

California Management Review

Making Invisible Work Visible:
Using Social Network Analysis to
Support Strategic Collaboration

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 ver the past decade, significant restructuring efforts have resulted in organizations with fewer hierarchical levels and more permeable internal and external boundaries. A byproduct of these restructuring efforts is that coordination and work increasingly occur through informal networks of relationships rather than through channels tightly prescribed by formal reporting structures or detailed work processes. For example, informal networks cutting across core work processes or holding together new product development initiatives are not found on formal organizational charts. However, these networks often promote organizational flexibility, innovation, and efficiency as well as quality of products or services by virtue of effectively pooling unique expertise. Supporting collaboration and work in these informal networks is increasingly important for organizations competing on knowledge and an ability to innovate and adapt.

Unfortunately, critical informal networks often compete with and are fragmented by such aspects of organizations as formal structure, work processes, geographic dispersion, human resource practices, leadership style, and culture. This is particularly problematic in knowledge-intensive settings where management is counting on collaboration among employees with different types of expertise. People rely very heavily on their network of relationships to find information and solve problems—one of the most consistent findings in the social science literature is that who you know often has a great deal to do with what you come to know.¹ Yet both practical experience and scholarly research indicate significant difficulty in getting people with different expertise, backgrounds, and problem-solving styles to effectively integrate their unique perspectives.² Simply moving boxes on an organizational chart is not sufficient to ensure effective collaboration among high-end knowledge workers.

Movement toward de-layered, flexible organizations and emphasis on supporting collaboration in knowledge-intensive work has made it increasingly important for executives and managers to attend to informal networks within their organizations. Performance implications of effective informal networks can be significant as the rapidly growing social capital tradition has indicated at the individual, team, and organizational levels.³ Yet while research indicates ways managers can influence informal networks at both the individual⁴ and whole network levels,⁵ executives seem to do relatively little to assess and support critical, but often invisible, informal networks in organizations.⁶

Over the past eighteen months, we have conducted research to determine how organizations can better support work occurring in informal networks of employees. Working with a consortium of *Fortune 500* companies and government agencies, we assessed collaboration and work in over 40 informal networks from 23 different organizations. In all cases, the networks we studied provided strategic and operational value to the embedding organization by enabling employees to effectively collaborate and integrate disparate expertise. The first goal of our research was to better define scenarios where conducting a social network analysis (SNA) would likely yield sufficient benefit to justify the investment of time and energy on the part of the organization. A second goal of our work was to develop generalized insight into analyses that were informative and actionable for practitioners.

Assessing and Supporting Informal Networks

Put an organizational chart in front of most any employee and they will tell you the boxes and lines only partially reflect the way work gets done in their organization. Informal relationships among employees are often far more reflective of the way work happens in an organization than relationships established by position within the formal structure. However, these informal relationships are often invisible or at least only partially understood by managers—a problem that is growing with de-layering of organizations, virtual work, and globalization. While managers often think they understand the networks around them, studies show that they can vary widely in the accuracy of their network perceptions.⁷ As outlined by Krackhardt and Hansen: “Although managers may be able to diagram accurately the social links of the five or six people closest to them, their assumptions about employees outside their immediate circle are usually off the mark.”⁸

Social network analysis can be an invaluable tool for systematically assessing and then intervening at critical points within an informal network. Of course, social network techniques have been around for some time. The idea of drawing a picture (called a “sociogram”) of who is connected to whom for a specific set of people is credited to Dr. J.L. Moreno, an early social psychologist who envisioned mapping the entire population of New York City.⁹ Cultural anthropologists independently invented the notion of social networks to provide

a new way to think about social structure and the concepts of role and position,¹⁰ an approach that culminated in rigorous algebraic treatments of kinship systems.¹¹ At the same time, in mathematics, the nascent field of graph theory began to grow rapidly, providing the underpinnings for the analytical techniques of modern SNA.¹² The new methods were particularly embraced in sociology, where relational theoretical perspectives had been important since the dawn of the field.¹³

