowledge based economy (Maskell, 2000; Fromhold-Eisebith, 2004; Capello & Faggian, 2005; Tura & Harmaakorpi, 2005).

Schuller, Baron and Fields (2005) claim that the discourse on social capital has been important in dispersing the under-socialized views of economic actors and in emphasizing the significance of social factors for economic development. Still, there are serious conceptual shortcomings in the literature, which obscure the causal role of social capital (Adler & Kwon, 2002; Taylor & Leonard, 2002; Huber, 2009). The predominant conceptualizations view social capital as a catch-all notion involving different sorts of social concepts (Huber, 2009). Different data sources, sampling designs and various wordings make a comparison between different studies within the discourse problematic. The empirical indicators are also too indirect and do not satisfactorily grasp the studied phenomena (Sabatini, 2007). Social capital remains a nebulous term and the causal mechanisms of specific dimensions are indefinable as long as social capital is treated as an undifferentiated mixture of social dimensions (Hauser et al. 2007).

However, a lot of empirical results within the research stream indicate that social capital can be differentiated into several dimensions. The heterogeneity of the concept constitutes an important finding in itself. Hauser et al. (2007) believe that this heterogeneity has to be considered in future studies, and analyses regarding the concept of social capital have to be conducted in a more focused fashion. An important question concerns the dimensions to be specified to facilitate the study and management of innovation.

Hauser et al. (2007) and Beugelsdijk and Van Schaik (2005) claim that only some dimensions of the concept social capital exhibit a positive relationship to innovation and regional economic growth. The components of social capital need to be better defined to support research on and management of innovation. Some researchers claim that several conceptual shortcomings have been generated by an analytical leap from the individual to the collectivity (Portes, 2000; DeFilippis, 2002). Huber (2009) proposes that a major reason for these conceptual shortcomings is the lack of understanding and inclusion of individual actors as an analytical factor. Mayntz (2004) makes a similar claim and poses that social mechanisms are

driven by lower-level actors and that such mechanisms are best understood from the individual actors' point of view.

Focusing solely on collective properties and collectivities makes the study of socio-cultural processes conceptually difficult (Markusen, 2003; Huber, 2009). Economic geography and regional studies have neglected the actor-oriented and network-based conceptualizations of social capital (Flap, 2002; Lin, 2002; Van der Gaag & Snijders, 2003; Burt, 2005; Huber, 2009). Such a focus upon socio-economic and cognitive issues is thereby described to deflect attention from network structures and the individual actors.

Cooke, Clifton and Oleaga (2005) claim that only social capital on a firm level of analysis has showed strong effects on innovation and that "only weak evidence of a link between regional social capital and regional competitiveness" has been empirically proven. Huber (2009) states that a network-based conceptualization of social capital can be applied easily at a micro level perspective of individuals, but it is a difficult task to shift the unit of analysis to incorporate collectivities such as economic clusters and regions. The "conceptual departure requires, however, more care and theoretical refinement than that displayed so far" in regard to this analytical leap (Portes, 1998: 21). Similarly Ibarra, Kilduff & Tsai (2005) argue that only few attempts have been made to link individuals and their networks to larger network systems. To abandon wider generalizations of social capital on a community level in favor of a network and actor-centered conceptualization is thus in line with current research within the field.

Studying network formation on an actor level and linking this to the creation of social capital implies a more specific use of the term. Still, innovation is often explained as inherited and related to geographical proximity and shared cognitive culture (Putnam, 1993; Leenders & Gabbay, 1999; Semitiel García, 2006; Coletti, 2010). Talking about "learning regions" is thus common in innovation research (Morgan, 1997; Florida, 2002; Hauser et al. 2007; Koschatzky & Kroll, 2007). To find a common nominator between actor-oriented conceptualizations and shared cognitive traits within geographical regions might help in operationalizing the concept of social capital. Dividing social capital into different dimensions incorporating both cognitive cultures and network structures, and applying these dimensions in an empirical context, contributes to the usefulness of the concept in innovation management. By doing this we want to answer the call to search for common denominators that underlie and define social capital (Huber, 2009) and to reduce the worry that "social capital is treated as an undifferentiated mixture of multiple independent social dimensions" (Hauser et al. 2007).

The purpose of this paper is to identify and describe dimensions of social capital derived from previous research and to create operational formulations of social capital that can be used to stimulate business innovation. In order to strengthen social capital as an analytic tool the identified dimensions are applied in the empirical context of a regional strategic network.

We wish to contribute both to an understanding of how social capital might create an innovative environment within a regional strategic network (RSN) and to the definition of the social capital concept as such. The data collected allow a comparative analysis between two points in time highlighting the process of designing a regional strategic network.

THEORETICAL PERSPECTIVES

Crossing different levels of analysis is well in line with current arguments in the social network literature regarding the need to develop a multilevel understanding of inter-organizational networks (Contractor, Wasserman & Faust, 2006; Hagedoorn, 2006; Slotte-Kock & Coviello, 2010). In an early contribution Granovetter (1973) attempts to relate micro-level interactions to macro-level patterns with an analysis of social networks. He points out that relationships between people can exhibit either frequent contacts or deep emotional involvement (close friends or strong ties), or sporadic interactions with low emotional commitment (loose acquaintances or weak ties) (Hauser et al., 2007). In this manner Granovetter (1973) links the traits of the individual actors' connections to the density of the whole network, but research investigating this relation has been sparse (Cooke et al., 2005).

In a similar fashion Westlund (2006) highlights the need to create a multilevel understanding within the research regarding the use of the concept social capital in civil society. But instead of arguing for the need to connect the dyadic relations to the network structure Westlund (2006) sees a need to incorporate the single actor and its networks within the socio-economic definition of the concept social capital. Westlund (2006) claims that a weakness in both Putnam's (1993;2000) and Florida's (2002;2005) hypotheses is that they ignore the social networks as well as the single actor in favor of a focus on solely socio-economic cultures.

Hauser et al. (2007) concur and claim that contemporary measures on social capital provide empirical indicators for analyses on a national or regional scale. Researchers therefore often "fail to point out the characteristics that shape an environment conducive to learning and knowledge transmission". Hauser et al. (2007) state that the question "what turns an industrial cluster into a learning region?" often remains unanswered. The connection between the cognitive traits of the region and the structures of the focal networks are left unproblematised.

Some attempts have been made to divide the concept of social capital and networks into dimensions of analysis based upon reasoning similarly to what is presented above. Slotte-Kock and Colviello (2010) pose that a network is a dynamic system where ongoing change occurs at different levels: in dyads, across several actors, and within the broader environment. They suggest that scholars should distinguish between "(1) the focal firm and entrepreneur that are endogenous to the network and broader system, (2) the network or structural social context that is exogenous to the focal firm or entrepreneur, (3) the macro environment or cognitive context including sector influences, market, economic, or legislated conditions, technological or cultural change".

