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Horizontal Cross-Ties: Benefits of cross-hierarchy and cross-unit ties for innovation

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Abstract

Innovative project teams are embedded in an organizational context, and teams typically consist of people with expertise from diverse units and backgrounds. Team members may have ties to other teams, business units and hierarchical levels. Although it seems clear that such ties can influence team performance, little research has focused on such what we refer to here as vertical and horizontal cross-ties. Previous research may have ignored the possibility that vertical and horizontal bridging ties may have different performance outcomes. Although literature suggests that diversity of input, or horizontal cross-unit ties will benefit team performance and innovativeness, there is reason to believe that ties to higher organizational levels might have an effect on project team performance and innovativeness. This paper studies the role of vertical cross-hierarchy ties. In an exploratory analysis of several NBD project teams at a European financial service provider we show that successful innovation project teams are characterized by a large number of cross-unit ties in combination with a large number of cross-hierarchical ties compared with less successful project teams. Additionally

we find proof that vertical cross-hierarchy ties should be concentrated rather than scattered across project members.

Vertical and Horizontal cross-ties: Benefits of cross-hierarchy and cross-unit ties for innovative projects

Abstract

Social networks are an important driver for successful innovation, both at the individual level and at the organizational level. Recent research has also shown that networks within teams can enhance performance as well. Innovative project teams are embedded in an organizational context, however, and teams typically consist of people with expertise from diverse backgrounds and different units. Team members may have ties to other teams, business units and hierarchical levels. If and how such ties influence team performance, has been little researched. We distinguish between vertical cross-hierarchy and horizontal cross-unit ties, a distinction largely ignored so far. Although the literature suggests that diversity of input, from horizontal cross-unit ties, benefits team performance and innovativeness, ties to higher levels in the organization might have a distinct and separate effect on project team performance and innovativeness too. This paper in particular studies the role of vertical cross-hierarchy ties as distinct from horizontal cross-unit ties, researching their added value to team performance by providing access to influence resources. Furthermore we investigate the contribution of concentrating horizontal cross-unit and vertical cross-hierarchy ties among a small number of team members. In an exploratory case analysis combining quantitative and qualitative data, we show how horizontal cross-unit and vertical cross-hierarchy ties contribute to the performance of innovative teams. Successful innovation project teams entertain a much larger number of cross-unit horizontal ties as well as a larger number of cross-hierarchical vertical ties compared with less successful innovative teams. Successful teams concentrate these horizontal and vertical cross-ties among a few team members. These findings constitute a substantial contribution to both academic literature and managerial practice.

Vertical and Horizontal cross-ties: Benefits of cross-hierarchy and cross-unit ties for innovative projects

1. Introduction

Project teams have long been an essential instrument to accomplish organizational objectives (Ancona and Caldwell 1992a; Blindenbach-Driessen *et al.* 2010) and have received considerable attention in the literature (e.g., Schonrok 2010; Haas 2010; Kratzer *et al.* 2010; Leenders *et al.* 2007a; Van Engelen *et al.* 2001; Markham, 1998). By and large companies organize their innovation endeavours in multi-disciplinary project teams (Griffin 1997; Van Engelen *et al.* 2001). Such cross-functional teams are indispensable because modern product development requires both increasingly deep technical knowledge and the combination of different kinds of expertise. Modern product innovation then results from combining and integrating knowledge, insight and ideas from multiple team members (and even of multiple teams), each with their own specific backgrounds. Project team composition and particularly their functioning as drivers of innovative performance has been a focus of attention in the literature (Hansen 1999; Tsai 2002; Earley and Gibson 2002, Baer *et al.* 2010). This has led to the insight that access to diverse knowledge and information provided by bridging ties may be critical for project team performance and innovativeness (Blindenbach-Driessen and van den Ende 2010, Leenders *et al.* 2007b). A project team's access to diverse knowledge yields better informed decisions and helps teams benchmark their activities and enhances their functional expertise (Haas 2010; Roth and Kostova 2003; Burt 2004; Szulanski 1996). What we call "cross-ties," maintained by boundary spanners (Ancona 1990; Ancona and Caldwell 1992a; Marrone *et al.* 2007), connect the team to other knowledge sources within the firm such as other business units or even to sources outside of the firm. This can help the team to meet performance goals and task objectives by providing it with knowledge and insight that the team itself lacks (Ancona 1990; Blindenbach-Driessen *et al.* 2010; Geletkanycz and Hambrick 1997; Marone 2010).

Research on "cross-ties" has advanced our understanding of what determines the (innovative) performance of teams, yet what kind of cross-ties will have what effect has been left open to further research. Engaging in information-sharing or communication in the new business development process (McQuiston and Dickson 1991) can occur both through horizontal cross-unit ties (crossing unit-boundaries) and through vertical cross-hierarchy ties (crossing hierarchical levels). As we argue in this paper, horizontal cross-ties provide a team with diverse information and knowledge that make it possible for the team to be innovative. Vertical cross-hierarchy ties, on the other hand, provide access to (political) influence that

assists the team by finding support and resources (Atuahene-Gima and Evangelista 2000, p. 1269; Haas 2010; Kohli 1989; Wagner III 1994).

Thus far, studies centre on the information bridging aspect of (horizontal) cross-ties, focusing on the diversity of the knowledge that team tap into through such ties. The effect of access to influence resources is little studied (except for Cross and Cummings 2004). However, success for an innovation project team in an uncertain and ambiguous environment (Frost and Egri 1991; Maute and Locander 1994) may be argued to require both horizontal cross-unit as well as vertical cross-hierarchy ties. We argue that horizontal cross-ties have positive effects on the innovative performance of teams which is different from the positive contribution to a team's innovative performance that cross-hierarchy ties provide. These findings expand the common understanding in the literature on what determines team level performance.

Furthermore, concentrating horizontal and vertical cross-hierarchy ties among a small number of team members enhances the team's innovative performance.. For successful innovation teams, horizontal and particularly vertical cross-hierarchy ties are maintained by a small number of team members rather than scattered across a large number of project members.

Section 2 discusses theory and develops propositions, whereupon Section 3 discusses method, data and research setting. Following this, Section 4 presents results, while Section 5 concludes and draws management implications.

2. Theory and Proposition Development

As we argued above, not much attention has been paid to the issue of what kind of boundaries innovation teams need to span in order to improve their performance. We distinguish between horizontal ties crossing unit-boundaries and vertical ties crossing hierarchical boundaries. We also argue that such ties should be concentrated into the hands of a relatively small number of team members.

