Building Relationships Across Multiple Levels for Born Global Innovation

Paper to be presented at the IMP 2007 Conference,
Manchester Business School, August 30 – September 1, 2007

Authors:
Sigvald Harryson, Associate professor Sigvald.Harryson@hik.se
Hans Jansson, Professor Hans.Jansson@hik.se
Sandra Kliknaitė, Ph.D. student Sandra.Kliknaite@hik.se
Rafal Dudkowski, Ph.D. student Rafal.Dudkowski@hik.se

All at the Baltic Business School of Kalmar University
SE-391 82 Kalmar, Sweden
Fax: +46 480 497 110

Abstract
This paper examines how variables such as relationships, network structures and degree of external collaboration at one level of analysis influence innovation at another level. The analysis suggests that a dominance of weak ties is required for exploration in open creativity networks, whereas strong ties are required for exploitation in more closed process networks. Empirical results illustrate how social networks are dominating the organizational networks and act mainly as antecedents of organizational networks, and how social ties at the individual level of analysis interact with institutional and economic ties at the organizational level to drive born global innovation.

Key words: Innovation, R & D, network theory, multi-level approach, Annoto

INTRODUCTION

When the knowledge base of an industry is both complex and expanding and the sources of expertise are widely dispersed, the locus of innovation will be found in networks of learning, rather than in individual firms (Harryson and Lorange, 2005; Powell et al., 1996; Yamin and Otto, 2004). It seems to be widely accepted that innovation is based more upon personal interaction, emulation (Polanyi, 1948) and joint learning among a variety of actors than upon the pure upstream and quite isolated technology development process. Rather than being confined to a lone inventor in a research laboratory, or to a few firms, innovation is a learning process that takes place through open collaboration among a considerable number of users and producers (Mansfield, 1971; Badaracco, 1991; Berthon et al., 1999; Rigby and Zook, 2002; Sawhney, 2002; Chesbrough, 2003a; 2003b; 2004). The greater ability to identify and bring in external ideas and technologies enhances a company's flexibility to respond to changing customer needs. Conversely, the pursuit of specialization for technological leadership requires a very stable and deeply rooted architecture, or architectural stability, in its technology problem-solving process (Harryson, 2002; Kline et al., 1991; Leonard-Barton, 1992; 1995). If a stable structure of technology architecture is imposed on a product development process requiring a new product concept, unique and new combinations of technological knowledge might be prevented (Kline and Rosenberg, 1986; Lorange and Nelson, 1987; O'Connor et al., 2001; Florida et al., 2002). Both external and internal networking abilities are lost and the problem solving in product development becomes subordinate to the internally developed and continually increasing technological knowledge. In this sense, a strong focus on internal specialization can leave many people in marketing, R&D and design and manufacturing short of the cross-functional learning skills they need to manage the transfer and transformation of scientific knowledge into product innovation (Hedlund, 1992; 1994; Harryson, 1997). The consequence is that any transfer and transformation of tacit knowledge may require transfer of the actual carrier of that knowledge (Allen, 1977), which poses significant challenges and costs (Kogut and Zander, 1991) that need to be addressed at different levels of increasingly complex innovation networks.

Research in the management and organization science had been characterized by a variety of different levels of theory and analysis leaving them highly fragmented and disintegrated (March, 1996). During a long period, this split into macro and micro domains of management research has prevented multilevel approaches to emerge (Tosi 1992, House et al., 1995). Hackman (2003) argues that researchers generally conduct research being initially anchored at a particular level of analysis (individual, group or the organization level), but later they often refer to the next lower level for explanatory perspective, being lured by a tendency of "reductionism". As a precondition for understanding social and organizational dynamics, Hackman (2003) argues that a focus both on higher as well as lower level of analysis is required. Many scholars made similar conceptual efforts to better understand the complex nature of organizations, and cross-level analysis has received increasing attention in the organization research literature over the last decade. In this context, we apply multilevel theories to span the levels of organizational behavior and performance and close the macro-micro gap, which makes a deeper and richer understanding of organizational phenomena possible (Klein et al., 1999). Carpenter and Westphal (2001) blend macro-environmental and socio-structural context with micro-behavioral processes to examine how a combination of external network ties determine a Board's ability to contribute to the strategic decision making processes.

While some multilevel research efforts have been made, the empirical research that reflects these views remains scarce. In particular, relatively few scholars have analyzed the impact of organization on individual and group behavior, or the impact of individual and group behavior on the organization. As argued by Klein et al. (1999), the main barriers to the development of multilevel theories reside in: the variety of the aspects of theory and

research available; diverging values and research interests of macro and micro scholars; difficulty of determining the appropriate scope of such theory and the related problem of conducting multilevel research.

Although innovation typically involves processes and activities that exist at multiple levels across industry, organization, team and individuals, most innovation researchers tend to focus at one or two levels of analysis without taking the many cross-level interdependencies into consideration. In this context, Nonaka (1994, 20) views organizational knowledge creation as "an upward spiral process, starting at the individual level, moving up to the collective (group) level, and then to the organizational level, sometimes reaching out to the interorganizational level." Our paper integrates the macro and micro perspectives (inter-organizational, intra-organization and individual) of the networking theory across the domain of innovation management. This cross-level account examines how relationship building between a networked start-up company and strongly established alliance partners allow for born global innovation to happen.