Antonacopoulou (2006) and Antonacopoulou and Chiva (2007) similarly divide the aspects of learning within network contexts into individual-centered, relational and societal aspects. Möller and Halinen (1999) suggest a framework that captures the structural complexity and variety of emerging strategic business nets and presents four interrelated levels of conceptualization: (1) industries as macro networks, (2) strategic nets, (3) net and relationship portfolios, and (4) strategic relationship. Westlund (2006) claims that "it is necessary to distinguish between a general, social capital on societal level and social capitals specified for the needs of organizations". He also claims that "[i]ndividuals build organizations and together those levels form a society". Westlund (2006) thereby poses that actors build cognitive social capital on three levels: the individual, societal and organizational ones. Rozenblat (2010) claims that social networks are interconnected through multilevel interactions and proposes that "[s]ome factors act at the interpersonal level (dyadic), while

others act at the collective level of agglomeration economies (triadic—i.e. involvement of several agents). Also, residual factors act at the interurban level of the competition over localization attractiveness and complementarity in the division of labour” (Rozenblat, 2010).

Based upon a comparison of these different levels or dimensions of analysis (Table 1) we present three dimensions of analysis concerning the concept of social capital. Table 1 is divided into three dimensions of analysis: the *socio-economic dimension*, where social capital is defined as being created within a geographical region by “citizens” (Maskell, 2000) and a specific “culture”, (Inglehart & Baker, 2000; Coletti, 2010); the *structural dimension*, where social capital is being created within a network (Putnam, 1995; Nahapiet & Ghoshal, 1998; Partanen & Möller, 2011) as a product of the network’s density (Burt, 1997; Lin, Huang, Lin & Hsu, 2011), structure (Bourdieu & Wacquant, 1992; Huber, 2009), and evolution (Tunisini & Bocconcelli, 2009; Daskalaki, 2010); and the *actor-oriented dimension*, where social capital is being created by a single actor through the formation of weak or strong ties in order to gain access to other social actors’ resources (Granovetter, 1985; Knoke, 1999; Cousins, Handfield, Lawson & Petersen, 2006).

INSERT TABLE 1 HERE

The socio-economic dimension of social capital

Tacit knowledge is a core concept in innovation research, and the term is generally understood as knowledge inherent in and diffused through idiosyncratic personal interaction and social networks and therefore not easily replicable in other locations (Hauser et al., 2007). Such considerations put collective learning processes rooted in the local community at the center of analysis. “Learning regions” are locations with a strong social and institutional endowment that exhibit continuous creation and diffusion of new knowledge and high rates of innovation (Florida, 2002; Morgan, 1997; Hauser et al., 2007; Koschatzky & Kroll, 2007). Hauser et al. (2007) claim that “this theoretical orientation emphasizes ‘soft’ factors such as social interaction and cognitive cultural characteristics in the analysis of ‘hard’ outcomes such as innovative production and economic development”. Such socio-cultural embeddedness of economic life has become a prominent topic in economic geography according to Huber (2009).

“Field-specificity of social capital” (Tura & Harmaakorpi, 2005) has according to Huber (2009) therefore become a factor in the usefulness of social capital. The concept of social capital is thus a “context-specific” variable (Cousins et al., 2006; Björk & Magnuson, 2009; Evers, Gerke & Menkhoff, 2010). The spatial context of innovation is often defined as nations, states (US) or regions (Lambooy, 2005) and innovation is often explained as inherited and related to geographical proximity and shared cognitive culture (Putnam, 1993; Leenders & Gabbay, 1999; Semitiel García, 2006; Coletti 2010). For instance, the term knowledge-spillover tends to be viewed as a consequence of “cultural differences” (He & Fallah, 2009). Saxenian (1994) claims that the unique local culture was the key factor distinguishing Silicon Valley from other IT clusters such as Boston/Route 128 in terms of mobility and innovation. Thus, a network structure or a cluster adjusts to the cultural and cognitive social context as well as to market conditions (Slotte-Kock, 2009).

An example of strong social capital on the societal level in Sweden is the “dependence-oriented culture” (*bruksanda* in Swedish) (Westlund, 2006; Eklinder-Frick, Eriksson & Hallén, 2011), which characterized small and mid-sized regions with a single dominant manufacturing industry in the industrial era (Westlund, 2006). According to Hammar and Svensson (2000) the dependence-oriented culture developed out of the relation in previous centuries between the dominant local employer and the workers at the mill. The employer and proprietor guaranteed employment in exchange for the workers’ loyalty. This loyalty entailed the expectation that commercial activity outside the one undertaken or controlled by the dominant employer was undesirable (Eklinder-Frick et al., 2011). Therefore the dependence-oriented culture was based upon few and very strong connections, both internally within the local society and externally through customer contacts (Hammar & Svensson, 2000; Bursell, 1997).

The specific relationships between employers and trade unions, often referred to as the Swedish model, of which the dependence-oriented culture in some sense was a component, had its great days from the 1930s to the 1960s. Since then, Sweden has become globalized and the knowledge society has replaced the manufacturing-industrial society (Westlund, 2006). Westlund (2006) assesses that a “reasonable hypothesis could be that the homogeneous social capital that Putnam (1993; 2000) focuses on, in general stood in a positive and self-reinforcing relationship with economic growth during the late industrial period”. During this period mass production created economic growth but not path-breaking innovations (Westlund, 2006; Braunerhielm, 2006; Keating, Loughlin & Deschouwer, 2003). Lindberg (2002) and Hammar and Svensson (2000) describe Söderhamn, the region in focus within the analysis part of this paper, as a municipality typifying the traits of the dependence-oriented culture.

The structural dimension of social capital

An extensive body of literature argues that innovation is not the result of single firms but must be regarded as resulting from distributed inter-organizational networks (Coombs, Harvey & Tether, 2003; Douglas & Ryman, 2003; Powell, Koput & Smith-Doerr, 1996; Camisón & Forés, 2011). However, a prerequisite for innovation is the structure or the identity of the network (Hoang & Antoncic, 2003; Partanen & Möller, 2011). Polletta and Jasper (2001: 298) posit that “similarly to organizational identity, network identity describes imagined as well as concrete communities, preexisting bonds and boundaries.” Thus, the network identity can be described as the unique yet flexible configuration of structural relations among individual members differentiating it from other network constellations.