Horizontal cross-unit ties (fostering diversity).

Innovation is often argued to be the epitome of nonroutineness (Pasmore 1997) - the more novel a task for the team, the less it can rely on routines and existing knowledge. Isolation is likely to hamper innovation team effectiveness (Haas 2010; March 1991). Many of today's challenges for firms are non-routine. Through effective communication, using the knowledge developed by others outside the team, teams obtain previously unavailable information and can then develop new knowledge and insights (Sethia 1995; Moenaert et al. 2000). When shared within the project team, the diversity of insights and knowledge benefits the overall

project team’s knowledge base and hence team performance (Allen 1977; Tushman 1979; Ancona and Caldwell 1992b).

For the team to be creative and suggest novel and useable solutions to technical and commercial problems, interaction and cross-fertilization of ideas beyond team boundaries can be essential (Leenders et al. 2003). Through consultation and interaction, teams may anticipate and prevent potential weaknesses in technical and marketing solutions. Through between-team communication knowledge may be accessed, to be combined into new knowledge and insight. The performance of a team that concentrates on innovation thus depends in part on the team’s communication effectiveness. Teams that do not communicate effectively beyond team boundaries with outside specialists may unlikely to generate novel and feasible solutions to the multifaceted problems they face.

Literature has shown that accessing knowledge from across organizational boundaries is an important driver of innovative performance and project team success (Cohen and Levinthal 1990; Obstfeld 2005; Leenders et al. 2007b; Tortoriello and Krackhardt 2010). Besides bringing in their own specialized expertise, team members who maintain horizontal cross-unit ties to other business units are more likely to think and act outside of the narrow confines of their own task and project team (Duncan 1976; Floyd and Lane 2000). Having access to diverse resources stimulates creativity in itself (Woodman et al. 1993; Paulus 2000; Reagans and McEvily 2003; Burt 2004). Complementary functional expertise may be brought to bear; participation in cross-unit activity by members of an innovation team increases access for the team to alternative ideas and insights (Floyd and Lane 2000).

Based on these considerations, we suggest the following proposition:

Proposition 1: *The number of horizontal cross-unit ties maintained by an innovation project team will be positively associated with innovative team performance (Figure 1A vs. Figure 1B)*

Figure 1: cross-unit ties

Figure 1A (less successful)

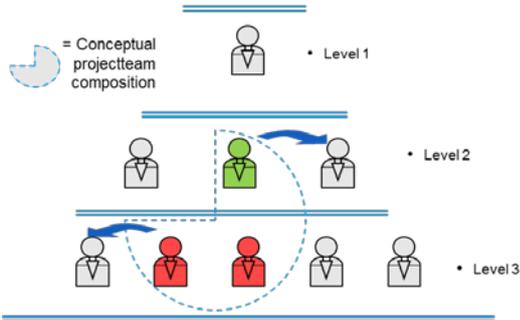
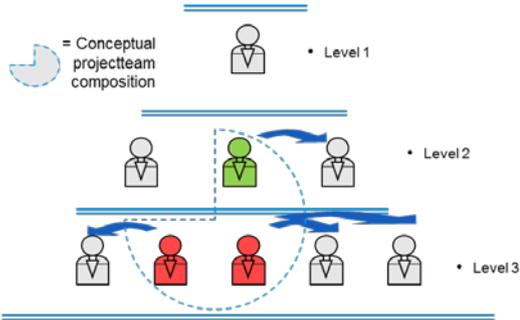


Figure 1B (more successful)



Vertical cross-hierarchy ties (fostering influence).

Vertical cross-hierarchy ties (or vertical cross-ties) are ties that the team maintains with organization members at higher hierarchical levels (Jaworski and Kohli 1993; Sheremata 2000). Such ties connect the team to individuals with higher status positions that have desirable influence resources such as access to funding, prestige, power, and privileged access to still others in the organization.

Although the relationship between upward influencing capability and performance is not new at the individual level of analysis (Athanassiades 1973; Porter et al. 1981; Schilit 1986), studying the capability of upward influence at the project team level has remained largely unexplored. The limited amount of studies that have researched the project level, focus on the project team leader specifically (Shim and Lee 2001) and visualise influence as flowing from a single manager to his subordinates, rather than the other way round (Tourish and Pinnington 2002). The overall team effort is commonly neglected, thus ignoring the effect of the combined attributes of team members and their upward influencing behaviour. Taking the team perspective as point of departure, we pose that besides access to a broader range of information, cross-hierarchy ties also provide a project team with the capability of upward influencing power in relation to project team performance.

Vertical cross-hierarchy ties can provide the team with access to knowledge and information of a different nature than that which the team accesses through its horizontal cross-unit ties. Influence resources are not readily accessible from the lower echelons due to the design of responsibilities for business units and individual roles, of reporting structures, and the allocation of budgets (Galbraith 1973; Mintzberg 1973; Stevenson and Gilly 1991; Carroll and Teo, 1996). Teams that have cross-hierarchy ties may be expected to have access to information and other resources that provide them with a broader perspective than those who do not have vertical cross-hierarchy ties (Cross and Cummings 2004).

Utilizing the cross-hierarchy ties effectively allows teams to gain a perspective of how the team output fits in the overall firms objectives and goals. Teams may otherwise tend to focus on their isolated part of the overall design task, neglecting the bigger picture (Schönrok, 2010; Smit-Bakker, 2010). Access to higher hierarchical levels helps teams to take stock of what is relevant from a technical or commercial point of view within the rest of the project or organization so team activities can be aligned to this (Hansen *et al.* 2001; Nahapiet and Ghoshal 1998; Subramaniam and Youndt 2005; Mom *et al.* 2009).

Teams that utilize the cross-hierarchy ties effectively also gain access to support and influence resources available at higher level management (Ancona and Caldwell 1992a; Schilling 2008; Blindenbach-Driessen and van den Ende 2010). The higher hierarchical

echelons in the organization provide legitimacy to information obtained to either a person or an idea, helping teams to put their plans into action (Brass 1984; Cross, Rice and Parker 2001; Feldman and March 1981). Access to influencers can help in bringing new ideas developed by the innovation team to the attention of management, it can generate positive publicity, and it can even hamper or stop competing projects (Kijkuit and Van den Ende, 2007).