Networks emerge because no organization is self-sufficient in R&D, but rather dependent on extra-organizational resources for its sustained competitiveness. As each individual product development activity can be seen as part of a total knowledge creation process, which in turn may be an integral feature of a specific network, it follows that a network perspective will help us more fully to understand corporate technology and innovation management processes. With respect to the increasing intensity and extensity of knowledge, companies need to excel both at in-house research and at cooperative research with external partners, such as university scientists and skilled competitors, to move quickly in identifying new projects and funneling them inside the organization for accelerated innovation (Ahuja, 2000; Hedlund, 1995). The question arising in this context is: what type of network ties serve the purpose of supporting exploration versus exploitation of innovation? There seems to be a risk that excessive focus on exploitation will divert the resources away from exploration and stifle the innovativeness of the company. However, too much focus on exploration can impair the ability of the company to appropriate and capitalize on the innovation (March, 1991; 1999; Levinthal and March, 1993; Murray, 2001). The key-question emerging in this context is: to what extent can a company pursue both exploration and exploitation and at which levels of an innovation network do these complementary activities take place?

MAIN PURPOSE

A theoretical framework has been developed to analyze this major issue by allowing for contributions and activities operating at different levels to be considered in combination. The main purpose of this paper is to present and illustrate this framework and describe how it was developed. While the theoretical framework is based on a total sample of ten companies, the paper presents the case that best illustrates this framework in terms of cross-level innovation in collaboration with academic research and with global partners. This case illustrates how Anoto's approach to accessing and making use of complementary assets shifts across levels over the innovation life cycle.

THEORETICAL FRAMEWORK

The Paradoxical Organizational Needs of Radical Innovation

Based on Burns and Stalker (1961), it seems to be widely accepted that the creation of radical invention requires flexible organizations that are relatively flat in hierarchical levels, informal and collegial, with cosmopolitan researchers who have numerous contacts outside the firm (Betz, 1987; Brockhoff, 1990; Peck, 1990; Quinn, 1985). Such a system in which

autonomy of individuals is assured is also more likely to establish a basis for self-organization and widen the possibility that individuals will motivate themselves to acquire and create new knowledge (Hedlund, 1986; 1990; Nonaka, 1988b; 1994; Ridderstrale, 1997). As opposed to inventive exploration, when the optimal size may be fairly small (Mansfield, 1971; Mansfield et al., 1977; Kline and Rosenberg, 1986; Nonaka, 1988a), the commercial exploitation through rapid processing of an invention towards innovation usually calls for institutionalized routines in a rather large, bureaucratic organization with clear hierarchies (Mansfield, 1968; Nelson and Winter, 1982; Knott, 2002). That hierarchic control is associated with decreasing innovativeness has been noted by a large number of authors after Burns and Stalker (Hedlund, 1990; Nonaka and Konno, 1998; Nonaka et al., 1994; Martins and Terblanche, 2003; Stern, 2004). Based on these arguments, the ideal organization for creative invention seems to be the opposite of the one that yields rapid innovation. While the creation of novelty through proactive unlearning is key to exploration, consistency through incremental improvement of well-defined structures carries the day in organizations geared towards knowledge exploitation.

According to Duncan (1976), ambidextrous organizations can reconcile conflicting demands by implementing 'dual structures' – organizational arrangements that enable innovation while also cultivating existing business. In other words, ambidextrous organizations can embrace both incremental as well as revolutionary change and create an environment in which both established as well as emerging businesses can coexist (Herberet al., 2000; Tushman and O'Reilly, 1996; Knott, 2002; Ichijo, 2002); Katila and Ahuja, 2002; Birkinshaw and Gibson, 2004; Gibson and Birkinshaw, 2004). In this context, He and Wong (2004, 492) conclude that 'the organizational tension inherent between exploration and exploitation may become unmanageable when both are pursued to extreme limits'. It would be a challenging act of ambidexterity to combine organizational opposing extremes like this. Our paper argues that it is possible to use networking and relationship building across different levels of analysis to leverage and combine the desired characteristics of small and big and of heterarchy and hierarchy. Although the literature is replete with insights regarding ambidextrous organization, there is no clear formulation of a general theory explaining ambidexterity (Adler et al., 1999). With this paper, we intend to explain the link between ambidexterity and cross-level innovation. This type of cross-level innovation will be explored further by introducing a network perspective that will allow for a more complete and enriched perspective of innovation and the innovation process by exploring and illustrating how:

- Variables at one level of analysis influence innovation at another level.
- Variables at different levels of analysis interact in determining the extent and type of resulting innovation.
- Innovation processes and specific networking mechanisms can be applied across different levels of an innovation eco-system.

The Network Framework

A network approach is perfectly suited to analyze cross-level innovation. Firstly, a network is loosely coupled, which means that it contains interdependent actors that vary in the number and strength of their interdependencies at the same time as they are subject to spontaneous changes and have some degree of independence. A network is simultaneously open and closed, indeterminate and rational, spontaneous and deliberate (Orton and Weick, 1990). Contrary to organization theory, inclusive of inter-organizational theory, organizations are not taken for granted. Rather, a closer look is taken at organizational boundaries and how they are organized.

Secondly, a network approach provides a dualistic quality of combining the whole with the particular by giving a holistic view of entire organizational/social structures as well as

illuminating particular elements within such structures (Knoke and Kuklinski, 1982; Jansson et al, 1995). Accordingly, the focus of the network approach is not entirely on the network within and around a particular actor and how it assists this actor to achieve goals, e.g., the organization set (Aldrich and Whetten, 1981). Neither is the network seen as a whole, where the function of the individual components is to serve the interest of this totality. Rather, the networks have both these characteristics. Actors within the network have both their own interests and are part of a larger collective with a right to carry out work on behalf of the whole network.

