

Vertical and Horizontal Cross-Ties: Benefits of Cross-Hierarchy and Cross-Unit Ties for Innovative Projects*

Rick (H.L.) Aalbers, Wilfred Dolfsma, and Roger (Th.A.J.) Leenders

Social networks are an important driver for successful innovation, both at the individual level as well as the organizational level. Recent research has also shaped that networks within teams can enhance performance. Innovative project teams are embedded in an organizational context, however, and teams typically consist of people with expertise from diverse backgrounds, and from different units. Team members may have ties to other teams, business units, and hierarchical levels. Although it seems clear that such ties can influence team performance, remarkably little research has focused on what is here referred to 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 the 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 levels in the organization might have an effect on project team performance and innovativeness too. This article in particular studies the role of vertical cross-hierarchy ties. In an exploratory analysis combining quantitative and qualitative results, it is distinguished between horizontal cross-unit and vertical cross-hierarchy ties and their contribution to new business development (NBD) project performance, thereby making a substantial contribution to both academic literature and managerial practice. Our study is based on a multiple case-study approach of several NBD project teams in a large European financial service provider. Our results 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, proof is found that vertical cross-hierarchy ties should be concentrated rather than scattered across project members.

Practitioner Points

- A project team's innovation success depends on how well it is connected in the organization.
- Connections crossing unit boundaries horizontally foster information diversity.
- Connections crossing hierarchical boundaries vertically foster influence.
- Horizontal cross-ties can be spread among team members, but vertical cross-ties should remain concentrated among a few team members only.

Introduction

Project teams have long been an essential instrument to accomplish organizational objectives (Ancona and Caldwell, 1992a;

Blindenbach-Driessen and van den Ende, 2010; Blindenbach-Driessen, van Dalen, and van den Ende, 2010) and as such they have received considerable attention in the organizational and network literature. Project teams are a common way to structure collaborative or joint activities within and also between departments under conditions of uncertainty about the parties' intentions and expertise as well as the route that joint innovative activity will take. Project team composition and particularly their functioning has been a focus of attention in the literature as a possible driver of innovative performance (Earley and Gibson, 2002; Hansen, 1999; Tsai, 2001). This has led to the insight that access to diverse knowledge and information provided by bridging ties may be critical for a project team's performance and innovativeness (Blindenbach-Driessen and van den Ende, 2010). Diversity in contacts available to a project team secures access to diverse knowledge and information, which in turn yields better informed decisions and helps teams benchmark their activities and enhances their functional expertise (Burt, 2004; Haas, 2010; Roth and Kostova, 2003; Szulanski, 1996). Team members crossing boundaries within or between firms may be referred to as boundary spanners (Ancona, 1990; Ancona and

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Caldwell, 1992a; Marrone, Tesluk, and Carson, 2007). Such actions can help the team, and the organization it is part of to meet performance goals and task objectives (Ancona, 1990; Blindenbach-Driessen and van den Ende, 2010; Blindenbach-Driessen et al., 2010; Geletkanycz and Hambrick, 1997; Marrone, 2010, p. 914).

This research stream has advanced our understanding of what determines the (innovative) performance of new business development (NBD) teams, yet what kind of cross-ties will have what effect has been left subject to further research. Engaging in information sharing or communication in the new product development process (McQuiston and Dickson, 1991), it is suggested, can be horizontal, crossing unit-boundaries, but can also be vertical, crossing hierarchical boundaries.

BIOGRAPHICAL SKETCHES

Dr. Rick (H.L.) Aalbers is an assistant professor of strategy and innovation at the Institute for Management Research at Radboud University, the Netherlands. He earned his PhD in Business and Economics from the University of Groningen, the Netherlands and holds two master's degrees from Erasmus University, one in business administration and one in business economics (*cum laude*). His main research area is innovation strategy, with special interest in the evolution of organization networks under conditions of network intervention. His work has been published in *Research Policy*, *Journal of Engineering and Technology Management*, *MIT Sloan Management Review*, and *British Journal of Management*, among others. His *Sloan Management Review* contribution won the 2013 *SMR Richard Beckhard Memorial Prize*. His dissertation on intra-organizational collaboration and restructuring won the *SOM Best Dissertation Award* of the University of Groningen.