Today, the scholarly discipline is growing in the field of management as researchers have clearly demonstrated the extent to which informal networks pervade and effect life and work within organizations.¹⁴ A particularly important line of inquiry in this work has been to understand forces influencing the emergence of informal networks within organizations.¹⁵ Through such work we have learned that communication is likely to occur in homophilous¹⁶ relationships and have evidence of the role of similarity between people in increasing the likelihood of communication.¹⁷ At the same time, we have also learned that design of an organization can have a strong influence on the pattern of informal networks via formal structure,¹⁸ physical proximity,¹⁹ and nature of the task.²⁰

This and other research has begun to help us think about means of assessing and supporting informal networks within organizations. Yet while clearly informing the field of management, the majority of this work is found in academic outlets often inaccessible to practitioners due to the technical nature of the publications and network terminology employed. In addition, these pieces intend to advance science and so do not as a matter of practice make clear to managers the ways in which network analysis can be applied to organizational issues. While the outcomes of such research might influence decision makers in terms of policy variables, a more contextualized perspective is needed to help practitioners apply network analysis to their specific organizational concerns.

At the most rudimentary level, we have found that visually assessing the pattern of relationships that hold a certain group together can reveal a number of interesting and actionable points. For example, identifying people that are highly central in networks (and so disproportionately impact a group by controlling information or decision making) can help a manager consider how to reallocate informational domains or decision-making rights so that the group as a whole is more effective. Alternatively, understanding who is peripheral in a network and crafting ways to engage these people is also an important means of ensuring that expertise resident in a given network is being effectively utilized. Particularly in high turnover situations, it is increasingly important to get people connected more and more quickly so that they are productive for an organization. Furthermore, assessing junctures in networks that are fragmented across functional or hierarchical boundaries (or detecting sub-groups) can be particularly informative for social or technical interventions that help to integrate disparate groups.²¹

While social network information can be obtained in a variety of ways, the most pragmatic means in organizational settings is typically through surveys.

Very informative social network diagrams can be generated from 10-15 minute surveys assessing information or knowledge flow among members of a group. In this process, the first step is to identify an informal network where effective collaboration and knowledge sharing has a significant impact on the organization's operations or strategy. Often, these groups do not appear on a formal organizational chart, yet their ability to collaborate and pool disparate expertise is critical to the current and future success of an organization. As a result, in the first stages of an SNA it is often important to push executives beyond groups defined by the formal organizational chart to those that might cross functional or hierarchical boundaries (e.g., new product development, communities of practice, or top leadership networks). These groups often go unrecognized and unsupported even when their interactions underlie organizational capabilities or support strategically important innovation.

Conducting a social network survey is a straightforward process of obtaining a list of all people in the defined network and simply asking all members of the group to characterize their relationship with each other. In this process, it is important to ensure that the kinds of relationships measured are appropriate for the task at hand and not unnecessarily inflammatory. Organizations are very different in their tolerance for disclosure of various kinds of social relations. In some, we have been asked to map relationships of trust and power, while in others we have been asked to disguise names on all relationship diagrams (including more innocuous ones such as who works with whom). One of the most powerful ways to apply SNA as a diagnostic tool and a catalyst for change is to put people's names on a network diagram and make the diagram available to all group members as a basis for dialogue. However, such diagrams can be sensitive, depending on the kinds of network questions asked and the culture of the specific organization. As a result, we pay considerable attention to shaping the questions asked so that they are helpful to the specific issue an organization is grappling with while at the same time not unnecessarily disruptive to existing relationships.

As a guide, we have outlined several important relationships and reasons for targeting these relationships in Appendix 1. The primary focus of our research lay with establishing applications of SNA as a diagnostic tool for managers attempting to promote collaboration and knowledge sharing in important networks. Through this process, we found SNA uniquely effective in:

- promoting effective collaboration within a strategically important group;
- supporting critical junctures in networks that cross functional, hierarchical, or geographic boundaries; and
- ensuring integration within groups following strategic restructuring initiatives.