An especially powerful cross-hierarchy tie is one that connects the project team to a project champion. A champion adopts the project as its own and shows personal commitment to it, generating support to it from other people in the firm, and advocating the project generally (Markham 1998; Kelley and Lee 2010). Champions accept project risk, vigorously support or advocate the project, and help it through critical times by overcoming opposition (Markham 1998). Once a team has a champion on their side, it stands a much better chance of getting access to more resources (e.g., financial resources, time, of manpower) and more positive milestone evaluations than do teams that are not supported by a champion.

The degree to which a project team effectively organizes, synthesizes and communicates information can influence the collective understanding of upper management and set the groundwork for championing activities. Synthesizing - collecting and summarizing - information is an upward oriented activity (Floyd and Wooldridge, 1992, 1994; Wooldridge and Floyd, 1990). Synthesizing can be a more-or-less routine activity, but it can also be a tool for influencing superiors. By what selection of the information is presented, by the structure given to the information presented, and even by the format of the presentation others can be influenced (Ferris and Judge 1991; Wayne *et al.* 1997; Somech and Drach-Zahavy 2002). Floyd and Wooldridge (1992, 1994) and Medcof (2009) identify this behavior as typical for the manager of a project team. We submit that similar advantages to the team can be reaped when other team members engage in cross-hierarchical ties as well (Markham 1998; Medcof 2009).

Teams that are equipped to construct and maintain ties to higher hierarchical relations and so create managerial resources and support are expected to perform better than teams that do not have such ties. Cross-hierarchy ties can help the team resist efforts by management to impose inappropriate agendas and prevent extensive debate over aspects of and constraints for their projects (Haas 2010). As organizational politics may not be the strong suit of innovation professionals, having a champion can positively affect the team's performance (Weissenberger-Eibl and Teufel 2011). Maintaining cross-hierarchy ties thus provide innovative teams with management-related information and support that assist it in performing their tasks.

Our reflections on the expected contribution of a project team's vertical cross-hierarchy ties lead us to suggest the following proposition:

Proposition 2: *The number of vertical cross-hierarchy ties maintained by an innovation project team will be positively associated with innovative team performance (Figure 2a vs. Figure 2b).*

Figure 2: Hierarchical cross-ties

Figure 2A (less successful)

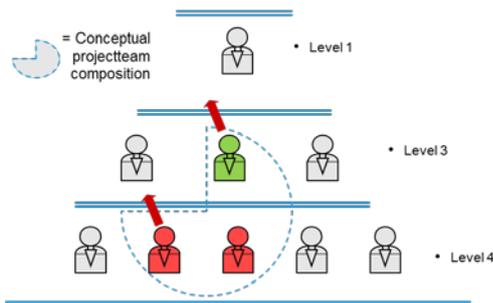
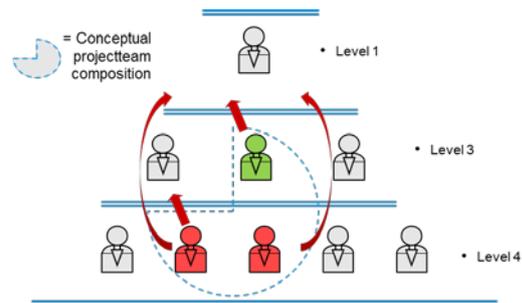


Figure 2B (more successful)



Propositions 1 and 2 differentiate between horizontal and vertical cross-ties and submit that the availability of these ties to the project team benefit innovative project performance. To utilize both dimensions effectively, moreover, we suggest that concentrating these project team ties into the hands of a limited number of members further stimulates project team performance. The network and innovation literatures have largely ignored these possible benefits of team composition and division of labor or specialization at team level.

Allen (1977) stressed how specialization at the innovative team level enhances the flow of knowledge and thus stimulates scientific and technological developments. The gatekeeper, receiving only modest attention in recent years, is recognized as a key actors in the innovation process. Gatekeepers acquire, translate, and disseminate external information throughout the organization (Whelan et al. 2010). An innovative project team's performance is due to activities along multiple dimensions, and specialization for each, horizontally and vertically, could be beneficial. A project team that specializes in terms of securing horizontal and vertical cross-ties may perform different from a project team that assigns the maintenance of these contacts to a limited number of its team members.

In line with the idea of specialization, in particular when only a small number of people mediate between the project team and the upper hierarchical echelons the effectiveness of the team would increase. Horizontally, specialization is likely to be by type of knowledge or information accessed, and so horizontal ties may be more dispersed throughout a team. The hierarchical broker is capable of establishing himself as a preferred

point of contact towards the upper echelons, enhancing trust and developing skills suitable to this role such as networking capabilities (Macdonald and Williams 1994). Division of tasks at the project level enables other team members to specialize in developing horizontal cross-ties or on team-internal activities such as using knowledge and information to complete project deliverables. This line of reasoning is supported by transactive memory theory (Wegner 1987; Moreland 1999; Monge and Contractor 2003). People in a group develop expertise in different areas, thereby reducing the load on individuals to develop expertise in all areas. Division of cognitive labor reduces the amount of information for which each individual is responsible, yet provides all members with access to a large pool of information across knowledge domains (Hollingshead 2000, pp 258).

Hence we submit that project teams for which only a relatively small number of team members maintain horizontal or vertical ties perform better than project teams with a team configuration where a larger amount team members fulfill this role. This results in the following proposition:

Proposition 3: Innovation project teams whose horizontal and vertical cross-hierarchy ties are maintained by a small number of team members, perform better than project teams that have scattered these ties across project members.

Previous research has assumed that especially vertical cross-ties are maintained by one individual only. Our theoretical discussion does not assume this. What is more, it suggests that more individuals might entertain either type of cross-tie. The number of vertical cross-ties for successful innovative teams are likely to more concentrated than for horizontal ties for successful innovative teams.

This research, thus, distinguishes between and compares the effects of horizontal and vertical cross-ties. The latter have not received much attention in empirical research. The research also submits that the distribution of horizontal and vertical ties among project team members affect team performance. Concentration of cross-ties among a small number of team members is expected to enhance team performance.