Thirdly, by using network theory, it is possible to analyze how organizations and persons coordinate activities to solve the organizational dilemma at different organizational levels. Networks are often divided into different levels so as to better concentrate the level of analysis to a specific phenomenon where the main-activities happen at that specific stage of the innovation process. In accordance with Brass et al. (2004), we take a multilevel perspective to networks and distinguish between three levels of networks: interpersonal or social networks, interunit networks, and interorganizational networks. The latter two are both organizational networks. These major types of networks interact in the way that activities at one level result in consequences, which become antecedents for another level. For example, the formal organization structure of an organization can be seen as a hierarchically determined network, which is seen as an antecedent for the interpersonal network, since it determines how individuals build networks among themselves, inter alia constraining the formation of informal relationships. Similarly, the resulting structure of the informal social network becomes an antecedent to the interunit network, since it influences the pattern of cross-unit connections. This division of levels also includes a division between external and internal networks, where interunit networks are internal and interorganizational networks external, while social networks can be both internal and external. This means that the definition of organizational networks is broad and includes relations between organizations that lack formal authority over one another as well as relations between organizations, where there is such a formal authority. Organizations are linked to each other in different ways. Some are loosely connected, rather market-like autonomous organizations where entry into and exit from the network is relatively easy. Networks characterized by opposite traits are more similar to hierarchies. Social network relationships take place between individuals and how they form networks influences the formation of organizational networks. These network ties are therefore socially embedded. Actually, the main network theories concern such social networks, e.g. ‘social exchange theory’ (Blau, 1965), ‘weak/strong ties theory’ (Granovetter, 1973) ‘social embeddedness theory’ Granovetter (1985), ‘structural holes theory’ (Burt, 1992) and ‘social capital theory’ (Coleman, 1988).

Based on Granovetter (1973), Hansen (1999) uses a network study to explore how weak inter-unit ties help a new product development team with purposeful knowledge-sharing. His findings are that while weak ties help the team find new knowledge located in other units, they are not useful in supporting the actual transfer of complex knowledge. The more complex the knowledge, the stronger the ties required to support its transfer. Research findings by Uzzi (1996), Rowley et al. (2000) and Van Wijk et al. (2004) confirm that strong ties are positively related to firm performance when the environment demands a relatively high degree of exploitation and weak ties are beneficial for exploration purposes and to prevent the network’s insulation from market imperatives.

Based on the arguments outlined above, it seems reasonable to assume that strong and weak ties are complementary from the perspective of time, and that the structure of an ideal network should maximize the yield per primary contact. We also learn that weak ties are likely to accelerate development speed in early phases of exploration when the required knowledge is not complex. Conversely, weak ties may slow down speed in situations of high knowledge complexity where strong ties are required to support exploitation of innovation. It

seems that radical innovation requires management of both weak and strong ties cutting across both peripheral and core networks with a strong focus on developing and managing relationships for transfer and transformation of information into innovation across multiple levels. Based mainly on such arguments, Harryson (2002) makes a distinction between three interrelated network levels with different foci:

Extracorporate creativity networks with weak ties as primary sources of specialized knowledge and technology focused on exploration through collaboration with external partners;

Intracorporate process networks with strong ties focused on exploitation of innovation through strong linkages between R&D and marketing & sales (M&S) for market alignment, and from R&D to design & manufacturing (D&M) for commercialization;

Transformation networks focused on interlinking the complementary creativity networks and process networks. This is where and how cross-level innovation seems to happen.

Insert Figure 1 about here

Our model serves as a starting point of the theoretical framework and guides the empirical as well as the theoretical analysis. The perhaps less well-explored challenge seems to be how to manage external 'creativity networks' both for steering of direction during exploration, and for transformation and internalization of the results so as to secure exploitation of innovation. In this context, we see a strong need to understand the role of transformation networks to analyze when and how which types of ties and relationships contribute, respectively, to exploration and exploitation of innovation.

THE INNOVATION NETWORK THEORY

The network theory for innovation networks builds on three major divisions made in industrial network theory between networks as relationships, as structures, and as a process (Easton, 1992). In the first case, the focus is on the relationships of the innovation network, e.g. what they look like, how they are established, or whether they are direct or indirect. Network structure concerns the number of links and the degree to which the nodes in the form of organizations or persons are linked to each other. Network relationships concern flows or processes, e.g., the sequence over time of the particular activities going on within the innovation network.

Networks as Relationships

The relationships part builds on Jansson (2007b) and Jansson et al. (1995), which are developed further by making a distinction between three major aspects of relationships: purposes, types, and directions. Of the two major purposes, instrumental factors concern the tasks or purposes of the innovation network or of its environment. Social factors express the social aspects of networks, which may be instrumental but not necessarily so. There are two major types of relationship contents (resource exchange and social exchange), and three types of directions (vertical, horizontal, and diagonal).

Purposes

Purposes, or reasons for establishing relationships, differ between organizational and social networks. Either organizations are connected for instrumental reasons, or they are connected for social reasons (socially embedded). Instrumentality is defined as purposive action, i.e., organizational units or persons are assumed to make conscious, intentional decisions to establish relationships. Social relations concern the embeddedness situation as they naturally concern the human side of relationships or how social relations result in

organizational relationships. So both some kind of instrumentality is behind organizational relations as well as some social reason through the social network forming an organizational network (Oliver, 1990).

Types

There are two main types of relationship contents: exchange of resources and social exchange.

(1) Exchange of resources is mainly related to how the instrumental factor is expressed as a relationship between organizations. There are two main types of flows, one constituting a material resources network and the other a communications network. Innovation networks are mainly characterized as a communications network, where intelligence such as information and ideas as well as skills, knowledge, and solutions are exchanged.