Promoting Effective Collaboration within a Strategically Important Group

SNA can be a very effective tool for promoting collaboration and knowledge sharing within important groups such as core functions of an organization, research and development departments, and strategic business units. For example, in one global consulting organization, we worked with a highly skilled group that was commissioned to provide thought leadership and specialized support to the organization's knowledge management consultants. This group was composed of people with either advanced degrees or extensive industry experience in strategy and organizational design or technical fields such as data warehousing or information architecture. By integrating these highly specialized skill sets, leadership of the consultancy felt the firm could provide a holistic knowledge management solution that would differentiate it from competitors focusing on solely technical or organizational solutions. However, the partner leading this group felt intuitively that the team was not leveraging its abilities as effectively as possible and asked us to conduct an SNA of information flow within the group.

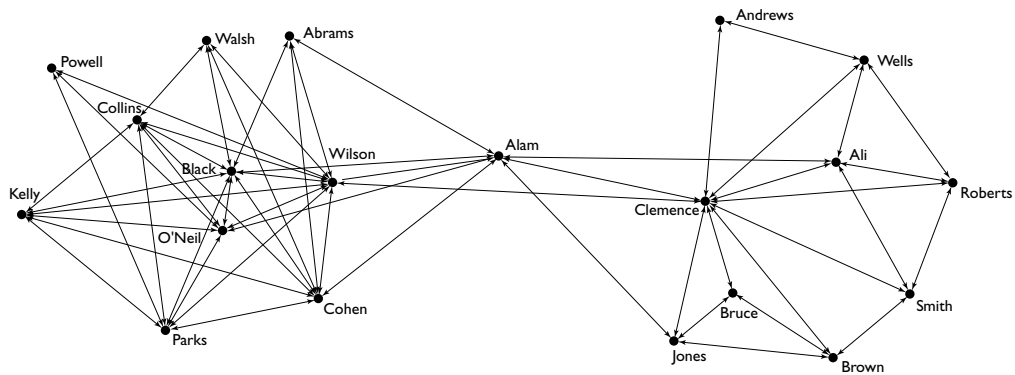
Our analysis confirmed the partner's intuition. As shown in the top half of Exhibit 1, the information sharing network revealed not one group at all, but two distinct sub-groups. Interestingly enough, the network had become divided on precisely the dimension it needed to be connected, as it was the group's unique skill sets that turned out to account for the fragmentation of this network. The group on the left side of the network was skilled in the "softer" issues of strategy or organizational design, often focusing on cultural interventions or other aspects of organizations to help improve knowledge creation and sharing. The group on the right was composed of people skilled in "harder" technical aspects of knowledge management, such as information architecture, modeling, and data warehousing.

Over time, members of these two sub-groups had gravitated to each other based on common interests. These people often worked on projects together and just as importantly shared common work-related interests in terms of what they read, conference attendance, and working groups within the organization. The problem was that each sub-group had grown to a point of not knowing what people in the other sub-group could do in a consulting engagement or how to think about involving them in their projects. Thus, even when there were opportunities in client engagements to incorporate each other's skill sets, this was often not done because neither group knew what the other knew or how to apply their skill sets to new opportunities. This was despite the fact that the group's strategic charter was to integrate these unique skill sets and that all aspects of formal organizational design supported this mission (e.g., reporting structure, common performance metrics and incentives).