Daskalaki (2010: 1653) claims that “these relations are defined through qualitatively distinctive ties and patterns of tie evolution among sets of norms, values and motives”. Therefore the process that needs to be focused on is the process of balancing bonding and bridging of ties which lead to the formation of persistent yet flexible network boundaries and identities (Daskalaki, 2010).

Social networks with heterogeneous ties encourage innovation among their members (Ruef, 2002), since individuals only capitalize on the “strength of weak ties” (Granovetter, 1985) if low levels of conformity are enforced by the network structure (Feist, 1999; Zhou, Shin, Brass, Choi & Zhang, 2009; Daskalaki, 2010). Structural features of networks such as the density of

ties encourage “structural holes” (Burt, 1992) and thereby influence access and mobilization of social capital (Huber, 2009). Partanen and Möller (2011) pose that “researchers might need to go ‘back to the basics’ and adopt social network theory into their research frameworks” to investigate network structures.

Social network theory often measures such entities as “density of network structure” and “sub-group cohesion” to analyze network structures (Semitiel García, 2006). Semitiel García (2006:11) points out “as a network of agents and relations is embedded in a more complex one, social networks have no natural frontiers and, therefore, it is a methodological problem, faced by the researcher, to decide the boundaries and the relations to be studied”.

In this paper the focus is put upon a regional strategic network and the network identity and structure studied therefore concerns the members of this temporary meta-organization.

The actor-oriented dimension of social capital

Houghton, Smith and Hood (2009) claim that there is a direct link between a single firm’s social resources, the firm’s involvement in external networks and the firm’s strategic complexity. Shan, Walker and Kogut (1994) also make a clear connection between the number of collaborative relationships a single firm develops and its innovation output. Elfring and Hulsink (2007) examine tie formation processes and put them in relation to entrepreneurial processes and innovation. Another example of this micro-level perspective (Portes, 1998; Huber, 2009) upon networks is the social network tradition which often studies the network structures of individuals (Slotte-Kock & Colviello, 2010). Examples include research on the impact of social ties in job-seeking (Granovetter, 1995) and career advancement (Podolny & Baron, 1997). To put a single firm or individual in focus and to investigate the value of their surrounding network of contacts is sometimes referred to as relational capital (Nahapiet & Ghoshal, 1998; Kale, Singh & Perlmutter, 2000; Villena, Revilla & Choi, 2011) or as contact capital (Niklasson, 2005; Lagerlöf-Nilsson, 2010). These terms are often defined as subcategories to the wider concept social capital.

Analyzing actor-oriented social networks often considers the centrality of actors and the structural equivalence of the actors’ positions (Semitiel García, 2006). Structural equivalence might be contrasted to Burt’s (1992) notion of structural holes referring to previously not connected areas in the structure of a network. By bridging structural holes, and thereby connecting to actors not tied to their existing network structure, brokerage opportunities are created by the diversity of information accessed. Balancing these forces is seen as strategically managing an actor-oriented network (Hoang & Antoncic, 2003; Daskalaki, 2010; Partanen & Möller, 2011).

Bridging and bonding forms of social capital in business network

Putnam (2000) claims that social capital may have two different effects upon human interaction: bridging and bonding. Bonding represents strong connections within homogeneous groups that often exclude interaction outside the group. Bridging, on the other hand, entails interaction between different social groups, and more loose bonds between actors (Eklinder-Frick, 2011). Huber (2009) criticizes the widespread assumption that strong ties and dense, cohesive communities are a requirement for social capital within economic

geography and regional studies. He stresses the importance of the often overlooked instrumental role of weak ties (Granovetter, 1973) or structural holes (Burt, 1992) within the social capital literature.

Granovetter (1973:1364) introduces the concept of a bridge as “[a] line in a network which provides the only path between two points”. Hauser et al. (2007) claim that “the importance of these bridges as carriers of useful economic knowledge was highlighted with a renewed interest in location theory and a novel perspective on industrial clusters”. Combining different patterns of bonding and bridging of social capital is therefore considered to promote collaboration and the creative potential in networks (Slotte-Kock & Coviello, 2010; Daskalaki, 2010; Camisón & Forés, 2011; Lin et al., 2011).

The risk of “lock-ins” (Grabher, 1993; Uzzi, 1997; Gargiulo & Benassi, 2000; Parra-Requena, Molina-Morales & García-Villaverde, 2009) and cultural “over-embeddedness” (Granovetter, 1985; Grabher, 2001; Uzzi, 1997) that adheres to the bonding form of social capital should on the other hand not be neglected. Moreover, bridging social capital might erode trust (Ahuja, 2000) and existing network structures (Portes, 1998) thereby causing irrelevant information to be shared among collaborating companies (Gabbay & Zuckermann, 1998).

Regional strategic networks

Network cooperation between organizations takes many forms, e.g. clusters, alliances, industrial districts and regional strategic networks (RSNs). The latter can be defined as cooperation projects involving companies in a region with the support of public agencies and other organizations, which strive to promote innovative network structures (Hallén & Johanson, 2009; Eklinder-Frick et al., 2011). Investing in or encouraging companies to networking in such RSNs is a common strategy used by municipalities to promote innovation and regional growth in peripheral regions (Håkansson, Ford, Gadde, Snehota & Waluszewski, 2009; Cooke, 2007; Sölvell, 2009; Coletti, 2010; Eklinder-Frick, 2011; Hallén & Lundberg, 2004). Local institutions act as intermediaries and play a relevant role in providing regional firms with new information and knowledge thereby supporting innovation (Camisón, 2004; He & Fallah, 2009; Camisón & Forés, 2011; Evers et al. 2010).

The emphasis of RSNs on the strategic aspect separates them from regional innovation systems (Cooke, Boekholt & Tödtling, 2000; Tödtling & Trippel, 2011) and from geographical clusters (Porter, 1990; Vatne, 2011). RSNs show more organizational traits such as clearly defined membership and a management group or hub responsible for designing the collaboration between the selected members (Gebert-Persson, Lundberg & Andresen, 2011; Lundberg & Andresen, 2011). The development of the RSN is therefore less organic and more strategically designed than regional innovation systems and clusters (Hallén & Johanson, 2009).