3. Setting, Data, Methods and Analysis

This study, based on primary data, analyses five innovation project teams at company ABC, one of Europe's largest and most innovative payment processors. ABC orchestrates and processes billions of transactions annually for financial institutions and commercial entities from the world over. It is an exploratory or illustrative case study since the existing

knowledge base is underdeveloped (Yin 1994) and the inductive way of data generation is anticipated to provide a greater understanding and a broader description of process and meaning (Doherty and Alexander 2004). The functioning of innovative teams and the contribution of horizontal and vertical cross-ties to team performance is rather under-researched. Drawing from the interpretive research tradition, we employ qualitative techniques and an illustrative case study design. The adoption of a qualitative approach provides for a holistic yet focused means of data gathering, analysis, interpretation, and understanding that is particularly suited to research that investigates the “why” and “how” of management decision making in organizations (Gummesson 2000; Silverman 1997). Because the multiple case research methodology is considered to be more robust than a single case study, the potential benefits of data richness, depth, and quality compensate for the associated shortcomings of possibly more limited representativeness and generalizability (Eisenhardt and Graebner 2007; Ibeh, Ibrahim, and Panayides 2006; Yin 1994).

The study's aim is to analyse the performance of innovative project teams in terms of their horizontal and cross-hierarchy ties. We do this by combining quantitative data on the cross-ties maintained by five teams with qualitative interview and observation data. The qualitative analysis of data followed an inductive process and observed the recommendations of both Morse (1994) and Lindlof (1995). This allows us to gain insight in both the (dis)advantages that cross-ties bring to innovation teams and whether the two types of cross-ties indeed provide the teams with the benefits argued above.

Company ABC. As a leading European payment processor, company ABC is dependent on reliable technology and processes, and supports this with investments in product and service innovation. Company ABC is organized according to a unit structure, following a functional segmentation, with much autonomy for the separate units. The company expands its reach within Europe under recent SEPA (Single European Payments Area) objectives and aims to become a key player in this market. Focusing on ABC's innovative activities organized in a separate business unit that cooperates with the other functional units, the firm's five innovative projects studied concentrate on the improvement of financial logistics processes and technologies.

Observations at company ABC began in the first half of 2010 and extended up until the 2nd annual quarter. Company ABC maintained five innovation project teams in the period under study – each of which was included in our analysis as typical examples of high-end innovation teams. Company ABC expects a substantial strategic long term contribution from the development and implementation of the innovative concepts developed by these teams.

Each of the teams operated under the responsibility of the Innovation department. Data collection was sponsored by the director of the Innovation department. We investigated the workings and performance of all five innovation project teams running in parallel over a period of several months. The five projects were organized in a similarly autonomous manner, with delegated control and discretion over tasks and decision making (Amabile *et al.*, 1996; Goodman *et al.*, 1988). All projects were also considered equally important by management, and could thus lay claim to similar resources.

Data collection. Data was collected using two separate methods: semi-structured interviews with managers as well as project team members, and a network survey among the full population of employees involved in innovation at ABC. The interviews allowed the researchers to become familiar with the organizational setting to design the network survey, and, secondly, to serve as the first round in our snowball sampling procedure. Snowball sampling is commonly applied in studies that include network analysis and especially useful when the population is not clear from the beginning (Wasserman and Faust 1994). Our target population stretched across innovation unit boundaries and reached across the majority of other departments too. Snowball sampling may involve upon several rounds of surveying or interviewing where information from each round helps to determine who should be approached in the second round and so on. To exclude the risk of inadvertently ignoring 'isolates' who possess relevant knowledge but are left out by the study because they are not connected (Rogers and Kincaid 1981), this study initially targeted the full employee list of the innovation unit at ABC. This unit initiated and takes the lead in each of the five innovative projects at ABC.

Questionnaire. The online questionnaire contained questions identifying individual relations and perceived project performance. Every questionnaire was accompanied by a personalized cover email, signed by the senior manager of the innovation unit to stimulate the rate of response. Respondents who did not reply initially, were approached to fill out the questionnaire in a personal interview. Information from the 30 employees of the Innovation unit involved in at least one innovation projects led to a further 54 individuals. Surveying these finally resulted in a total network population of 281 individuals. We allowed for new names to be mentioned by respondents in this third wave, but no additional names emerged. The list of individuals surveyed was also validated as all involved in innovation activities by the general management of ABC. The current study does not face a boundary specification problems common to an egocentric approach in social network analysis (Laumann *et al.* 1983; Marsden 1990, 2002). To reduce ambiguity regarding the interpretation of the

questions by the respondents, the network questions were formulated in the native language. The overall response rate was 93 percent.

Interviews. Semi-structured interviews were conducted with each of the Innovation unit members as well as a selection of team members and management from other units that were identified as part of the innovation network. This provided contextual input in addition to the network data. Interviews typically lasted one hour, were recorded, transcribed and coded. Following Ancona (1990), questions were general initially and concerned initial team goals and team activities. The intent was not to prompt immediate talk about interactions outside of the team, but rather to allow respondents to raise issues themselves. If they mentioned external activities themselves, as all did, we explored specifics (cf. Ancona 1990). In addition to the scheduled interviews, we conducted a large number of ad-hoc interviews with people engaged in the projects, as well as study agendas, minutes, project plans, and other written material relating to the projects to avoid bias.

Team performance. Performance data was collected on all Innovation unit employees and for the five innovative projects by means of a management team survey and interviews with members of the management team. Overall project evaluation scores and contextual data conform to standardized project evaluation procedures at ABC (Bretz, Milkovich and Read 1992, p.331; Scullen and Mount 2000). Evaluation by supervisors is a valid reflection of performance in work settings (Arvey and Murphy 1998: 163). In line with Mehra *et al.* (2001), performance ratings were treated confidentially (Wherry and Bartlett 1982).

We studied the activities and performance of the five innovation projects over a period of three months. At the end of this period each of the projects was scored by the Management Team on nine items on a 7-point Likert scale (see Appendix; Campion *et al.* 1996; Smith-Doerr *et al.* 2004). In line with Balkundi *et al.* (2007), the Management Team provided an overall assessment of team performance as either “performing” or “underperforming” as well. The team performance classification procedure resulted in three projects qualified as performing and two projects qualified as underperforming. The Cronbach’s alpha, testing scale reliability of the performance construct indicated a score of 0.84 which suggests a high consistency among the answers given to questions about group performance.

Variables. As part of the questionnaire the network ties of each team member were measured by asking the individual respondents with whom they discussed new ideas, innovations and improvements regarding products and services relevant to their projects

(Borgatti and Cross 2003; Cross and Prusak 2002; Rogers and Kincaid 1981; Stephenson and Krebs 1993; Krebs 1999). Based on the network data thus generated, the number of horizontal cross-ties and vertical cross-hierarchy ties were calculated. *Horizontal cross-unit ties* refers to the number of ties outside the unit that a team member is affiliated with, but inside the boundaries of the organization. Following Cross and Cummings (2004), *cross-hierarchy ties* was defined as ties to those higher in the hierarchy. We aggregated to the team level based on innovative project team membership: a total count and average of the number of horizontal and vertical cross-ties per project team was calculated using Ucinet 6 (Borgatti *et al.* 2002).