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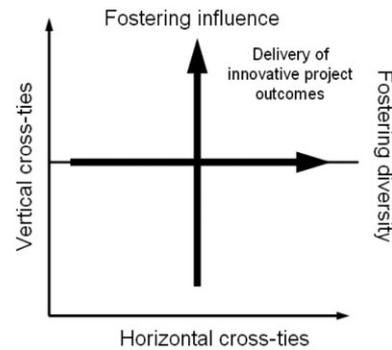


Figure 1. Horizontal Cross-Unit and Vertical Cross-Hierarchy Ties

As Figure 1 indicates, fostering diversity of input for innovation projects by generating interactions across unit boundaries may have a different effect from fostering influence to help an innovation project by finding support and resources (Atuahene-Gima and Evangelista, 2000, p. 1269; Haas, 2010; Kohli, 1989; Wagner, 1994). The effects one can expect for these aspects are different and are in need of further study. Influence is commonly left out in network studies as these studies tend to focus on the participation aspect of bridging ties, focusing on the diversity of the knowledge that is tapped into (one recent exception is Cross and Cummings, 2004). Being successful as an innovation project team in an uncertain and ambiguous environment (Frost and Egri, 1991; Maute and Locander, 1994), however, may be said to require both horizontal cross-unit ties as well as vertical cross-hierarchy ties.

The conceptual model that will be thus entertained is presented in Figure 2. The next section discusses relevant theory and develops propositions. Next is a discussion of methods, data, and research setting. Following this is a presentation of results. The article concludes by drawing a number of management implications.

Theory and Proposition Development

Exchanging knowledge across boundaries within a firm was found to be important to allow a firm to meet performance goals. What kind of boundaries to span has not, however, been subject of much research so far. In this article we distinguish between horizontal ties crossing unit boundaries on the one hand, and vertical boundaries crossing hierarchical boundaries on the other hand.

Fostering Diversity

Literature has shown that accessing knowledge from across organizational boundaries is an important driver of

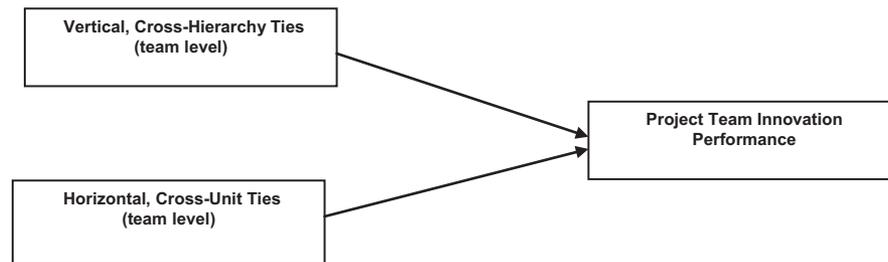


Figure 2. Conceptual Model

innovative performance for organizations and is linked to project team success (Aalbers, Dolfmsa, and Koppius, 2013; Cohen and Levinthal, 1990; Obstfeld, 2005; Tortoriello and Krackhardt, 2010). It is commonly assumed that having access to diverse resources stimulates creativity (Burt, 2004). Participation in cross-unit interfaces by individual members of a team increases access to alternative ideas and insights relevant for a firm's existing strategy, goals, interests, time horizon, core values, and emotional tone (Aalbers and Dolfmsa, 2015; Floyd and Lane, 2000). Complementary functional expertise may be brought to bear. The more novel a task for the team members involved, the more isolation can hamper strategic effectiveness as the experience assessing its strategic options will be more limited than may be required (Haas, 2010; March, 1991). Isolation of team activities also poses operational risks for innovative projects as the novel tasks require that team members engage in trial-and-error processes that may involve making and rectifying mistakes (Haas, 2010; Levitt and March, 1988).

Furthermore, when shared within the project team, the diversity of insights and knowledge can benefit the overall project team knowledge base and hence project performance (Allen, 1977; Ancona and Caldwell, 1992b; Tushman, 1979). Besides bringing in their own specialized expertise, and representing the interest of their own specific project team, team members who maintain horizontal cross-unit ties think and act outside the narrow confines of their own job and position as part of the project team (Duncan, 1976; Floyd and Lane, 2000). Hence the following proposition is suggested:

Proposition 1: A larger number of horizontal, cross-unit ties available to a project team will be positively associated with innovative project outcomes.