Several studies of the attempts of governmental and public investors to facilitate regional business networks have been made previously (Welch, Welch, Wilkinson & Young, 1996a; Welch, Welch, Wilkinson & Young, 1996b; Benz, 2001; Heidenreich & Koschatzky, 2011). However, Sotarauta (2010:387) claims that “[p]eople responsible for regional development often understand fairly well the need to construct regional advantage and build clusters, but they have not been given much advice on how to do it”, and the key management question of how to design networks has received relatively limited attention (Ireland, Hitt & Vaidyanath, 2002; Nosella & Petroni, 2007; Wassmer, 2010; Partanen & Möller, 2011). Previous research

provides models and theories for building inter-firm relationships, but the literature often deals with the issue in a dyadic perspective (Gulati, 1998; Ireland et al. 2002) and “disregard[s] the design of strategic networks or alliances, including several partners” (Partanen & Möller, 2011). Möller, Rajala and Svahn (2005) pose that “more knowledge about the organizational arrangements and managerial practices in nets aiming to create radical technological innovations and new business concepts is needed”, since “research regarding strategic nets is still in its embryonic phase”.

METHODOLOGY AND DATA COLLECTION

Case study research is a well-established methodology in industrial marketing and network research (Visconti, 2009) and plays an “important role in theory development within industrial marketing and the industrial networks paradigm” (Wagner, Lukasse & Mahlendorf, 2009:6). As stated by Borghini, Carù and Cova, (2010) the principal objective of case study research is “a deep understanding of the actors, interactions, sentiments, and behaviors occurring for a specific process through time”. According to Henneberg, Naudé and Mouzas (2010) the methodological challenge for current business marketing research is to conceptually integrate the perceptions and cognitions of the individual manager or actor into the industrial network approach. However, Henneberg et al. (2010) and Harrison, Holmen and Pedersen (2010) claim that no systematic research exists that links actors’ cognition and networking empirically.

The municipality of Söderhamn (26 000 inhabitants) is situated on the Swedish coast of the Baltic Sea 260 kilometers north of Stockholm. At the turn of the millennium Söderhamn was hit by major downsizing both in the private and the public sector, as both the telecommunications factory Emerson and a military air force base were closed down. Together with the previous management at Emerson, officials of the municipality set up a cluster initiative in collaboration with researchers at the regional university. In 2004 these three actor groups formed the regional strategic network Firsam of the triple helix type supported by the EU Regional Development Fund.

The project idea was to bring to market the combined competence and capacity of the 15 companies joining the Firsam network. The ultimate mission was to find a product idea to develop and produce jointly. Each company should be responsible for a step in the value chain. This demanded joint efforts in searching for new products, product development, marketing and financing. The aim was to develop Firsam into a permanent organization that in the long term would create business relationships equally important for the region as Emerson (Ericsson) and the military air force base had been.

Social network research has predominantly focused on quantitative studies of network structure (Granovetter, 1973; Burt, 1992; Breiger, 2004; Baer, 2010). The aspect of “character and culture of social relations in which economic actors are embedded together” are left widely unproblematized (Biggart & Delbridge, 2004; Daskalaki, 2010; Kajikawa, Mori & Sakata, 2011). Many researchers believe that a qualitative approach should complement quantitative findings since a multi-theoretical approach to inter organizational relationship is necessary to understand such complex phenomena (Eisenhardt, 1989; Halinen & Törnroos, 2005; Möller & Rajala, 2007; Coletti, 2010; Parmigiani & Rivera-Santos, 2011). In this paper such a multi-theoretical methodology is applied by combining qualitative and quantitative data, and by incorporating a multidimensional approach to the concept of social capital.

We started the research project through participant observations made during the initial phase of the network project, which lasted for approximately half a year in 2004. We also conducted in-depth interviews with all the involved companies during the first three months. Hence, the participating managers of all the 15 companies included in the Firsam network were interviewed in separate meetings, lasting 60-140 minutes. Very broad and open questions were formulated in order to let the respondents reflect freely over the network. After all the interviews were carried out and transcribed we started to sort the qualitative data by using open coding influenced by Strauss and Corbin (1998).

We met with the same managers for in-depth interviews in 2010 to follow up the development of the Firsam project as well as the managers' personal development tied to the Firsam venture. In 2010 the Firsam project was in its closing stage since it had failed to acquire additional funding. Out of the original 15 managers 13 were interviewed in 2010 along with two of the founders of the RSN project. The interviews conducted in 2010 addressed the same issues as the interviews conducted in 2004, and were sorted in the same manner. This enabled a comparative analysis between two points in time.

Some quantitative data were also collected through a questionnaire that was filled in by the same respondents that participated in the in-depth interviews. This was done both in 2004 and in 2010. The questionnaire dealt with issues regarding the respondents' current contacts with the companies included in the Firsam project. The questionnaires were filled out by the respondents themselves in the presence of the interviewer and collected at once. In the questionnaire the respondents were asked to assess how often their own company worked together with the other member companies of the budding strategic network by using a scale from 1 (not at all) to 5 (very often). The member companies were identified through aided recall as a list of company names was presented to the respondents. The qualitative data collected enabled the drawing of "directed" network graphs or so called "digraphs" (Iacobucci, 1994) depicting the Firsam network. In a digraph the relations depicted in the graph considers the direction of the contact, and the data are not dichotomous (binary) but valued as portraying a more or less frequent contact (De Mesnard, 2001) (see figure 1 and 2).

Social network analysis uses graph theory and matrix analysis for its empirical application (Semitiel García, 2006). These techniques enable mathematical calculations to obtain particular measures, such as size, density and centrality, to identify social networks and to study their structure. Density concerns the relation between the number of threads in a graph and the number of nodes (Borgatti, 1994; Degenne & Forsé, 1999) and is defined as ratio of effective to possible connections. Setting L as the number of threads (effective connections) and g as the number of nodes, density is

$$\Delta = \frac{L}{g(g-1)}, 0 \leq \Delta \leq 1$$

Besides the density of the whole network, social cohesion among sub-groups might be of importance in portraying the traits of a networks structure (Semitiel García, 2006). Emirbayer and Goodwin (1994) define social cohesion as the presence of a dense network with strong ties among a set of actors. Moreover, Contractor, Whitbred, Fonti, Hyatt, O'Keefe and Jones (2000) define the existence of group cohesion when there are forces holding group members together. The general properties of cohesive sub-groups are the mutuality of ties, the

frequency of ties among members, and the relative frequency of ties among sub-group members compared to non-members (Semitiel García, 2006).

According to Wasserman and Faust (1994) a measure of sub-group cohesion is the degree to which strong ties are present within rather than outside the sub-group. With the summation indicating the total number of threads tying together nodes within a subgroup divided with g as the total number of nodes in the network, and g_s as the number of nodes in a sub-group, a number higher than 1 indicates significant cohesion within that specific sub-group. Sub-group cohesion is thus calculated as

$$\frac{\sum_{i \in N_s} \sum_{j \in N_s} X_{ij} / g_s (g_s - 1)}{\sum_{i \in N_s} \sum_{j \in N_s} X_{ij} / g_s (g - g_s)} > 1$$

There are many ways of analyzing the structure of an actor-oriented social network (Semitiel García, 2006). An aspect to consider in actor-oriented social network theory is the degree centrality of a node within the network. Degree centrality is defined as the number of connections that a node has with other nodes. A node's degree therefore equals the number of nodes linked with it (Liao & Yen, 2012; Otte & Rousseau 2002).