When analysing vertical cross-ties, for robustness purposes, we used 2 different classifications. The first classification of hierarchical levels followed the classification used by ABC, distinguishing between 8 hierarchical levels. To avoid bias due to, for instance, job title inflation, we only include vertical cross-ties skipping at least 2 hierarchical level. The second classification distinguishes between 3 levels, two within a team and business unit (medium and low; 259 employees in total) on the one hand, and one hierarchical level above that on the other hand (22 employees). For this classification we only analyse the vertical cross-ties from either lower or middle level to what may be referred to as senior management.

Data analysis. Additional data analysis used content analysis and cross-site analysis methods for the context specific functioning and performance of teams, provided by both management and team members during the interview sessions and from the open ended questions on project collaboration in the questionnaire. Content analysis by searching of text for recurring words, themes, or core meanings in interview transcriptions allows for the emergence of important themes and patterns in the data (Patton 2002; Strauss and Corbin 1998). The use of different data methods allows for a consistency verification for the (interpretation of) the information collected (Patton 2002), reflecting a triangulated approach to empirical research in which the theory is continually confronted with evidence from different sources (Hartley 1994, 2004) to avoid bias.

The transcripts of interviews and the questionnaire output were content analyzed for the presence of positive, neutral or negative expressions by team members and management about team structure (horizontal and vertical cross-ties, and the distribution of these ties across team members) and about team performance. Qualitative data collected during interviews and through the online questionnaire was independently coded; ratings were discussed when necessary. Relevant yet difficult to classify quotations were clarified by revisiting the individual that had been the source at ABC. As an additional check on the interpretation of the content, we deployed peer and managerial examination. Colleagues as

well as general management were asked to comment on our interpretations. The procedure resulted in characteristic quotes by team members and management that were classified and coded by project type (successful or unsuccessful) in tables 3a, 3b and 3c.

To avoid bias as a result of only surveying or interviewing those who are willing to speak up, we monitored interactions of all project teams by means of observation on the work floor, studying agenda topics and minutes of meetings, and studied other written material. During this process we were overtly inquisitive for any input that might suggest falsification of the questionnaire and interview transcripts. No signal that suggested a different interpretation of our data than what is presented was obtained.

4. Results

We present the findings from the five case studies. We codified project teams according to alphabetical letters (A, B, C, D and E) to preserve confidentiality. Key descriptive statistics are presented in Table 1. In addition, selected quotations relevant for the focus adopted in this paper are used as the basis of the analysis (Coviello, Ghauri and Martin 1998; Hutchinson, et al. 2007).

Table 1: Descriptives: Innovation Networks Company ABC

Network descriptives:	Overall network	Team A	Team B	Team C	Team D	Team E
# of actors / team members	281	30	17	10	28	30
# of unique ties	841	258	294	123	304	183

Figure 3a presents the full network of individuals involved in innovation, either as part of a project team or primarily involved in other organizational units. For aesthetic reasons the outer circle of individuals who did not have an onward tie was not included. Node-colour indicates unit membership. Figure 3b present the network structures for the five projects – classified as either performing or underperforming. The affiliation of each of the actors to a project was validated by project management and the Innovation unit Management Team. There exit links between the teams and between different organizational units.

Figure 3a: The innovation networks at company ABC (n=281)