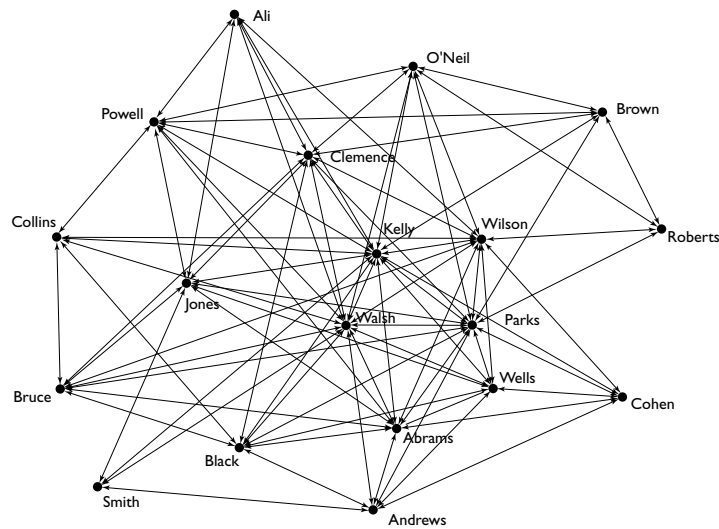
Conducting the SNA provided several intervention opportunities. A lengthy facilitated session with this group allowed them to assess and discuss the relative isolation of the two specialties as well as more pointed concerns

EXHIBIT I. Information Sharing within an Expert Consulting Group*

Pre-Intervention



Post-Intervention (Nine Months Later)



* Names were disguised in this example at the request of the organization.

about certain members' expertise not being tapped while other members appeared to be bottlenecks in sharing information. As a result of the discussion around this social network, various changes were made to the group's operations. First, a variety of internal projects—ranging from white papers to development of a project-tracking database—were jointly staffed with one person from each group. This forced people to work together and so begin to develop an appreciation of each other's unique skills and knowledge. Second, the partner

implemented mixed revenue sales goals so that each of the managers was accountable for selling projects that included both a technical and organizational component. This also forced people to find ways to integrate their approaches to addressing client problems. Finally, several new communication forums were created—including weekly status calls, a short update e-mail done weekly, and a project-tracking database that helped each person keep up to date on what other members were doing.

The result of these interventions was significant. Over the course of the next several months, the group began to sell more work that integrated technical and organizational skills. Importantly, this integration often proved to differentiate the consultancy from their competition in the sales process. Further, as can be seen in the bottom half of Exhibit 1, a network analysis conducted nine months later revealed a well-integrated group that was sharing information much more effectively.

In this case, the underlying problem was that each subgroup had grown to a point of not knowing what the other group knew (and so how to even consider integrating their expertise in projects). As a result, the interventions undertaken focused on helping to develop this awareness and not simply implementing a collaborative technology or group process intervention that ultimately would not have addressed the underlying need to create an awareness of each other's expertise. Other common factors fragmenting networks include:

- hierarchical leadership style;
- physical dispersion and virtual work;
- politics resulting in sub-groups;
- “not invented here” mentality resulting in networks with dense sub-groups only weakly connected to other sub-groups; and
- workflow processes or job descriptions that overload specific roles and slow the group.

Each of these issues demands a different set of interventions; however, social network analysis, combined with some interviews, makes these interactions visible, allowing for a diagnosis and an appropriate solution.

Supporting Critical Junctures in Networks that Cross Boundaries

SNA can also be an effective means of pinpointing breakdowns in informal networks that cross functional, hierarchical, geographic, or organizational boundaries (e.g., merger or acquisition scenarios, new product development or top leadership networks). People within these networks must often collaborate effectively for the organization to benefit despite the fact that they may reside in different physical locations and/or be held accountable for different financial and operational goals. SNA provides insight into collaborative behavior within and across boundaries that can yield a similar purchase on performance improvement opportunities as process mapping did for reengineering in the early