Another aspect to consider is structural equivalence, which indicates that two actors occupy the same position in the network leaving their contacts redundant to each other (Lenski & Nolan, 1984; Nemeth & Smith, 1985).

ANALYSIS

Based on the review of previous research we identified the socio-economic, structural and actor-oriented dimensions as common denominators of social capital. In the present analysis we focus on the actor-oriented dimension, both because management action is directly concerned with actors in day-to-day network management and because the data from the case study particularly reflect the development on the actor level.

From the interviews conducted with the managers of the involved companies it is evident that they viewed the combination of the companies within the RSN as originating from two different cultures or markets: one group that had previous ties to the telecommunications manufacturer Emerson (prior Ericsson), and another group that had ties to another RSN involving local manufacturing companies. The companies belonging to the Emerson group were all involved with production and design of quite intricate electronic systems, while the other group ventured in manufacturing and welding mostly as subcontractors for large scale production. The respondents described these two groups as kept apart by differences of organizational culture and traits adhering to the different markets they were catering to.

When calculating the social cohesion of these two groups, the manufacturing group of companies measured 2.5 and the electronics group only 1.0. The manufacturing group can therefore be referred to as a cohesive sub-group, while the electronics group does not show internal ties that are significantly more prevalent than ties outside the group. There was in 2004 in other words one cohesive sub-group that to some extent excluded the other actors

within the network. It thereby seems as the sentiments expressed by the respondents also were manifest in the network structure.

When calculating the density of the Firsam network it was found that the ratio had risen from 0.205 in 2004 to 0.240 in 2010. The Firsam RSN venture in other words generated some novel connections between the involved companies increasing the networks structural density. When calculating the social cohesion in 2010 the manufacturing group, which had showed significant social cohesion in 2004, the value 2.25 was obtained. This indicates that the group was less cohesive than in 2004 but the sub-group was still more internally connected than externally. The group of electronics companies showed a 1.16 cohesion value that made it a significantly cohesive sub-group in 2010.

This indicates that the Firsam RSN had not managed to merge all the actors together into a single cohesive network, since the Firsam network incorporated two separate cohesive sub-groups in 2010. The respondents described this rift within the network in 2010 as a hindering factor towards creating joint business ventures within the Firsam RSN.

INSERT FIGURE 1 HERE

Three individual actors were selected for closer analysis in order to bring down the analytical level to an actor-oriented network perspective (Portes, 1998; Huber, 2009). This enabled us to investigate the relational or contact capital of the focal actors and put their positions in the network structure in contrast to the wider network of the entire RSN. The actors were chosen since they held different positions within the network structure and because they represented different network developments during the six years of the project.

Actor 1 was chosen because it enjoyed the highest centrality within the whole RSN network in 2004. It was also in a bridging position between the two sub-groups since it was one of the actors with strong relations to actors belonging to both sub-groups. Actor 2 was chosen since it was the actor with highest centrality within the significantly cohesive sub-group in 2004 and lacked any connections outside of this sub-group. Actor 3 was chosen since it was the only actor within the whole Firsam network that in 2010 became included in a different sub-group than in 2004. Also, Actor 3 was one of the actors within the whole network that showed the highest expansion of its actor-oriented network during the Firsam project.

INSERT FIGURE 2 HERE

Actor 1 was involved in the RSN of manufacturing companies in Söderhamn that was formed prior to the Firsam RSN. Actor 1 became a member of that RSN although the company also operated in other lines of business. Although Actor 1 was a relatively small company in comparison to the other actors within the Firsam project, it enjoyed both a bridging position and the highest centrality within the Firsam network. Actor 1 held such a central position in the actor-oriented network of 2004 that the risk for structural equivalence was imminent in the sense that the contacts provided through the RSN would be redundant to it.

Still, besides the strong two-way connection held by Actor 1 there is only a single one-way connection between the two sub-groups through node 2 in the electronics and node 2 in the manufacturing sub-group. This situation put Actor 1 in a position of being a technology broker between the manufacturing sub-group and the rest of the network, thereby overriding the possible drawbacks of structural equivalence.

The respondent representing Actor 1 described how subcontractors collaborated to improve products, and suggested that such collaboration should be the goal for the Firsam RSN:

Then this group of subcontractors in Sweden looked at the design of the hatch, to come up with suggestions on how to change it, in order to be competitive. We managed to narrow it down to three different components, or four, something like that. We basically changed the whole machine, and made it possible to mass-produce it. That made it much cheaper. That is how we must compete, in order to get any orders at all. (2004)

The fact that the respondent representing Actor 1 suggested such collaboration might indicate that the respondent was aware of its role as a technology broker and was used to bringing companies together to work on joint ventures.

In 2010 the actor-oriented network of Actor 1 was much denser than in 2004 and the structural equivalence between the involved actors consequently greater. The role of Actor 1 as a technology broker within the network thereby seemed exhausted since most of the surrounding actors had established other contacts between the two cohesive subgroups. Still, when the representatives of the other actors within the Firsam network were asked to mention different projects undertaken within the RSN many mentioned Actor 1 as a collaborating partner.

A representative of the management group within the Firsam project expressed it as follows:

[Actor 3] also worked together with [Actor 1] to design stuff for [a company producing specialized medical equipment]. That is a whole story in itself. There we managed to get some companies to work together and actually deliver some products. So when you look back, some projects really got launched.

This indicates that Actor 1 played a role as a technology broker within the Firsam network. Also, the mere fact that a lot of the actors within the network of Actor 1 by then were tied together and the actor-oriented network had become much denser also highlights Actor 1 as a technology broker. The respondent representing Actor 1 in 2010 described its role as technology broker in this way:

We are functioning as some sort of gateway into Söderhamn to our customers. We attract a lot of production to the area. By recommending for instance [Actor X] and the other companies we are trying to influence our customers to move more of their production here. But we get almost nothing in return from the other companies; they never refer anyone to us. I do not know if it is because they do not want to, or because they do not know how to. I do not think that they are used to bringing something like that up, or even discussing it at all.