(2) Social exchange (sentiments). Friendship and trust are the expressive, or emotional, factors of the linkage – both originating out of the social element. Social exchange, in contrast to economic exchange, is signified by unspecified obligation as it involves the principle that one person does another a favor, and while there is a general expectation of some future return, its exact nature is not stipulated in advance (Blau, 1964). Diffused future obligations are created and are not precisely specified as in economic exchange. Social exchange requires trusting others to discharge such unspecified obligations.

Trust

Establishing trustful relationships is a critical part of innovation networks (Harryson, 2002). Trust is mainly related to social exchange in the social network, where a distinction is made between organizational trust and individual trust (Jansson, 1994; 2007a). Organizational trust is a relation between an individual and an organization, i.e., combining the social and organizational aspects of the network. However, it does not mean that it is less emotional than other person-to-person relationships, since an individual may be highly involved in an organization, and identifying with it through its brand in a very personal way. Reputation is an expression of this trust. Individual trust regards persons and the friendship among them, i.e., the social network. One type of individual trust is related to coalitions and concerns the individual as a representative of his or her company. This type of trust is defined as professional trust, since it has to do with how tasks are completed together with other individuals, and is more instrumental than emotional. An employee can, for example, be expected to complete his tasks in a certain way, not being biased from undue influences. This relationship is personal and formal. The connection between the social and organizational networks becomes another than for organizational trust. Professional trust originates from the organizational network, is established through the social network, and strengthens the organizational network.

Directions

Relationships take place towards various directions. A distinction is made between three types of relationships. The traditional buyer/seller relationships along the vertical value added chain is defined as vertical relationships. Innovation networks for product development in industrial markets are often vertical, since they mainly involve suppliers and customers Håkansson (1987; 1989; 1990). Relationships with competitors are defined as horizontal relationships, e.g., when proprietary innovations are licensed to competitors. Normally, parties outside the market are key members of innovation networks, e.g., universities and other research bodies. Relationships with such persons and organizations for innovation purposes are defined as the diagonal part of the innovation network.

Networks as Structures

The network structure expresses a certain combination of nodes and relationships. Connectivity or the degree to which the organizations or persons are linked to each other is a major aspect of the network structure. The other two are the number of direct links and the number of indirect links that organizations have (Ahuja, 2000).

Arm's length and hierarchical networks

A distinction is made between arm's length (external) and hierarchical (internal) networks. Arms-length relations are formed to facilitate concerted action on the part of autonomous organizations in situations, where there is no formal authority to impose coordination, e.g. concerning buyer/seller relationships or creativity networks. An arm's-length network consists both of market and non-market relations. A network having an authority directly present within the network to control it is defined as a hierarchical network, e.g., an MNC.

Action and organization networks

A distinction is made between action and organization networks (Aldrich and Whetten, 1981; Jansson et al., 1995). The action network is a temporary set of units, which has been established out of different units in the organization network for a specific purpose, e.g., to solve and transfer a customer solution or for creating a new product/service. A *transformation network* is an example of an action network, which is established to transform knowledge from the arm's length creativity network into a product/service. When the task of this internal/hierarchical network is completed, the action network is dissolved, the units remaining in the organization network awaiting formation of future action networks.

Open and closed networks

Along the connectivity dimension of the social network, a distinction is made between open and closed social networks. Based on the idea that organizations are embedded in social ties (Granovetter, 1985), the characteristics of these networks are also assumed to be valid at the organizational level of the network. In most research on innovation networks, this similarity is taken for granted and is not discussed (e.g., Ahuja, 2000; Gulati, 1999; Gulati and Garguilo, 1999). The open network is mainly about resource exchange of information, while the closed network focuses on social exchange, trust and shared norms. An example of an open network is one in which firms have direct social contacts with all their partners, but these partners do not have any direct contacts with each other. A high number of such non-connected parties, or structural holes, means that the network consists of few redundant contacts and is information rich, since people on either side of the hole have access to different flows of information (Burt, 1992). Burt (1993) argues that to enhance network efficiency an actor should focus on maintaining only primary contacts and delegate the task of maintaining all (complementary) contacts to these primary contacts. The major selection criterion for such partners then concerns how many contacts they have. This implies that the structure of an open network is suitable when gathering, processing and screening of information is the primary purpose as well as identifying information sources. This kind of innovation network then stresses the indirect linkage, has mainly weak relationships and is loosely coupled. The opposite is the tightly coupled closed network, where all partners have direct and strong ties with each other. This network is centered on social capital, which is built through trust and shared norms and behavior (Coleman, 1988). The contradiction between open and closed networks is also stressed by Ahuja (2000), who proposes that the larger the number of structural holes spanned by a firm, the greater its innovation output. There seems to be a trade-off between a large network that maximizes information benefits and a smaller network promoting trust building and more reliable information. This contraction is studied by Soda et al. (2004) regarding the organization of

project teams. They found that the best performing teams (action networks) are those with strong ties among the project members based on past joint-experience, but with a multitude of current weak ties to complementary (non-redundant) resources.

The main-contribution of our article is to illustrate and analyze how a strongly networked company performs revolutionary innovation across the previously introduced creativity-, transformation-, and process networks.