Fostering Influence

In addition to benefits of horizontal cross-unit ties for project teams, access to contacts higher in the hierarchy

has advantages too (Ancona and Caldwell, 1992b). Surprisingly, this hierarchical effect has only received limited attention in recent organizational literature (Drach-Zahavy and Somech, 2010). First, often the higher hierarchical levels in an organization have access to information not accessible at the lower echelons in the form of reporting structures available to them or specific managerial meetings (Carroll and Teo, 1996; Galbraith, 1973; Mintzberg, 1973; Stevenson and Gilly, 1991). Team members who have vertical cross-hierarchy ties are expected to have access to more diverse information and hold a broader perspective than those who do not have cross-hierarchy ties (Cross and Cummings, 2004).

Second, to get things done in terms of obtaining support and resources, it is also relevant to have access to the influencers in an organization (Ancona and Caldwell, 1992a; Blindenbach-Driessen and van den Ende, 2010; Schilling, 2008; Whelan, Parise, De Valk, and Aalbers, 2011). High influencing capacity is commonly linked to higher hierarchical echelons in the organizational literature as they provide legitimacy to information obtained to either a person or an idea and thereby help people put their plans into action (Brass, 1984; Cross, Rice, and Parker, 2001; Feldman and March, 1981). Vertical cross-ties may be defined as the ties that team members have directly with other organization members across hierarchical levels and organizational units (Jaworski and Kohli, 1993; Sheremata, 2000). Vertical cross-hierarchy ties connect to individuals with higher status positions who have desirable resources such as access to funding, prestige, power, and access to others in the organization ego might not know about or have access to. Ties to such people can improve job performance outcomes (Cross and Cummings, 2004; De Graaf and Flap, 1988; Lin, 1999; Marsden and Hurlbert, 1988). Such contacts are expected to contribute positively to a project team's innovative performance as well. Top managers have for instance been found to be able to substantially influence an organization's innovative capability and thus the organization's chances of survival and growth (Blindenbach-Driessen and van den

Ende, 2010; Howell and Avolio, 1993; Howell and Higgins, 1990).

Having access to influencers can also help in getting new ideas developed by the project brought to the attention of the management team, in generating positive publicity and even in blocking off other competing projects to the favor of the project at hand (Kijkuit and van den Ende, 2007; Whelan et al., 2011). Elenkov and Manev (2005) indicate that higher echelons in an organization affect innovative performance in several ways such as by personal identification, internalization, encouraging diversity of opinions, and providing protected environments (Henry, 2001; Yukl, 2002). Internalization refers to a process in which followers accept the leader's values as their own, whereas personal identification occurs when followers seek to emulate a leader's behavior (Yukl, 2002). When the leader's values emphasize innovation in the form of the relevance of a particular new business project, his or her idealized influence and inspirational motivation behaviors induce followers to accept these values as their own (internalization) and imitate the leader's behavior (personal identification). Followers engage in innovation-enhancing activities because they seek to gain approval from the leader to satisfy their needs for acceptance and esteem (Elenkov and Manev, 2005, p. 384). Additionally, then, access to higher hierarchical levels helps a project in taking stock of what is seen as relevant within the rest of the organization so project activities can be aligned to this (Hansen, Podolny, and Pfeffer, 2001; Mom, van den Bosch, and Volberda, 2009; Nahapiet and Ghoshal, 1998; Subramaniam and Youndt, 2005).

Teams that are involved in the development of new insights with the purpose of capitalizing on them in the near future also are relevant to the higher management levels. This mutual dependency creates the opportunity for a project team to develop new, innovative products to influence higher management to a larger extent than when the content of that knowledge is more common. Such possibilities are only available when there is awareness of and attention for such projects by management (Brass, 1984; Haunschild and Beckman, 1998). Influence literature stresses that subordinates can be active players in shaping reality and influencing decisions at higher managerial echelons (Ferris and Judge, 1991; Somech and Drach-Zahavy, 2002; Wayne, Shore, and Liden, 1997). Teams that are better equipped to utilize this advantage of control on a hierarchical relation are expected to perform better than teams that do not, as they can resist efforts by management to impose inappropriate agendas on their projects, and void extensive debate over aspects of and

constraints for their projects (Haas, 2010). While securing political sponsorship involves action by both parties, a management team especially in a larger organization will have multiple projects each vying for attention (Ocasio, 1997). In sum, project teams that are well connected to higher hierarchical contacts are expected to show better innovation performance, and hence the following proposition is formulated:

Proposition 2: A larger number of vertical, cross-hierarchical ties available to a project team will be positively associated with innovative project outcomes.