Actor 2 is the actor with the highest centrality within the socially cohesive manufacturing sub-group. Also, in 2004 Actor 2 had no connections with the electronics companies at all. Structurally Actor 2 was thereby deeply immersed in a cohesive sub-group. In 2004 the respondent representing Actor 2 expressed sentiments that suggested that the respondent believed that he did not need to venture out of the socially established network:

Of course, if we had more time in which to concentrate on making new connections, both with suppliers and customers, that would be great. But, still, we are able to live up to our business concept since we have all the resources ourselves.

The respondent also expressed skepticism towards working with the electronics companies, and indicated that there were some companies that the respondent preferred to work with:

We are coming from completely different worlds, the electronics field and the manufacturing field. Also, there are some issues with this so called "Söderhamn spirit"; some companies you really want to help and support, since they are really fun people and interesting to meet, while you do not feel at all comfortable with others.

Actor 2's network connections within the Firsam network decreased in 2010, and Actor 2 also displayed less centrality within the manufacturing sub-group. Actor 2 had established some contact with an actor from outside the manufacturing sub-group, but Actor 2 is less connected to the whole Firsam network in 2010 compared to 2004. The respondent representing Actor 2 expressed some animosity towards the four managers of the Firsam RSN, and hinted that Firsam did not have the trustworthiness or regional know-how required to build a new strategic network:

The more you get to know each other the more trust is created, and that way it would have been resolved by itself in time. But it is not built by four people brought in from the outside that need to build a new network of contacts, which has no connection to the reality of the local businesses. It must be built from the inside. There were a lot of us that said, "By God, we could have been able to do so much more in [the previous RSN of manufacturing companies] if we had had the same resources as Firsam got". It was horrific to see four full time employees, millions of crowns getting spent and for what? Nothing more than we managed to do in [the previous RSN].

Actor 3 was a newly formed company in 2004 when the Firsam RSN was initiated. It only had one established contact within the Firsam network and only a few established customers overall. The respondent representing Actor 3 was generally very positive towards the Firsam project in 2004. The respondent highlighted the fact that Firsam incorporated companies from a wide variety of business fields and claimed that this gave opportunities for the involved companies and the region:

I see [...] enormous benefits to this project. You have full coverage within the production and manufacturing areas, everything from an idea to a finished product, really. There are also opportunities for companies to grow and develop in Söderhamn. All of a sudden there are a lot of facilities and workforce. This is a project that will hopefully be a driving force for the community.

In 2010 Actor 3's contacts within the Firsam network had grown substantially. Actor 3 was also the only actor that originated from the electronics group of companies in 2004 and in 2010 became more strongly included within the manufacturing sub-group. Actor 3 was still very positive towards the Firsam RSN in 2010, and saw the project as an opportunity to seize to form new contacts:

My opinion of Firsam is generally positive. I guess I am a networking kind of guy; I enjoy these kinds of clusters. I have continued down this line and built networks during the whole history of [Actor 3] even if that network obviously has grown to become much bigger than Firsam.

DISCUSSION

The dependence-oriented culture seems to play an important role as a component of the socio-economic dimension of social capital based on the information from the respondents within the Firsam case as well as in previous studies about the region of Söderhamn. Hammar and Svensson(2000) claim that the dependence-oriented culture is based upon few and very strong connections, and the empirical findings presented in this paper also show such social conformity among the Firsam participants. The dependence-oriented culture resembles the bonding form of social capital (Putnam, 2000) since it represents strong connections within homogeneous groups,excluding interaction outside the group. The socio-economic dimension of social capital within the Firsam case is therefore characterized by the bonding form of social capital, making the involved actors conservative in their social interaction. The respondents describe this as a hindering factor towards achieving technological cooperation within the RSN project.

If the making of a “learning region”(Florida, 2002; Morgan, 1997; Hauser et al., 2007)are a result of what Huber (2009) calls the“socio-cultural embeddedness of economic life” it is doubtful if Firsam managed to create such a learning atmosphere within the RSN.Slotte-Kock (2010) claims that networks or clusters adjust to the cultural and social context as well as to market conditions (Hauser et al.,2007). The social context is thereby described as counterproductive for creating an innovative environment within the studied RSN.

When analyzing the structural dimension of social capital within the Firsam RSN it becomes evident that the network identity consists of one cohesive sub-group excluding interaction with the rest of the network. The respondents describe how this sub-group is kept apart from the rest of the network by differences in culture and business orientation. This unwillingness of the cohesive sub-group to venture outside of its already established social network, and the consequent mistrust of outsiders, resemble the traits of the bonding form of social capital. High levels of conformity were therefore enforced (Feist, 1999; Zhou et al. 2009; Daskalaki, 2010) by the structure of the Firsam network, which hindered heterogeneous ties to form and technological innovation to flourish (Ruef, 2002).

When analyzing the “pattern of tie evolution” (Daskalaki,2010) within the structural dimension of social capital it is evident that even if the Firsam network had become denser in its structure in 2010, the network consisted of two cohesive sub-groups. The Firsam network therefore failed in becoming a cohesive network during the preceding six years. Instead, another significantly cohesive sub-group emerged and one remained, indicating that the bridging form of social capital did not break the bonds enforced by the structural cohesiveness of the sub-groups.

When analyzing the “actor-centered social networks” (Semitiel García, 2006)within the actor-oriented dimension of social capital it is possible to see how the network structure influenced individual cognition. Actor 1 enjoyed high centrality in the network and also occupied a bridging position within the actor-oriented network structure. He consequentially described the benefits of technology brokering and suggested such endeavors as the goal of the Firsam project. Actor 1 thereby seemed to be influenced by a logic coherent with the bridging form of social capital, a notion likely connected to his structural position within the Firsam network.

Actor 2 was the actor with the highest centrality within the cohesive sub-group in 2004, and lacked any connections outside this sub-group in 2004. Actor 2 also expressed an

unwillingness to interact with actors outside their established social network. In 2010 the actor was somewhat less strongly connected to the Firsam network as a whole. The actor also articulated that the resources invested in the Firsam project would have been better used if invested in developing the cohesive sub-group of manufacturing companies. Mistrust in the management group governing the Firsam project was expressed, together with a statement that the management group was “from the outside”. Since Actor 2 was strongly included in the cohesive sub-group that showed structural traits connected with the bonding form of social capital it is no surprise that the actor displayed sentiments very much associated with this form of social capital. Actor 2 clearly expressed a willingness to build strong bonds rather than weak and bridging ties, and a desire to stay within its socially established networks. This might be the reason why Actor 2 became increasingly alienated from the Firsam network.