EXHIBIT 2. Collaboration Across Merged Divisions within a Conglomerate

	Div. 1	Div. 2	Div. 3	Div. 4	Div. 5	Div. 6	Div. 7	Div. 8
Division 1	33%							
Division 2	5%	76%						
Division 3	11%	18%	45%					
Division 4	2%	11%	21%	38%				
Division 5	6%	7%	12%	6%	75%			
Division 6	7%	2%	13%	7%	2%	76%		
Division 7	1%	3%	16%	6%	8%	2%	36%	
Division 8	10%	2%	9%	6%	3%	10%	0%	90%

1990s.²² Reengineering generally focused on “hand-offs,” decision points, and the “white space” in organizational charts to improve efficiency of work processes. Today, concern has shifted to innovation that often requires critical collaboration within and between functional units, divisions, and even entire organizations. Network analysis provides us with the means to understand where collaboration is and is not occurring.

Collaboration across Functional Boundaries

For example, we mapped the relationships of one *Fortune 500* organization’s top 126 executives to assess collaboration across divisions. This was an organization that had grown by acquisition over several years with the primary intent that acquired companies would combine their expertise in developing and taking to market new products and services. The CEO of this organization had become acutely aware of the need to create a leadership network that was able to recognize opportunities in one sphere of the network and know enough of what others in the conglomerate knew to be able to combine the appropriate resources in response to these opportunities. As there was some evidence that this was not happening, we were invited to come in and conduct an SNA of his top executives both within and across these acquired organizations.

While various network diagrams were generated in our assessment, the most insightful view came from a simple table demonstrating collaborative activity among this network of executives. Exhibit 2 outlines a table of the percentage of collaborative relationships that existed within and between each specific division (out of 100% possible in each cell). Looking at the table provided an opportunity to learn from practices within one division and apply these practices in others where the work of each division required similar levels of collaboration. Similarly, we were also able to determine which of the merged organizations (termed divisions in Exhibit 2) had integrated well with other divisions.

For example, a quick review of Exhibit 2 shows that divisions 3 and 4 had a relatively high degree of collaboration; whereas divisions 1 and 7 had minimal contact.²³

This simple summary of collaborative activity within and between divisions provided a great deal of insight into the inner-workings of the organization. The company had acquired various organizations with the intent that they collaborate in bringing their offerings to market. However, the SNA showed that there was only limited collaborative activity in pockets of the organization. Various reasons existed for this. In some settings, members of the executive team were not sure what a given division did and so did not know how to even think about involving them in their projects. In others, cultural barriers restricted people from seeking information outside of their own division. In some, the complementarity of product offerings that was presumed when an acquisition was made did not exist. As a result, different interventions were applied as appropriate throughout the network; however, it was the view of collaborative activity afforded by the SNA that allowed the organization to intervene appropriately at these strategic junctures.

Throughout the organizations we worked with in our research we found this kind of cross-boundary view powerful for identifying points where collaborative activity is not occurring due to organizational boundaries and providing a more targeted approach to interventions. It is important to recognize that it is often not the case that you want high collaborative activity among all departments within an organization. People have a finite amount of time to put into developing and maintaining relationships. With network analysis, we can begin to take a portfolio approach to considering the constellation of relationships that is worth investing time and energy to develop and maintain. For example, in the disguised scenario outlined above, it was not critical that Division 1 be tightly connected to all other divisions to help the organization meet strategic objectives. To provide strategic value to the organization, Division 1 really only needed to be well connected to Divisions 3, 5, and 6. Thus, rather than engage in a company-wide initiative to improve collaboration, more targeted and ultimately more successful interventions were employed to facilitate collaboration at specific junctures.

Mapping the pattern of information flow (or, more frequently, lack of flow) across functional barriers can yield critical insight into where management should target efforts to promote collaboration that will provide strategic benefit. Quite often, initiatives attempting to promote collaboration and learning take a cultural perspective and usually struggle with the enormity of the task at hand. In contrast, we have found that by targeting junctures in networks that hold strategic relevance for an organization, it is much more feasible to intervene where investments in collaboration yield strategic payoff for the organization. Moreover, by tracking changes in networks over time, management and network participants have a very real way of assessing the impact of interventions on both the informal network and organizational effectiveness.