Although vertical ties are commonly left out of the equation when discussing team diversity, both vertical and horizontal cross-ties are expected to be positively, yet differently, related to innovative project outcomes.

Setting, Data, Methods, and Analysis

Company ABC

Our exploratory study was carried out at company ABC, one of Europe's largest and most innovative payment processors. Observation at company ABC began in May of 2009, when the first measurement round to collect network data was held and interviewing started. The study's aim is to analyze the performance of innovative project teams in terms of key characteristics of their social network (cf. Ancona, 1990). Company ABC had five NBD project teams in the period under study—they were all included in our analysis. Company ABC expects a substantial strategic contribution from the development and implementation of the innovative concepts developed by these teams. Each of the teams was given equal priority by the management team, and operated under the responsibility of the NBD department. Interviews and observation took place over a one-year period, and after that period, network data were again collected using the same method (described below). Data collection was sponsored by the director of the NBD department. Soon after measurement at time 1, a project manager was appointed whose main task was to stimulate knowledge transfer between individuals in the NBD department in particular and more specifically to stimulate knowledge transfer between NBD projects. This study consequently combines analysis of both qualitative and quantitative data.

An NBD department is considered an important approach to organize for corporate renewal and growth (Karol, Loeser, and Tait, 2002), for instance, by building new competencies targeted at future new business opportunities (Beer, Eisenstat, and Spector, 1990). Common to

strategic new business initiatives, the number of highly innovative NBD projects taking place at the same time is restricted because of such factors as availability of human and financial resources, ideas, management attention, considerations of short-term financial performance, and risk avoidance (Cooper and Kleinschmidt, 1995; Rice, Ambra, and More, 1998; Vanhaverbeke and Kirschbaum, 2005). The workings and performance of all five NBD projects running in parallel were investigated. The five projects were organized in a similarly autonomous manner, with delegated control and discretion over tasks and decision-making (Amabile, Conti, Coon, Lazenby, and Herron, 1996; Goodman, Devadas, and Hughson, 1988). All projects were also considered equally important by management, and could thus lay claim to similar resources. In between measurement at $t = 1$ and measurement at $t = 2$, senior management intervened at company ABC by installing a taskforce whose purpose was to increase the number of contacts throughout the firm, including the five innovation projects. This study allows for evaluation of this intervention. This similarity across the projects studied does not affect project performance (Hackman, 1987, 1990). Allowing a project team to be self-directed elevates team member motivation (Janz, Colquitt, and Noe, 1997), which is expected to increase the willingness to cooperate (Cohen and Bailey, 1997).

The field experiment setting allowed for the analysis of both quantitative network data at the project level and qualitative data from interviews and observation throughout the one-year period of study. The analysis of the network data necessarily employs rudimentary methods given the low number of observed projects. The focus of our study is that of the development and performance of the highly innovative NBD project team, however, and thus a larger number of observations at the same time interval could not be obtained. Given the specific context common to NBD activities at company ABC, comparison with projects in NBD settings at additional organizations proved inadmissible. Semi-structured interviews were used to gather information from the management team, team leaders, and selected team members. Interviews typically lasted for one hour, were tape-recorded, and then transcribed. Following the approach taken by Ancona (1990), questions were general initially and concerned initial team goals and anticipated early leadership and team activities. The intent was to not prompt talk for instance about external interactions, but rather to assess whether the project leaders or project members themselves raised these issues. If they mentioned external activities themselves, as all did, specifics were explored (cf. Ancona, 1990). In addition to the scheduled inter-

views, a large number of ad hoc interviews with people engaged in the projects and affiliated units were held, and agendas, minutes, project plans, and other written material relating to the projects were also studied.

Data Collection

Data were collected on project performance regarding all NBD employees and the five innovative projects. Performance data were collected by means of management team survey and interviews, which generated overall project evaluation scores as well as contextual data to conform with regular project evaluation procedure at company ABC. As researchers have noted, in organizations, the vast majority of performance ratings come directly from the immediate supervisor (Bretz, Milkovich, and Read, 1992, p. 331; Scullen, Mount, and Goff, 2000). A comprehensive review of performance evaluation in work settings concluded that supervisory ratings are most likely valid reflections of true performance (Arvey and Murphy, 1998, p. 163). In line with Mehra, Kilduff, and Brass (2001), performance ratings were used only for research purposes, treated confidentially, and were thus more reliable and valid than those obtained for administrative purposes (Wherry and Bartlett, 1982).