Actor 3 was a newly formed company in 2004. Therefore it is not surprising that Actor 3 was very positive towards the Firsam project. Actor 3 did not have an established social group to “bind” itself to and therefore did not resist the changes in network structures that Firsam imposed. The actor did consequently not have any structural bonding form of social capital to interfere with the logic of the bridging form. No structural hindrance towards forming new bridging ties and using a bridging logic existed. Only culturally induced social capital within the socio-economic dimension may have influenced Actor 3.

CONCLUSION

In the Firsam case the socio-economic dimension of social capital was affected by the dependence-oriented culture. This culture is seen as stemming from the socio-economic history of the region, together with a cognitive stance adhered to the individuals residing in the region. It is described as influencing cognitive traits among the residents creating an abundance of the bonding form of social capital.

The traits of the bonding form of social capital from the socio-economic dimension also seem to be reflected in the structural dimension of social capital. A significantly cohesive sub-group within the Firsam network expressed feelings of alienation from the rest of the network due to cultural and business oriented differences. Such alienation is a trait associated with the cognitive bonding form of social capital. Bridging aspects of social capital and weak tie formation was thereby hindered, a hinder adhering to both the cognitive social capital infused by the socio-economic dimension and the structure of the network described in the structural dimension.

Both structural and cognitive aspects of the bonding form of social capital kept the entire network structure of Firsam from becoming cohesive. The Firsam “identity of the network” (Hoang & Antonicic, 2003; Burt, 2000; Partanen & Möller, 2011) thereby did not seem to have produced the balance of bonding and bridging ties that Daskalaki (2010) and Ruef (2002) believe to be of importance in creating innovation in network structures. Capitalizing on the “strength of weak ties” (Granovetter, 1983) is only possible if low levels of conformity are enforced by the network structure (Feist, 1999; Zhou et al. 2009). The network structure of Firsam did not foster such an innovative milieu.

In the actor-oriented dimension it is possible to detect how the involved actors respond to the implementation of the Firsam RSN in different ways. Actor 1 enjoyed a bridging position in its network caused by the network structure analyzed in the structural dimension. Actor 1

therefore displayed bridging social capital and a strategic use of weak and bridging ties. Structural traits seemed to over-ride cognitive aspects of social capital infused by the socio-economic dimension in the case of Actor 1. This indicates that structural aspects of social capital were more significant than socio-economic ones when explaining and managing individual behavior in RSN development.

Actor 2 is strongly included in the significantly cohesive sub-group which would indicate strong bonds between the actor and its affiliates. In the case of Actor 2 it thereby seems as if the structural aspects of social capital found in the structural dimension correlate with the cognitive aspects of the socio-economic dimension. Both these dimensions would logically infuse an abundance of the bonding form of social capital, a notion that is supported by the empirical data. The negative stance towards the expansion of the network structure posed by Actor 2 could thus be interpreted against the background of the actor's social capital. This attitude might also explain the demise in the actor's network connections in 2010. High centrality within a cohesive sub-group therefore seems counterproductive when forming bridging ties within RSN collaboration. Hence, managing such individual embeddedness might be of importance in creating an innovative environment within an RSN.

Actor 3 was not included in the network structure of Firsam in 2004 and was consequently not affected by any structural form of the bonding social capital. Only the socio-economic dimension of social capital might consequently have an effect upon Actor 3 in regards to networking within the Firsam project. The actor seemed on the other hand driven by the thought of strategically extending the network by building bridging ties. The empirical finding therefore suggests that the effect of the bonding form of social capital related to the socio-economic dimension did not affect the actor to any large extent. This might indicate that the socio-economic dimension only had limited impact upon this actor's strategic networking, yet again elevating the importance of structural social capital over socio-economic factors.

Understanding both collective and individual behavior in network settings enables strategic managing of innovation networks and RSNs. Hence, practitioners might be aided in achieving technological innovation within an RSN by paying close attention to these different dimensions and how they might interact to influence the development of a network. It seems from investigating the Firsam RSN that the structural and actor-oriented dimension of social capital correlated well with the expressed views of the interviewed actors. Actors with high centrality within the whole network and with low structural equivalence seemed to be more positive towards forming new collaboration, and the actor with high centrality within the cohesive sub-group seemed less positive towards forming bridging ties. Understanding, analyzing and balancing such structural and cognitive relations on both a holistic and actor-oriented level might help a manager of an RSN to create the best possible prerequisites for an innovative milieu.

The three proposed dimensions of social capital also provide an empirically grounded contribution to the development of the concept of social capital, although further research should be done in testing the interaction between the dimensions.

The cognitive traits of social capital that were presented together with an analysis of the network structure contributed to deeper understanding of the Firsam project when the actor-oriented network structure was put in relation to a holistic analysis of the entire Firsam network. The analytical leap from the individual to the collectivity (DeFilippis, 2002; Camison

& Forbes, 2011) might thereby be bridged to some extent which facilitates the management of networks.

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	Slotte-Kock & Colviello (2010)	Antonacopoulou & Chiva (2007)	Möller & Halinen (1999)	Westlund (2006)	Rozenblat (2010)
Dimensions					
Socio-economic	The macro-environment	Societal aspects	Industries as macro networks	Societal level	Interurban level
Structural	The network		Strategic nets		Collective level
Actor-oriented	The focal firm	Relational aspects	Net and relationship portfolios, strategic relationships	Organizational level	Interpersonal level

Table 1. *Proposed dimensions of social capital in relation to levels and dimensions in previous research*