METHODOLOGY

The methodological strategy behind this research is mainly abductive, being a mix of deduction and induction (Alvesson and Sköldberg, 1994; Jansson et al., 1995; Dubois and Gadde, 2002). The purpose is theoretical development with a final stage of theory validation rather than theory generation based on grounded theory approaches. The empirical support of a theory is continuously assessed, or, inversely, a reality's theoretical support investigated through the matching of theories with realities. This process has started from a more preliminary frame of reference, using the case-study approach (e.g., Merriam, 1998; Yin, 1991). The framework has been continuously refined through changing perspectives between deductive and inductive approaches. The final aim is to create a solid theoretical and empirical base, while at the same time strengthening the practical validation of the research by making the results relevant for organizations and society. The extensive case study data base made it possible to establish a more general theoretical framework, which is used in this article. Through the in-depth case study method a large extent of information has been collected from a limited number of research units. The goal was to gain a deeper understanding and knowledge of "how" a selected few companies in Japan[1] and Europe[2] – that can be seen as innovation leaders in their respective businesses – manage the transformation between internal and external networking to enhance impact and speed of innovation. The primary instruments in the data collection have been interviews with audio recording and transcribing, including several types of documentation. There has been a continuous interchange between empirical data and theory, as empirical findings initiated the search for further theories. Internal validity concern has been addressed through the use of multiple sources for the case studies in terms of number of interviewees and their positions in the organizations. Complementary information has been gathered from corporate publications and from other literature. By having key informants review the case reports in several iterations, the issue of construct validity and reliability have been addressed as well. Both documentation and interviews were used to collect data. The information obtained during the interviews was summarized as soon as possible after each interview and sent back for review. Effort was also put into identifying the proper (additional) person(s) to interview. In addition, we organized three large seminars at which we presented the empirical research to all the European benchmarking companies for a group-wide dialogue on best practices regarding knowledge transfer in cross-level innovation. This has enabled us to get further detail in the feedback process to secure internal validity. Since our empirical research is based on ten different companies of different size and industry we believe that a good base for generalization is offered – within reasonable limits. The process – as outlined above

[1] 150 interviews were made in Japan between 1993 and 2002 – primarily with Canon, Sony, and Toyota to explore how these companies perform cross-level innovation in general, and how they leverage external sources in particular, as the main source of creativity and exploration so as to put the internal focus on exploitation and commercialization of the externally created invention.

[2] Between 2002 and early-2006, we have made approximately 160 interviews on cross-level innovation – with Northern European technology-intensive companies like Anoto, Bang & Olufsen, Gambro (medical equipment and biotechnology), Porsche, SIG Combibloc (highly innovative packaging company) and leading Finnish and Swiss mobile operators.

– of jointly reviewing the results with the research partners has partly also served the purpose of enhancing generalizability.

CASE STUDY – ANOTO – BUILDING RELATIONSHIPS FOR BORN GLOBAL INNOVATION

The founder, Christer Fåhreaus, was in his second year of graduate studies in mathematics and physics when he came up with the first breakthrough idea of Anoto. He wanted to make a digital pen that would read and store the parts of the text that you mark from any kind of printed text, and then download these selected parts on your computer. He turned to Torbjörn Gärdfors, who was the CTO of the Lund-based company Ericsson Mobile and they jointly sold the idea to the Board of Directors. However, while the BOD was convinced of the commercial viability of the idea, they did not see a strong enough fit to develop this type of technology and product within Ericsson Mobile. Instead, Christer got financial support from Ericsson Mobile and the 'founder' of this division of the Ericsson Group to start his own company to develop and commercialize the digital pen. Christer founded a company called C-Technologies, which was the starting-point of the Anoto Group. C-Technologies managed to recruit a lot of highly skilled engineers such as the aforementioned CTO, and the Chief Science Officer of Ericsson Mobile, as well as good student friends from Lund University and the Lund Institute of Technology and grew very rapidly into a company with brainpower to go far beyond the initial idea of the digital pen – called "C-Pen".

Leveraging Academic Brainpower to Build Intellectual Assets

Anoto started its exploration by absorbing skills from the strong university base of Lund in Sweden by running 30 joint master theses and 3 fully integrated PhD thesis projects over its first three years of operation. The success of the very advanced underlying research was strongly related to highly skilled individuals who were recruited based on personal contact networks. New employees were always handpicked from the personal networks of trusted employees. The original Anoto staff recruited people who knew were to find other engineering stars based on previous experiences, such as old co-workers and friends. A snowball-effect occurred as these newly recruited stars also brought along their personal contacts. This is how Anoto managed to achieve a rapid recruitment pace without losing focus on quality.

Through his personal enthusiasm, Christer Fåhreaus managed to make the most talented engineers highly motivated to break new ground and together they came up with a new original idea. They made a new type of digital pen – combined with digital paper to be used the old fashioned way, while simultaneously being connected to the digital world. This was made possible through a miniaturized camera that registers the movement of the pen across the digital paper and stores the information as series of map coordinates.

Leveraging Intellectual Assets to Attract Capital

The initial invention and the resulting academic collaboration resulted in more than 40 patent applications within the first year of the innovation cycle. This gave Anoto enough bargaining power to attract significant capital both from company investors and from venture capitalists. For example, Ericsson invested €16,6 mio for 17,9 per cent of the company. Several other global companies and investment funds followed the example at similar or higher evaluations. Christer Fåhraeus, defends his strategy:

> *When we had made the breakthrough, we first devoted six months to protect our initial discovery with 40 patent applications before going live with a press-conference in London together with partners like Ericsson, Time Manager and 3M… If you*

> *develop new technologies and products for a mass market it is very important that you protect them with patents. Once the market grows, the licensing revenues will grow accordingly. (Interview, 17.09.2005)*

Building Relationships to Global Partners for Exploitation

After 18 months of successful exploration with close to 300 patent applications as a result, Anoto started to establish partnerships with large corporates like Ericsson, Sony-Ericsson, Nokia, Hitachi, HP and Logitech so as to secure commercial exploitation of the technology and promote it into a global de-facto standard. A critical person in developing the new relationships to the combined investors and technology commercialization partners was Mr. Örjan Johansson.