The activities and performance of the five new business projects were followed over the period of one full year. At the end of this period each of the projects was scored by the management team on nine items of the validated project performance measure (Campion, Papper, and Medsker, 1996; see Appendix Table A1). The management team rated projects for each item on a 7-point Likert scale (Smith-Doerr, Manev, and Rizova, 2004) and, in line with Balkundi, Kilduff, Barsness, and Michael (2007), provided an overall assessment of project performance as either “performing” or “underperforming.” The information on project team performance was used to classify the five projects into two distinct categories of either successful or unsuccessful. The project performance classification procedure resulted in three projects qualified as performing and two projects qualified as underperforming.

Variables

For each of the employees taking part in the knowledge exchange, network input for all of the dependent and independent variables was collected. The knowledge sharing network was measured by asking individual respondents with whom they initiated a discussion of new

ideas, innovations, and improvements on products and services as developed by their respective projects (Borgatti and Cross, 2003; Cross and Prusak, 2002; Krebs, 1999; Rogers and Kincaid, 1981; Stephenson and Krebs, 1993).

The total network population studied included 181 actors at time 1 and 281 actors at time 2, identified by a snowball sampling method. For both measures, the first round of the survey started with the total population of the NBD department involved in at least one of the strategic innovation projects. These 30 employees all filled out the questionnaire, resulting in the target population for round 2. The selection of names generated by round 1 was validated by the director of the NBD department as well as by the head of the other units as involved in core project activities, resulting in the targeted group for round 2 of the egocentric survey. The second round of respondents was approached by e-mail and/or face-to-face interviews. The second round consisted of 30 employees at time 1, and 54 employees at time 2. Names generated in round 2 were also approached and surveyed. No new names emerged in this third round, and so network closure was reached. The outcomes were again validated with the management team on relevance with regard to the five NBD projects. A 94% response rate at time 1 and 92% response rate at time 2 was achieved. Network data were thus gathered on approximately 25% of the total population employed at the Dutch headquarters of the company ABC. Semi-structured interviews were conducted with each of the NBD department members to provide contextual input in addition to the network data.

Based on the network data gained via the egocentric survey, the dependent variables of number of cross-unit ties (horizontal) and number of cross-hierarchical (vertical) ties were calculated using Ucinet 6.0 (Borgatti, Everett, and Freeman, 2002; Freeman, 1979). *Cross-unit (horizontal) ties* refers to the number of ties outside the unit that the individual employee is affiliated with, but inside the boundaries of the organization. Following Cross and Cummings (2004), the number of *cross-hierarchical (vertical) ties* were constructed from the number of ties to those higher in the hierarchy on the individual level. For comparative purposes, based on team membership, information was aggregated to the team level. Based on company records and interviews with the management team, five hierarchical levels in company ABC were identified at the time of the survey. Since the top executives did not take part in the study, our analysis focuses on the remaining four levels. Based on the network of period 1, 181 distinctive individuals were coded on these levels: 15 at the senior executive level, 31

at level two, 55 at level three, and 80 at level four (cf. Yakubovich and Shekshnia, 2008). In a similar way, the network members in period 2 were coded: of 281 individuals, 22 were at the senior executive level, 48 at level two, 83 at level three, and 128 at level four.

Analysis

Cronbach's alpha was used to assess the scale reliability of the performance construct. The Cronbach's alpha indicated a score of .84, which suggests a highly reliable consistency among the questions asked on group performance.

The average number of cross-unit and cross-hierarchical ties was analyzed for each of the five projects in relation to performance. Given the small sample size and considering the normal distribution of the dependent variable, the analysis employs *t*-tests for several independent samples. Given the exploratory nature of this study, the outcomes of this statistical analysis are accompanied by analysis of the qualitative data described in Table 1.

Results

Key descriptive statistics are presented in Appendix Table A2. Figure 3a presents the full network of individuals involved in innovation and NBD, either as part of the project teams or involved in other organizational units. For aesthetic reasons, the outer circle of individuals who did not have an onward tie was not included. Colors indicate unit membership. Figure 3b and 3c presents the network structures of individuals who have self-identified as being involved in one of the five projects, for $t = 1$ and $t = 2$. The relevance of the affiliation was validated by project management and management team for each of the projects. Obviously, there are links between the teams and between different organizational units. Figure 3 and Tables 1 and A2 indicate variance in both structural network characteristics and performance outcomes between projects for two measurements. Basic analysis of quantitative data (Table 1) in addition to analysis of qualitative data (Table 2) will help to determine if our propositions 1 and 2 should be supported or rejected.