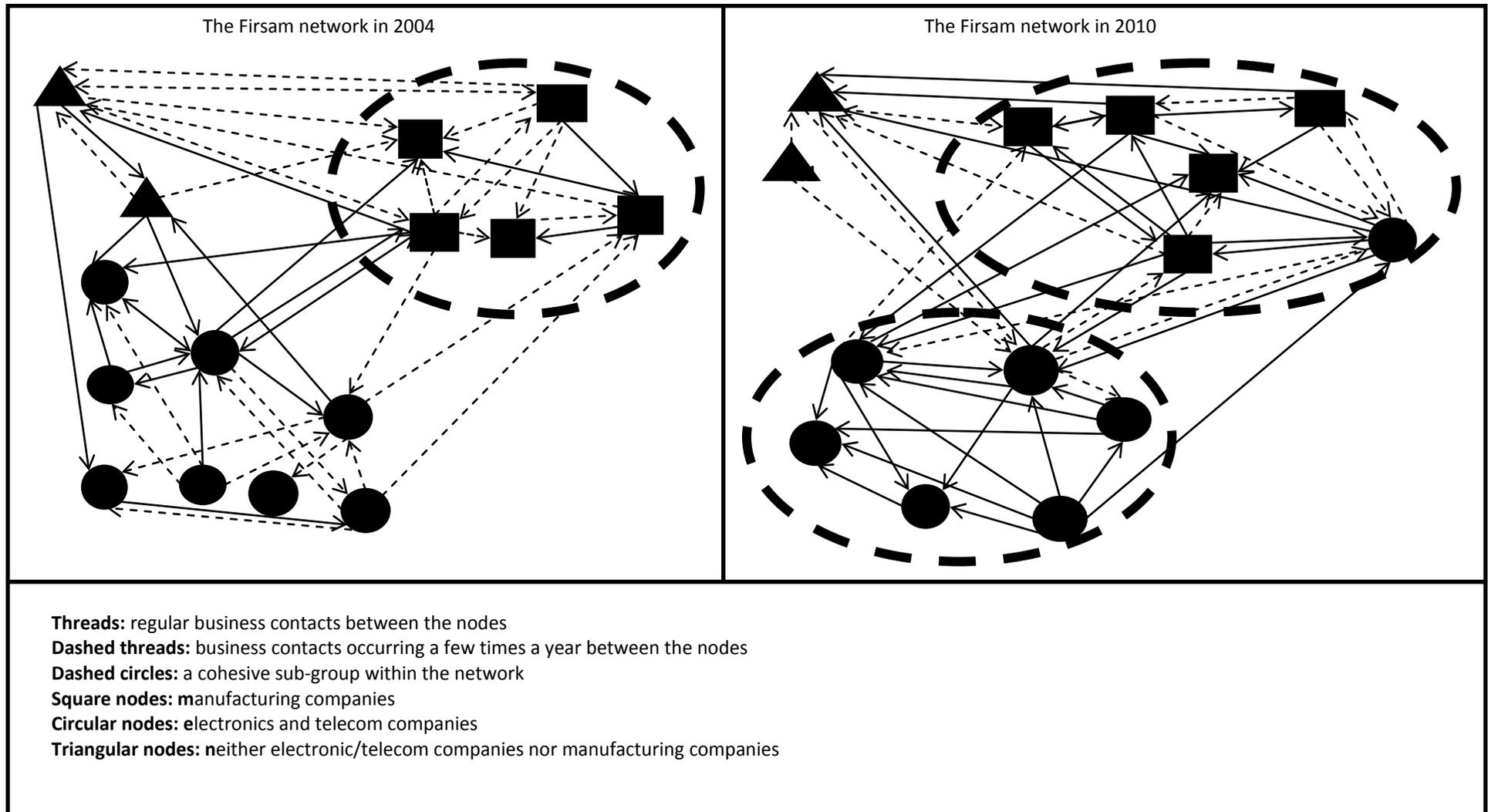


Figure 1: *The Firsam network in 2004 and in 2010*

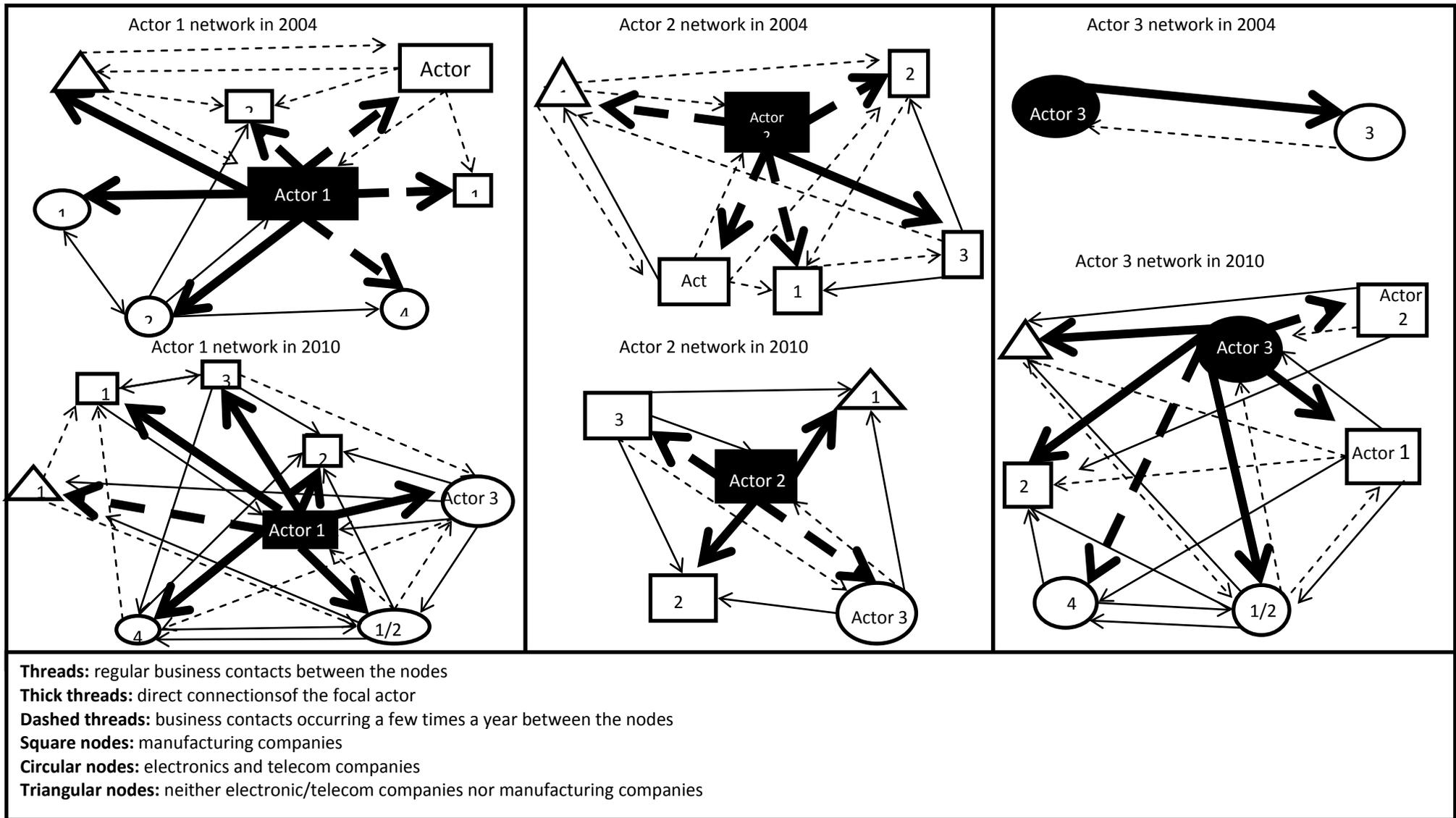


Figure 2: The actor-oriented networks of selected actors within the Firsam project