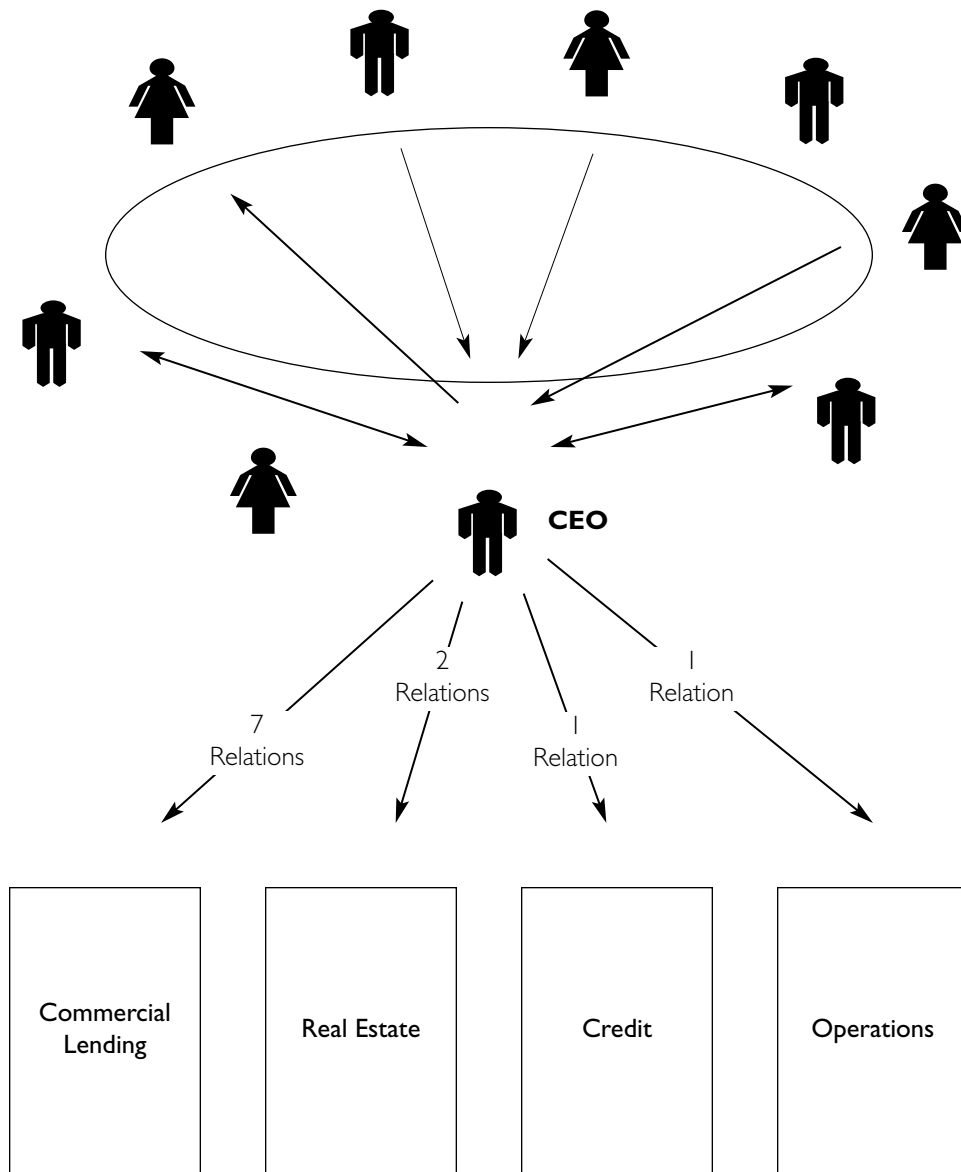
Collaboration across Hierarchical Boundaries