Results from the quantitative analysis indicate that successful innovation project teams have more ties in general. The more ties members of a team have to others, the more likely the team as a whole will be successful. A significant difference in means for total number of ties and project performance is found for both measurements 1 and 2. Performing projects have higher amounts of total ties throughout the organization than less performing

Table 1. NBD Projects Compared between Each Other and across Time

Variable	Category	Project type	Independent Sample <i>t</i> -Tests ^(a)			Independent Sample <i>t</i> -Tests ^(a)		
			Mean (Std. Dev)	Std. Error of Mean	(Sign. Level) df = 3	Mean (Std. Dev)	Std. Error of Mean	(Sign. Level) df = 3
			t = 1			t = 2		
Number of cross-hierarchical ties	Total/project	Performing	81.33 (14.64)	8.45**	3.166** (.050)	103.00 (7.94)	4.58**	3.125** (.050)
		Underperforming	44.00 (8.48)	6.00**		64.50 (20.51)	14.50**	
	Average/project member	Performing	3.14 (.10)	.060	-.459 (.677)	3.52 (.417)	.24**	-3.857** (.031)
		Underperforming	3.62 (1.95)	1.38		4.82 (.250)	.18**	
Number of cross-unit ties	Total/project	Performing	64.00 (7.93)	4.58**	4.272** (.024)	127.00 (15.72)	9.07	2.909* (.062)
		Underperforming	37.50 (3.54)	2.50**		67.50 (31.82)	22.50	
	Average/project member	Performing	2.50 (.349)	.20	-.686 (.542)	4.35 (.72)	.417	-.893 (.438)
		Underperforming	3.03 (1.37)	.97		4.90 (.56)	.40	
Total number of ties	Total/project	Performing	201.67 (28.02)	16.18**	4.312** (.023)	285.33 (24.19)	13.96**	4.607** (.019)
		Underperforming	108.00 (11.31)	8.00**		153.00 (42.43)	30.00**	
	Average/project member	Performing	7.84 (.59)	.34	-.415 (.706)	9.76 (1.130)	.65	-1.749 (.179)
		Underperforming	8.74 (4.04)	2.86		11.53 (1.09)	.77	

^a Comparison between performing and underperforming project teams. * $p \leq .10$; ** $p \leq .05$.

projects. However, as this no longer holds when averaging for project team size, it seems that such ties must be concentrated with a few individuals in the team.

Proposition 1 suggests, drawing on relevant literature, that the contribution from horizontal cross-unit ties would be largely due to the diversity effect. Evidence presented in this article supports this. At measurement $t = 1$ there is a significant effect of the number of horizontal cross-unit ties on team success at innovation. The mean number cross-unit ties for projects classified as underperforming is 37.50 at $t = 1$, respectively 67.50 at $t = 2$, and the mean for projects classified as successful is 64.00 at $t = 1$, respectively 127.00 at $t = 2$. This difference is significant at $t = 1$ at less than .025 probability (t -value = 4272, $df = 3$), yet less significant at $t = 2$. Since the effect disappears when looking at the average number of horizontal cross-ties, proposition 1 cannot be given full support.

After the intervention, which had the explicit goal of increasing the number of ties in general and cross-unit ties in particular, this effect, however, and contrary to expectations both from theory as by management at

company ABC, is weakened. This effect is also absent when averaging the number of cross-unit ties for teams, at both measurements.

The director of the NBD department overseeing the portfolio of NBD projects observes in this regard that:

“Project C is way too much internally focused, trying to get it right by themselves, and fails to get others involved. . . . Clear coordination is also lacking.”
“Also—project E—is getting stuck in attempts to distribute ideas within the team. These efforts seem to be largely failing, however, and opportunities identified by some 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 them going.”

This characterization is reflected as well in a number of other observations from ABC employees included in Table 2.