In 1996, long before the creation of Anoto, Örjan was contacted by Nils Rydbeck at Ericsson (the 'father' of the Ericsson mobile phone, the former CTO of Ericsson and the person who later sponsored the creation of Anoto) who wanted him to work with a new project, MC-Link. It was a new technology and Ericsson wanted it to be a world standard for short-distance-radio. Örjan's mission was to build an organization with the purpose to compose the standard. To succeed with this he realized that he needed help from other big companies in the relevant customer segments of mobile communication (Interview, 27.05.2004):

> *Our intention was to establish a global standard and thereby add value to the mobile phone, and drive technology sales. To set a de-facto standard is about finding the 'big players' within the areas and segments where the standard will be used; primarily in the industries of mobile phones and lap tops. It is far from trivial to get agreement on a standard among rivals.*

Örjan Johansson started to create a special interest group (SIG) to set a global de-facto standard called Bluetooth. The background of the name relates back to an important Scandinavian Viking – Harald Bluetooth – who became the symbol of this SIG. This was to highlight the important Viking-principle of never having a dinner-party without first settling any possible tensions among the Viking Kings in an open and straight atmosphere. Once all frictions had been eliminated, the party could start.

In a similar vein, Johansson would always encourage all meeting-participants (the 'Kings' of large rivaling companies) to first ventilate any possible divergence of opinion, or conflict of interest, and then move into an evening of wining and dining for continued relationship-building. According to Johansson (Interview, 27.05.2004), *'this was crucial in order to have a constructive meeting the next morning with an open atmosphere of fair compromise in the name of collective progress'*. To highlight the symbolic importance of this Viking-principle, a bestseller[3] about the history of Harald Bluetooth and other Vikings was distributed to all the members at an early stage of the SIG, which naturally chose to name the technology 'Bluetooth'. After this work he became known as "Mr Bluetooth". In year 2000, he had finished this work and became Chairman of the board in Anoto. One and a half years later, Örjan and Christer changed chairs to better allow for Örjan's personal network and Bluetooth experience to help the company to establish a better market reach through new partnerships and thereby enhance the return on the ingenious technology. Through his former SIG Bluetooth relationships, Örjan enjoyed continued top-management access to the big players – also in his new role within Anoto. Several of the partners, such as Hitachi and Logitech, also made significant investments by buying Anoto stock, which gave Anoto a total funding of €200 million. This gave more resources for further recruiting and patenting,

[3] *'The Long Ships'* by Frans Bengtsson, first published by Collins in 1954 and reprinted at least 18 times.

and Anoto now has more than 300 active and 60 granted patents in some 180 families, and a number of big market leading companies that already use the Anoto technology. Already in 2001, Anoto entered the top-ten list of Swedish companies with the highest total number of patents – together with companies more than hundred times the size of Anoto like SKF, Ericsson and Volvo. Christer Fåhraeus has found a way to reduce the total patenting cost significantly:

> *When filing a patent in close cooperation with Universities you can enjoy university status for the patent filing and thereby reduce the total cost to a fixed fee of 3.000 EUR for professional help with claim construction and a description. This is one of the reasons why it is particularly interesting to work with universities in Sweden. (interview, 17.09.04)*

Today, the only parts of the value chain that Anoto keeps in-house are the IPRs of the core technology and of the technologies that protect the core. Anoto's goal is to have the responsibility of only 50 per cent of the value chain and outsource parts like marketing, sales, distribution, product development and customer support to partners. Christer holds that it was obvious to keep technology development under control, but a necessary move to outsource brand-ownership to the commercialization partners (interview, 22.06.2004).
From this point onwards, Anoto's strategy was not to make and sell pens. Instead, the strategy was to sell technology licenses for the pen and basic component required to develop systems. CEO Örjan Johansson holds that:

> *This strategy is about narrowing down our position in the value chain to reduce development costs and at the same time control the core so that no one can threaten us. (interview, 07.04.2004)*

This outsourcing strategy is a vital condition in order to establish a global de-facto standard. The partners get a larger product responsibility which reduces Anoto's revenue per partner. But the value altogether increases when the partners volumes grow, since Anoto gets revenues from every unit that is sold and every pen that is used in a system. The founding team of Anoto was very focused on recruiting only engineers who could make a difference. Several of the engineers at Anoto have won national Physic Contests and thereby proved their high skills in the area. The ones who gained the trust of the founding team were asked, in turn, to bring in the best people they knew from their personal networks. This is claimed to be the main reason why Anoto has developed four Asics without having to do any re-spins. As a comparative figure, Johansson holds that nine out of ten Asics are usually re-spins.
The strong portfolio gave Anoto the opportunity to find new avenues of exploitation for their core technology. For example, Dai Nippon Printing and Standard licensed the technology for printing applications. Also in 2004, Anoto signed an agreement with US-based LeapFrog (world-leading developer of technology-based educational toys). Already at the beginning of 2005, LeapFrog introduced an entirely new product category for children and young people based on the proprietary Anoto technology. A new device – a 'Pentop Computer' called FLY – enables the child writing on paper to get feedback via speech and sound; provides aids in mathematical calculations; and helps translate foreign languages. This alliance opens up new areas of application such as: education, training and games.
Bluetooth's partnering strategy was to involve the right players with the sufficient market-share so that the joint network would get enough critical mass to enforce a global standard.