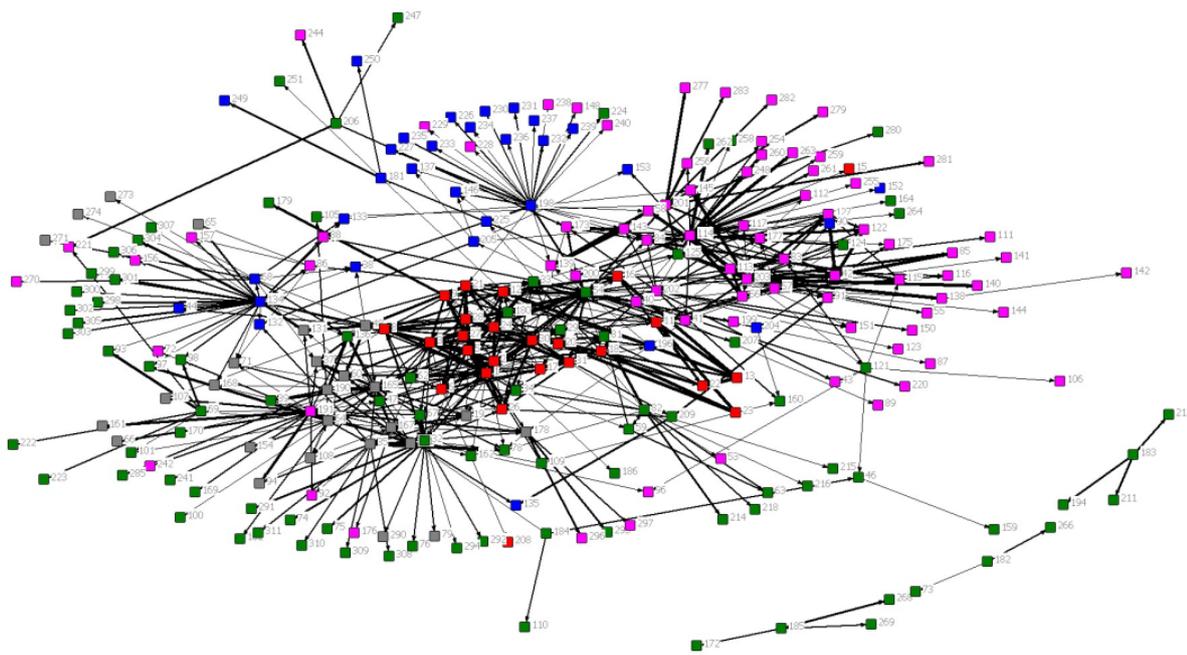
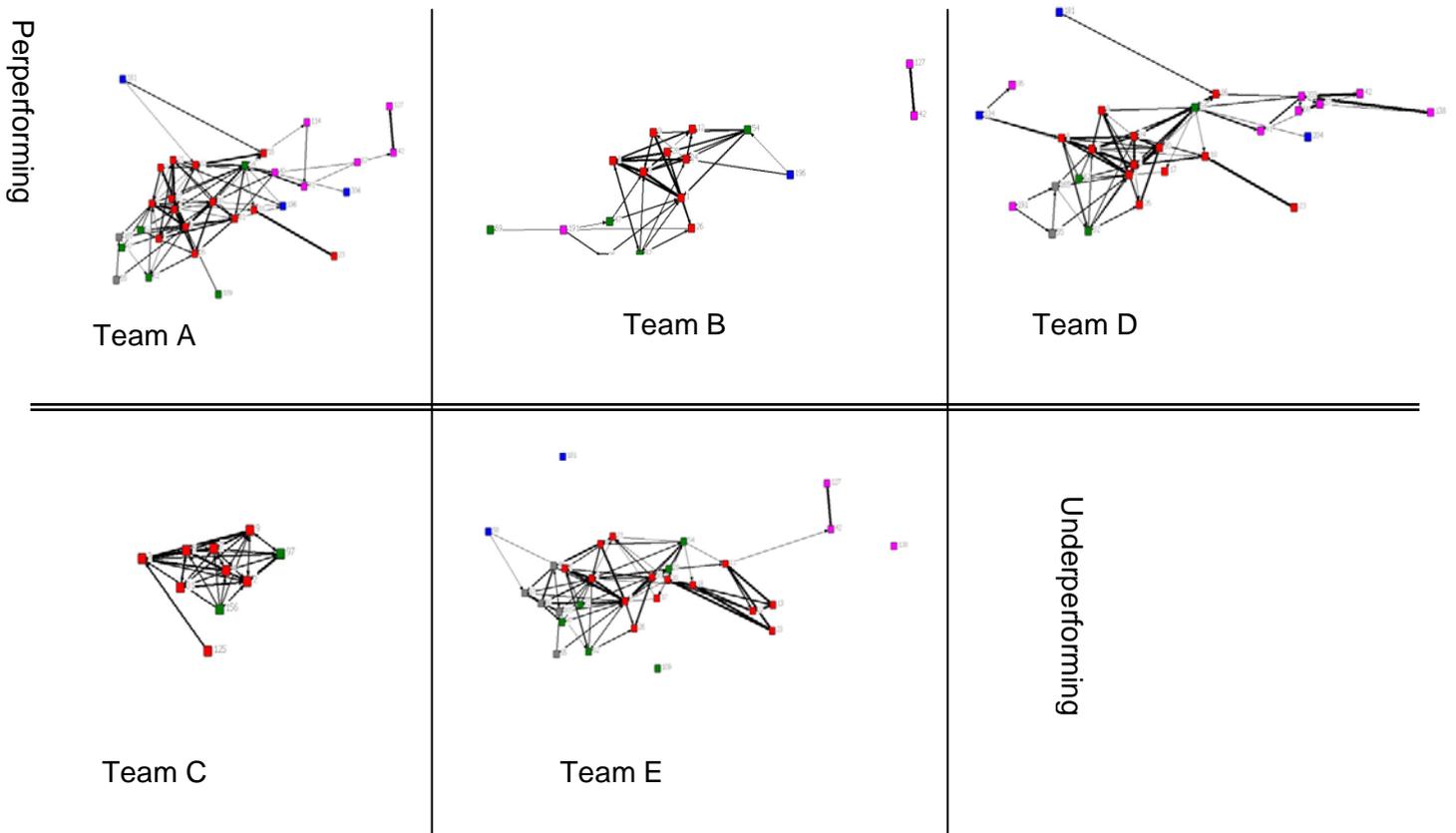


Figure 3b: Innovative team networks (performing and underperforming)



Effects of horizontal cross-ties (proposition 1).

Table 2 indicates the variation in both structural network characteristics and performance outcomes between the performing and underperforming projects. The quantitative data indicates that successful innovation project teams tend to have more horizontal cross-ties than underperforming teams (127.00 and 67.50 respectively).

Table 2: Performing and underperforming Innovative teams compared

	Proposition related to:	Project type:	Mean:
I. Horizontal cross-ties			
Tot. / team	1b	performing	127.00
		underperforming	67.50
Av. / team member	3	performing	4.35
		underperforming	4.90
II. Vertical Cross-ties: Skipping at least two hierarchical level (8 hierarchical levels)			
Tot. / team	2b	performing	43.00
		underperforming	29.00
Av. / team member	3	performing	1.47
		underperforming	2.20
III. Vertical Cross-ties: Reaching directly to senior management (3 hierarchical levels)			
Tot. / team	2b	performing	19.33
		underperforming	13.00
Av. / team member	3	performing	0.66
		underperforming	1.032

Analysis of the qualitative data showed a clear preference for team members of both performing and underperforming teams for including colleagues from outside of the team in their innovative activities. Recurring themes identified in this regard related to diversity of insights, specialized expertise, back-up in case of unforeseen events such as illness or job transfer by team members and sustainability of the final project deliverable in the organisation. Each of the project leaders or project members themselves found the topic of horizontal knowledge exchange salient enough to be raised underscored the relevance of horizontal connectedness. The performing projects were able to link the benefits of sufficient

horizontal ties to examples were their team had allowed them to think and act outside of the boundaries of their individual task and the day-to-day objectives of the project considerably benefitting team performance. The unsuccessful projects were aware of the relevance of horizontal cross-ties, but unable to organize these effectively. Our observations indicate that all members of the organisation were remarkably well capable of identifying the project teams that were labelled successful and related that to their ability of incorporating the insights of peers that were no official project members. The underperforming teams were commonly perceived as isolated horizontally.

The director of the Innovation unit overseeing the innovative projects observes about the underperforming teams that these: *“are far too much internally focused, trying to get it right by themselves, and they fail to get others involved...Clear coordination is also lacking.”* The director adds that one of the underperforming projects displays a team structure that is *“getting stuck in attempts to distribute ideas within the team. These efforts seem to be largely failing, however, and opportunities identified by some team members are not considered, let alone exploited by the project team to really get things going. This demotivates team members and leaves only a handful of individual to get the project going.”* The relevance of horizontal cross ties is reflected further in a number of observations from team members (Table 3a).