The best performing innovative project teams have significantly more cross-hierarchical ties. The effect of vertical cross-hierarchy ties on team innovative

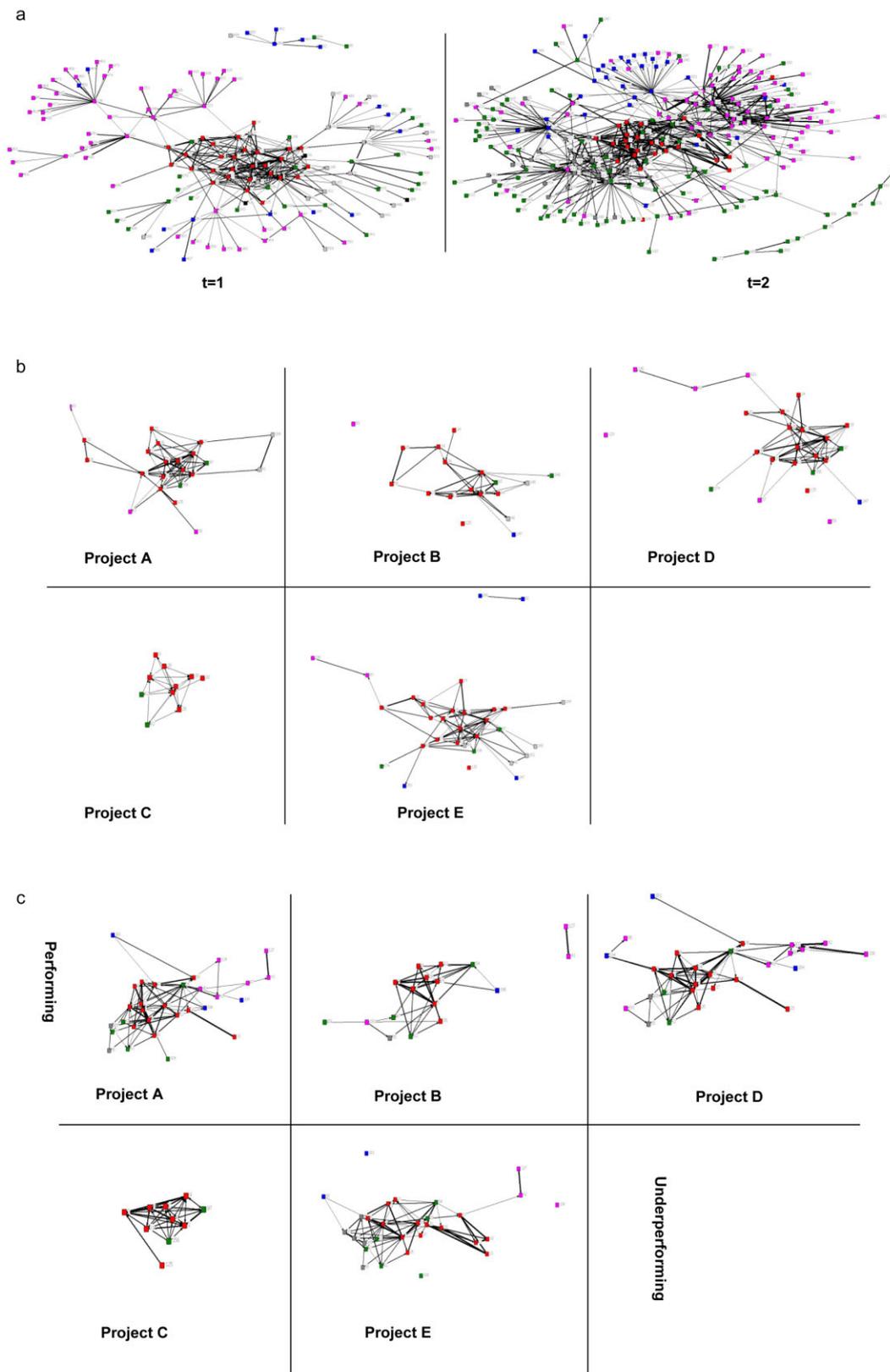


Figure 3. (a) The Innovation Networks at $t = 1$ ($n = 181$) and $t = 2$ ($n = 281$); (b) NBD Project Networks ($t = 1$); (c) NBD Project Networks ($t = 2$).

performance is positive for both measurements $t = 1$ and $t = 2$. The mean number of cross-hierarchy ties for performing projects is significantly higher than for the underperforming projects (t -values 3.166 and respectively 3.125; p -values both .050; $df = 3$). This suggests that total number of hierarchical contacts per project does relate to project performance and so supports proposition 2. However, when averaging for the teams, thus controlling for project team size, the effect actually becomes *negative* in a statistically significant way (t -value = -3.857 ; $p = .031$; $df = 3$). Although the observation proves only significant at $t = 2$, this seems to indicate that underperforming projects have a larger number of hierarchical cross-ties per team member than performing projects. Alternatively, it may be suggested that only a few individuals in the team should maintain cross-hierarchy ties. Reviewing the transcripts of the interviews (Table 2) underpins the findings in Table 1 discussed above.