ANALYSIS AND DISCUSSION

The theoretical framework is now used to analyze the case of Anoto to explore how mechanisms and processes at different levels are interrelated to drive born global[4] innovation.

Our use of network theory makes a more comprehensive analysis and illustration possible of how arm's-length and hierarchical networks jointly 'work' together in and between the different stages of the innovation process. We also study the joint effects of activities at different levels. Anoto's extensive extracorporate networking for targeted absorption of external skills – such as Christer's initiation and execution of 30 master thesis projects and three PhD thesis projects – is combined with strong internal networks from trust based 'snowball recruiting' and a focus on patenting to secure protection of the results.

The creativity network is mainly an open, diagonal, loosely coupled arms-length network encompassing selected external scientists and experts. The purpose of the creativity network is to create new scientific knowledge that can be transformed into commercialized innovation by a transformation network. Anoto continually spins academic webs consisting mainly of weak ties for initial exploration of the emerging technology. For promising inventions and researchers, Anoto selectively transforms certain weak ties into stronger ones to individual, organizational and inter-organizational strategic partners who become deeply involved in the exploitation of radical innovation. In this sense, the balancing act from exploration to exploitation can also be seen as an act of transformation from relatively open to more closed networks across different levels. The founder, the CTO and the Chief Science Officer initially have an open social network of mainly weak ties to the students at their home university. Strong social ties are developed with those students who are selected to do their thesis in collaboration and co-location with Anoto so as to interlink their knowledge-creating activities with the process network for exploitation. The relationship based transformation network is gradually closing to interlink creativity and process networks. The formation of this social network leads to the formation of the interorganizational transformation network, thereby being a precedent to it. Social trust and professional trust is developed through the social network, which later can turn into organizational trust.

Much in line with Gulati et al. (2000) Anoto is creating value through networks of low cost high performing master and PhD students. The diagonal social network is a precedent to the vertical interorganizational network, since the social capital based on mainly individual trust developed within the student-company network is sometimes used to establish a more formal collaboration with the student's university institute for joint patent applications to keep patenting costs down.

The nature of innovation at the interpersonal level is described by the social network, while its nature at the work group and organizational and other inter-unit levels are described by the organizational network. Christer Fåhraeus approached his old friend at Ericsson, who in turn mobilized the support of an important Board Member. Interaction in social networks led to the inter-unit relationship between Ericsson and Anoto. Later on, the social network from Örjan Johansson's Bluetooth experience supported the relationship building between Anoto and the many new technology commercialization partners.

The founder and his social network were instrumental for the development of the initial creativity network, which resulted into several vertical networks. In other terms, the social network of Christer resulted in the formation of a creativity network, which was an antecedent to the development of the vertical network between Anoto and Ericsson. This

[4] Born Globals are firms that already from their birth have an international orientation and participate in global relationships – often based on a strong technological competitive edge (Autio and Sapienza 2001; Blomstermo et al., 2004; Moen, 2002).

creativity network seems to be mainly based on professional trust ("engineering stars"). Our theoretical framework makes it possible to distinguish between theoretical constructs that are valid for only one of the levels (e.g., for the inter-individual level expressed through the social network) and those that are valid for all levels, such as the horizontal vertical and diagonal relationships. Anoto sometimes initiates diagonal relationships with universities and their students as a critical part of the creativity network. The students are brought into the organization to connect with other persons or units, forming a social transformation network. Joint patent applications promote absorption at mainly the inter-unit level. The social network is the main vehicle of cross-level innovation from exploration to exploitation, being the main antecedent to the structure of both the hierarchical and arm's length organizational networks of the creativity, transformation, and process networks.

Through its central position into the diagonal academic networks for exploration, and vertical partner networks for exploitation, Anoto seems to have optimized network efficiency on both ends, while the commercialization partners enjoy higher network effectiveness by using Anoto as primary contact for further exploration of the technology.

As suggested by our theoretical framework in Figure 1, moving from creative concept-creation to rapid business-implementation typically requires a more rigid and process-driven organization. As we have seen, Anoto's commercialization transformation involved a change in leadership, while interlinking critical external networks to build a flexible and cost-efficient value network for business-implementation and global commercialization of the Anoto technology. Our framework suggests that creative invention is more prone to happen in small, organic organizations, managed in absence of hierarchy or strong control, which corresponds to the start-up phase of Anoto. The framework also suggests that commercialization requires more structured process networks in large and resourceful organizations to secure production, marketing and sales, logistics and after sales service. Figure 2 outlines the two organizational extremes as different types of networks: Creativity networks and process networks. As suggested by the model, Anoto uses know-who and relationship building to span the organizational ambidexterity gap between the polarized creativity networks and process networks.

Insert Figure 2 about here

For Anoto, the whole initial knowledge (and company) creating phase seems to have been driven by a few strong and many weak ties. Fåhraeus used his know-who of strong ties into Ericsson as well as the organizational trust based on the strong reputation of this MNC to acquire the required know-how – such as the CSO and the CTO – to move from idea to a solid concept. The weak ties came into play when each newly recruited engineer, who gained the trust of Fåhraeus through rapidly demonstrated excellence, was asked to leverage his/her know-who to acquire further engineering excellence through a large snowball effect. In addition, a large number of weak ties into university students led to 30 master- and three full PhD theses written for and with Anoto. Anoto was particularly open to academic collaboration in the early exploration phase, while reducing this kind of collaboration as the company focused more on exploitation.