<i>Table 3a: Selected representative comments regarding horizontal cross-ties</i>	
Performing teams: A, B, D	Under-performing teams: C, E
<ul style="list-style-type: none"> • In my opinion this project is particularly successful due to the broad and multidisciplinary approach and the clarity of objectives. • Much of our expertise lies in knowing who is doing what inside the firm. When we need it, we can get it. • Historically we actually have quite some contacts on our own. I became more aware to utilize mine to our advantage. • Involvement was created with other specialist within the company which has led to improvements in the conceptual design. • Our expertise is appreciated throughout the organization and we can use this to our advantage when looking for input ourselves • By means of my formal and informal contacts I believe to have a rather good understanding of what goes on within the organization and whom to approach to get things done for my project. 	<ul style="list-style-type: none"> • Everyone is aware of the benefits of scouting new ideas and getting others involved, yet ideas and talents are being wasted. We lack effective distribution of our ideas to colleagues outside of the project or Innovation unit. • Some play their relations quite close to the chest. If they do so, I might as well do so. • There is insufficient between-teams talk about innovation. • Aligning between departments and the project <E> should improve. • Project <C> might be stopped next year, if things continue as they go at the moment. I might as well bail out now, as no one seems to notice what we do too much anyways

<ul style="list-style-type: none"> • There is certainly sufficient sharing of ideas, for instance at the coffee corner and in team and department meetings. • Good atmosphere, and people <other units> know what we are doing. • Performing according to plan. No issues with getting others on-board and as such it is relatively easy to secure the latest insight from throughout the organization and put them to good use <for activities of project B> • This project was established as an example of cross-unit staffing, and it seems to work out quite well indeed. 	<ul style="list-style-type: none"> • Things look poor; nothing seems to get done and nothing is accomplished for production to take up.
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Effects of vertical cross-ties (proposition 2).

Performing innovative teams have considerably more cross-hierarchical ties than underperforming teams. In line with proposition 2, the number of cross-hierarchy ties where new ideas and innovative insights are exchange skipping at least two level is substantially higher for the better performing projects (43,00 versus 29,00 ties for underperforming teams). The number of ties directly to senior management, the highest echelon of the organisation (level 1 and 2 in the 8 level hierarchical pyramid), shows that performing projects have significantly more vertical ties than their less performing equivalents (19,33 versus 13), again in support of proposition 2.

Interviews with management provide further insights: management clearly recognized that the most successful projects teams were well connected to upper management and had secured a project championing and political support generally. The studying of prior projects over the last 8 years further indicated to management that projects that had sufficient vertical cross-ties in place were also more likely to be successfully implemented in the organisation’s operating core after developed by the Innovation unit. The same management interviews indicated that project teams that had limited vertical ties were more likely to be terminated in the early project stages. Context analysis of interview transcriptions identified management commitment, access to information and resources as important resources resulting from vertical cross-ties.

The following observation by a team member of one of the successful teams summarizes the overall sentiment of these quotes effectively: *“Being able to utilize the established relationships with higher echelon management by a number of team members, has helped [the team] to secure critical resources to prove our value to the company.”* A colleague of one of the other teams that is classified as performing added that *“Management is clearly involved with our business. I believe <our project manager> has helped in getting them there and getting us involved too. I have seen that differently at other projects.”* A selection of quotes in Table 3b gives further indication.

Table 3b: Selected representative comments, regarding vertical cross-ties

Performing Innovative Teams: A, B, D	Under-performing Innovative Teams: C, E
<ul style="list-style-type: none"> • Over the last period (period monitored) awareness has been raised within the organization regarding added value to the business. It sometimes feels like our own dragons den. • Access to the higher management echelons and corresponding managerial commitment has paid off well for us. • Management is clearly involved with our business. I believe <our Project Manager> has helped in getting them there and getting us involved too. I have seen that differently at other projects. • The number of stripes does matter in our organization. We have only a few of us who can really make these stripes work to our advantage. Project manager (project A) is one of those people. • Particularly now the project is becoming more visible to higher management, the sense of urgency stimulates people to follow on and share their knowledge. • Being able to utilize the established relationships with higher echelon management by a number of them, has helped <project D> to secure critical resources to prove their value to the company. 	<ul style="list-style-type: none"> • Why can we not connect to the right sponsors? Setting clear directions furthermore seems to be contradictive as it drains energy from the team. • It seems as if management is not committed to us; gaining access to higher management seems not realistic. • Low morale among team members. I don't know why as everyone seems rather involved. • Things go slow and new service development happens in inner-circles. Decisions are politicized rather than based on arguments and company interests. • Project in pilot phase with low support within the organization and low resources to increase this support. • There seems to be much going on elsewhere in ABC that we don't know about. • Since we have no common goals and leadership, all seems to face much resistance. • There is little communication between NBD and the rest of the company.

Concentrated horizontal and vertical cross-ties (proposition 3).

The total number of horizontal and vertical cross-ties for performing projects is thus higher than for underperforming projects. When calculating average number of ties, we can both determine if proposition 3 is supported as well as control for team size. The *average* number of horizontal cross-ties for performing teams is 4.35, while it is 4.90 for underperforming. The quantitative indications for vertical cross-ties are more outspoken, however. The average number of vertical cross-ties that skip at least 2 hierarchical level is larger for underperforming teams (2.2) than for performing teams (1.47). Also when looking at the average number of vertical cross-ties directly reaching to senior management (highest echelon), this pattern remains intact (0.66 versus 1.032 for performing and underperforming teams, respectively). Project teams that have concentrated vertical cross-ties among a small number of team members perform better than project teams that spread vertical cross-ties across team members.

Qualitative findings confirm this conclusion. Specialisation regarding relationship management with the higher echelons is repeatedly related to a better functioning team. Observations show that team members of the performing projects had clear views and expectations about each team member and their strengths and weaknesses, including in regards to management activities. Team members of the performing projects clearly articulated the benefits of this “division of labour” to enhance performance, utilizing skills of each individual effectively, and so keep team morale high. The underperforming teams, in comparison, were much less clear about role distribution and showed low morale and conflict. Team members indicated that effective team coordination was lacking. Interviews with management underscored these observations, pointing to a gap between formal project structure and actual team activity.

Members of the unsuccessful projects tried to compensate for the lack of horizontal and vertical coordination. This resulted in a high average number of horizontal cross-ties and especially vertical cross-ties (Table 2), as well as frustration among team members and management. Reviewing the transcripts of the interviews allows for a representative selection commentaries (Table 3C). Team members that proactively developed and maintained horizontal or vertical cross-ties were perceived positively by colleagues and senior management, who referred to them as ‘entrepreneurs,’ ‘experts’ or ‘organisational runner-ups’.