Discussion and Conclusion

The objective of this study was to investigate the role of horizontal and vertical cross-ties in NBD projects. Our findings indicate there is reason to believe that ties to higher levels in the organization might in particular have an effect on project team innovative performance in addition to the more common suggestion in the literature that horizontal cross-unit ties fostering diversity benefit team performance and innovativeness. The role of vertical cross-hierarchy ties to foster organizational support and managerial sponsorship has been overlooked. Project teams that perform well have more cross-hierarchy ties, but these cross-hierarchy ties should, however, be concentrated in the hands of a few team members (cf. Hansen, 2002). Representation or brokerage (Gould and Fernandez, 1989), not only vertically but also horizontally, should be the specialized job of some team members.

Our qualitative data provide us with additional insight concerning the perception of project members that the distribution of these horizontal and vertical cross-ties to those best positioned to manage them is indeed relevant. Where Hansen (2002) assumed that project members could access cross-unit or cross-hierarchy 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 function effectively. Interviews with team

members of the unsuccessful projects showed that project management was not able to provide such cross-ties. As members of the unsuccessful projects tried to compensate, this resulted in a high average number of average general, cross-hierarchy, and cross-unit ties (Table 1), as well as frustration among team members and management. The better performing innovation projects have more general, cross-unit, as well as cross-hierarchy ties, but these are concentrated within the team.

Our findings 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 (Cross and Borgatti, 2004), but in particular, evidence is found for the contribution of cross-hierarchy ties. In addition to access to a diverse set of others through cross-unit ties, cross-hierarchy ties ensure management attention and legitimacy which may help provide resources in time.

Managerial Implications

Our findings are particularly relevant to team formation and ensuring successful cooperation in innovative projects. Distinguishing between horizontal and vertical cross-ties is shown to be important. Each type serves different purposes. Responsibility to take care of cross-hierarchy relations in particular is important to assign an individual. These are crucial to secure project buy-in and legitimacy and to gain managerial attention and securing resources (Brass, 1984; Cross et al., 2001; Feldman and March, 1981). Proper formation of project teams increases the chances of achieving successful innovation outcomes. A large number of contacts from the management team to many different team members is not a good sign for the functioning of the project team.

Limitations and Future Research

This study has a number of limitations. The organization studied is a large multinational and would resemble other such large firms. The full extent to which our findings are representative is difficult to determine, however, and so the exploratory nature of this study needs to be emphasized. Social networks analysis is necessarily restricted to quantitatively studying single cases, however. Social network data are 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. Despite including all

individuals involved in the subject area (181 at $t = 1$, and 281 at $t = 2$) 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, however (Cross and Cummings, 2004). Also from an NBD perspective, the number of highly innovative NBD projects taking place at the same time tends to be limited (Cooper and Kleinschmidt, 1995; Rice et al., 1998; Vanhaverbeke and Kirschbaum, 2005). This is a limitation common to strategic new business initiatives. The specific context of NBD initiatives makes future cross-organizational comparison difficult but nonetheless relevant. Future research will have to indicate to which extent our findings are applicable to other types of NBD environments.

A second limitation relates to the qualitative approach chosen for this study. Although a rigorous process has been followed to collect and interpret the qualitative data, organizational bias and cultural influences regarding performance data are possible. To counter this possible effect, explicit cross-references with established project performance procedures within company ABC were conducted. Including performance information for subsequent phases for the projects, including after market-launch has taken place, would enhance our understanding of the contribution of horizontal cross-unit and vertical cross-hierarchy ties to project performance.

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Appendix

Table A1. Project 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 nonteam members	1 to 7
10	Overall performance	1 to 7

Scale derived from Campion et al. (1996).

Table A2. Descriptives: Innovation Networks Company ABC

Network descriptives:	<i>t</i> = 1	<i>t</i> = 2
No. of actors	181	281
No. of unique ties	508	841
Density—Avg. (<i>std. dev.</i>)	.0417 (.3437)	.0221 (.2346)
Reciprocity—Hybrid score	.2120	.1215
Transitivity—% of ordered triples that are transitive	35.13%	25.10%