As the execution-oriented commercialization phase approached, the new CEO (Örjan Johansson) leveraged his Bluetooth-based know-who to establish very strong ties to a selected number of globally leading partners like Nokia, Logitech and HP. Accordingly, strong ties seem to have been critical to drive the execution of innovation across the process networks – from a creative concept turned into solid business plans, prototypes and commercial products. In this second phase, Örjan Johansson's 'Viking-approach' to relationship-building and partner meeting management seems to have played a critical role.

CONCLUSIONS

The organizational dilemma of innovation is properly addressed through cross-level innovation with transformation networks interlinking partly academic exploration and mainly industrial exploitation through key-people with rich social ties into both spheres. The relationship-dimension of our theoretical framework suggests that a dominance of weak ties is required for exploration in creativity networks, and a dominance of strong ties is required for exploitation in process networks. In network terms, the process network is therefore the opposite to the creativity network, being closed, tightly coupled, and hierarchical. The transformation network is a mix of both these networks, being semi open or closed, neither loosely or tightly coupled, and bridging the two hierarchical and arm's-length networks. The creativity network has a relatively open structure. It contains both individual and organizational levels. As illustrated by the case, the creativity networks are mainly social networks, driven by personal relationships and the establishment of a mix of professional and social trust. Selected individuals at the universities are more important than the universities themselves. Accordingly, the social networks are dominating the organizational networks and act mainly as antecedents of organizational networks.

By only recruiting new researchers who enjoy trust by current employees, Anoto illustrates the suggested model of Soda et al. (2004) in getting project teams with high past closure (strong ties within the team based on prior collaboration) and high current structural holes (weak ties to nonredundant resources at universities). As a complement to Uzzi's (1996) argument that a firm's performance peaks when it is linked by embedded ties to an integrated network composed of both strong and weak ties, the Anoto case strongly illustrates how social ties at the individual level of analysis interact with institutional and economic ties at the organizational level.

Limitations and Future research directions

Although our paper draws on extensive theoretical research and empirical research from ten companies, it presents only one case-study of a young born global from Sweden to illustrate the practical dimension of cross level innovation. Further research will be required to gain a more robust understanding of how learning both from extracorporate networks like universities, and across internal networks like R&D, M&S and D&M, can enhance flexibility and performance in innovation. In view of the evolution and dynamics of the mechanisms, further research would be needed to examine the evolution of cross-level networks from a longitudinal perspective. Finally, it would be valuable to explore to what extent the mechanisms described in our case can be observed in larger firms and in more mature industries.

Managerial Implications

The managerial implications of our study are that managers of technology innovation in high tech industries can apply a new approach to sourcing and internalization of excellent academic knowledge, and developing a *de facto* standard through relationship based inter-organizational networks. The emerging theoretical framework illustrates the important individual dimension of organizational innovation and shows how the social networks of an agent can be integrated into cross level innovation projects through the migration path from weak to strong ties as the innovation process advances from exploration to exploitation. The implication is that the organizational dilemma of excessive ambidexterity can be addressed through cross-level micro-macro dimensions of innovation, in with transformation networks mediate academic exploration and industrial exploitation through key-people with strong relationship building skills and rich social ties (know who) into both domains. In this sense, the relationship building approach illustrated by Anoto can be applied to build new bridges across previously disconnected disciplines and areas of value creating activities.

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FIGURE 1
Cross-Level Networks for Exploration and Exploitation of Innovation

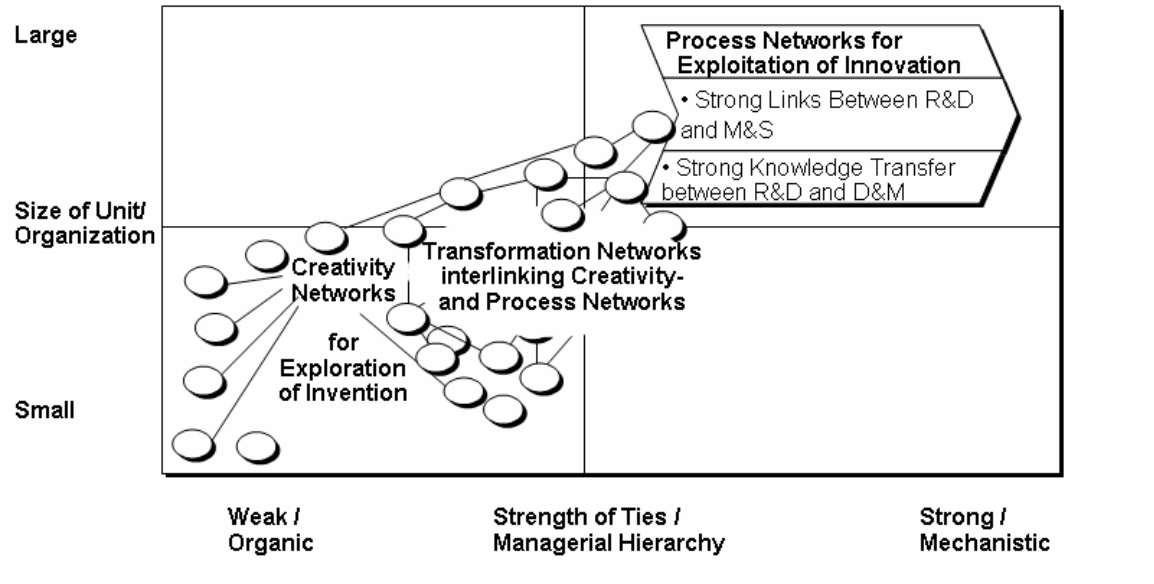

FIGURE 2
The Know-Who Based Multi-level Innovation Approach of Anoto – Linking Creation to Commercialization