Reflections on the project portfolio over the past eight years by senior management particularly pointed towards the relevance of concentrated vertical cross-ties as a means to enhance team performance. Vertical connectedness and dedication by a restricted number of members of a team (not necessarily the project manager only) was viewed as key to effective transition to the “mother” organisation. Exemplary for the perception at the underperforming teams is the comment by a team member of one of these teams who noted that *“My teammates and I do not have clear responsibilities. As a result delivery is running behind schedule and the project shows insufficient innovative potential”*.

Indeed, as suggested by Transactive Memory Theory, we observe in each of the performing project teams that horizontal cross-ties were maintained by others than vertical cross-ties. This indicates that different traits and capabilities are required for horizontal as compared to vertical cross-ties.

We thus find both quantitative and qualitative indication that project teams that have concentrated horizontal, but especially vertical cross-ties among a small number of team members outperform project teams that have scattered these ties across project members. These findings support proposition 3.

Table 3c: Selected representative comments regarding concentrated horizontal and vertical cross-ties

Performing Innovative teams: A, B, D	Under-performing Innovative teams: C, E
<ul style="list-style-type: none"> Responsibilities are clearly defined. Some are better at talking to management, others are plain specialist who get us noticed in another manner –and make sure we are recognized by others (specialists).Both make us successful as a team. It is vital to know how to use my contacts and tenure to get ahead of the pack and to secure capacity for our pilots (proof of concepts). <...> My colleagues know that and respect this as it helps us to move forwards 	<ul style="list-style-type: none"> No one is clearly accountable for specific tasks with regard to external alignment to other parts of the organization or even towards clients. People in project do not have clear responsibilities. Project shows insufficient innovative potential. Things could go much further; there is so much procedure and red-tape Since people are too much involved with all kinds of things, there is a lack of focus It is unclear who does what; responsibilities and results are not that clear. Activities are not coordinated and disconnected; there is no contact between projects on innovation. Developing a new service takes a lot of time for project C practitioners. Nobody <at project C> takes charge or seems to look at the bigger picture; everybody is taking care of their own immediate interests only.

5. Discussion and Conclusion

The objective of this study was to investigate the contribution of horizontal and vertical cross-ties to a team’s innovative performance. Our findings, analysing qualitative and quantitative data, indicate that both these ties help teams be more innovative, and that this is true in particular for vertical cross-ties. This indicates that conceptually separating horizontal from vertical cross-ties is important. The first foster diversity, while the latter foster organizational support and managerial sponsorship. We submit that this is an important theoretical contribution this paper makes.

Project teams that perform well have more cross-ties in general and vertical cross-ties in particular, but these cross-ties should, we suggest, be concentrated in the hands of a few team members (cf. Hansen 2002). Representation or brokerage (Gould and Fernandez 1989), vertically especially but also horizontally, should be the specialized job for some team members. If such insights were discussed in the relevant literature it is *assumed* that vertical cross-ties are or should be maintained by a single individual. This may, but need not be the case.

While Hansen (2002) assumes that project members can and do access horizontal and vertical cross-ties when needed, our qualitative findings suggest that this may not

happen. In both successful and unsuccessful project teams, access to cross-unit and cross-hierarchy contacts was expected to be the responsibility of the project manager, but only for the successful project teams did this process seem to function effectively. Project management may not be able to develop and maintain vertical cross-ties in particular. As members of the unsuccessful projects tried to compensate, this resulted in a high average number of cross-hierarchy in particular, as well as frustration among team members and management.

Our findings thus underscore the outcome of the field experiment by Cross and Borgatti (2004, p.152) that there is more to an innovation project being successful than just a general awareness about who has relevant knowledge. Access, engagement and perhaps safety play a role in explaining effective knowledge transfer (*ibid.*), but we in particular find indication for the contribution of vertical cross-ties. In addition to access to a diverse set of others through horizontal cross-ties, vertical cross-ties ensure management attention and legitimacy which may help provide resources in time.

Managerial implications. Proper formation of project teams increases the chances of achieving successful innovation outcomes. Our findings are particularly relevant to team formation and to ensuring successful functioning of innovative project teams. Horizontal and vertical cross-ties serve different purposes. Taking care of vertical cross-ties in particular is important, and should be assigned to an appropriate individual, but can and perhaps should be maintained by multiple team members. These vertical cross-ties are crucial to secure project buy-in and legitimacy and to gain managerial attention and securing resources (Brass 1984; Cross, Rice and Parker 2001; Feldman and March 1981). A large number of contacts from the management team to many different team members is not a good sign about the functioning of the project team, indicating noise.

Limitations and future research. This study has a number of limitations. The organization we studied is a large multinational and would resemble other such large firms e.g. in the number of new innovative teams deployed. As the innovation literature shows, the number of highly innovative projects taking place in a firm at one and the same time tends to be limited for obvious reasons (Cooper and Kleinschmidt 1995; Rice *et al.* 1998; Vanhaverbeke and Kirschbaum 2005). This is a limitation common to research on strategic new business initiatives. The specific context of innovation initiatives makes future cross-organizational comparison difficult but nonetheless relevant. The full extent to which our findings are representative is thus unknown, and so the exploratory nature of this study needs to be emphasized. Social network analysis is necessarily restricted to (quantitatively) studying

single firms, however. Social network data is exceedingly difficult to collect, for instance, because high response rates are imperative. What is more important still is the fact that network data across different firms cannot be meaningfully aggregated. Even though we included all individuals involved in the subject area in the organization that was studied, our project population size thus was relatively small. While this may surprise scholars not familiar with social network analysis, for social network analysts this is known not to be problematic per se (Cross and Cummings 2004).

A second limitation relates to the partly qualitative approach chosen for this study. Although a rigorous process has been followed to collect and interpret the qualitative data, organizational cultural influences may, for instance, affect performance data. To counter this possible effect we explicitly cross-referenced with established team performance procedures within company ABC and with other sources of data which also allowed for multiple methods to be used. Including performance information for subsequent phases of the projects, including the post market-launch phase, would enhance our understanding of the contribution of horizontal and vertical cross-ties to team performance.

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Appendix

Table A1: Team performance items

	Item	Scale
1	quality of work done	1 to 7
2	(internal) customer service provided	1 to 7
3	productivity	1 to 7
4	completing work on time	1 to 7
5	completing work within budget	1 to 7
6	providing innovative products and services	1 to 7
7	responding quickly to problems or opportunities	1 to 7
8	Initiative of the team	1 to 7
9	Cooperation with non-team members	1 to 7
10	Overall performance	1 to 7
Scale derived from Campion et al. (1996)		