Another type of critical boundary within organizations is not functional but hierarchical. Across the various companies in our research, we have seen very different network patterns in relation to hierarchy. Some organization's informal networks are very similar to, and thus obviously constrained by, the organization's hierarchy. Others are more fluid and seem to place less of a constraint on whether employees follow the chain of command to obtain information. What is good or bad depends on the kind of work the organization does; however, it is interesting diagnostically to see the extent to which hierarchy conditions information flow and knowledge exchange in a given organization. Just as we analyzed collaboration across divisional boundaries in the conglomerate noted above, we can also assess collaboration and information sharing across hierarchical levels within an organization.

Alternatively, we can assess how those in positions of formal authority are embedded in larger networks within their organization. For example, we were asked to map the top leadership network of a commercial bank. However, rather than just mapping the top nine members of the management team, we looked at information-seeking and sharing behaviors among the top 62 executives of this organization (SVP level and above) to understand how this network was collaborating. One particularly informative view came from assessing the pattern of relationships *among* the top nine executives and then *between* these executives and the overall top 62 executives in the institution. By pulling out the top nine executives and mapping the flow of information among these executives, we could assess the extent to which this group was effectively collaborating as a decision-making body. Further, by considering this group in the context of the larger network of 62 people, we could also see the extent to which the executive team tapped into the larger leadership network for informational purposes or communicated decisions effectively back to this group. Exhibit 3 shows a simplified graphic portrayal of this network that identifies connections between the CEO and the remaining executives in both the executive leadership team and the bank's functional departments. In this diagram, the direction of the arrows reflects whom the CEO seeks out for information or advice and the numbers beside the arrows reflect the number of people in each department that the CEO turned to.

Diagnostically, these kinds of views are important along two fronts. First, by looking at a completed diagram showing the same relationship patterns for all members of the top management team, we can get a sense of how information tends to enter and leave this group. The bulk of information that managers use to make decisions comes from meetings and conversations. SNA provides a way to better understand the way in which teams might be biased in critical decisions by virtue of the kinds of information received in discussions with others. Which members of the executive team seem to reach out to various functional areas (and so likely best understand issues and concerns of these groups)? Is the executive group seeking information from (or at least listening to) these people? Are

EXHIBIT 3. Collaboration Across Hierarchical Boundaries



certain functional departments more sought out than others (thereby potentially representing biases in information this group relies on for strategic decision-making)? Given the strategic importance of the decisions that a top management team makes, understanding their sources and usage of information can provide critical insight into ways to improve their effectiveness. This of course also holds

for other groups such as new product development initiatives or process redesign efforts where one hopes that the teams are effectively reaching out to relevant and balanced sources of information prior to making critical decisions.

In terms of executive development, these kinds of views can also be highly effective in uncovering potential biases in a single person's network. A long-standing finding in communication research is that people tend to interact with people that are similar to themselves on a set of socially important attributes, such as race, gender, and age.²⁴ This makes communication easier and often more satisfying; however, it is also a source of bias in what executives learn and think is important. In the example above, it was apparent that the CEO heavily attended to and was influenced by the concerns of the commercial lending group where he spent the bulk of his career. In private conversations after reviewing this diagram, he reflected on what he felt were ineffective tendencies in his own decisions over time due in large part to the biased way he sought information from others. As a result of the SNA of his organization, he made more concerted efforts to balance whom he sought out for information within and outside of the bank.

Ensuring Integration within Groups Following Strategic Change Initiatives

SNA can also play a powerful role in assessing the health of informal structure after a change has been implemented such as an internal restructuring or acquisition. It is well known that performance does not always improve as anticipated even when technically sound solutions are implemented. Frequently, this problem is attributed either to a misalignment somewhere in the organization's formal structure or to a failure of leadership. However, we have consistently found that a lack of social, technical, or organizational support provided to strategically important informal networks is at least as important a predictor of failure. Very often, large-scale change initiatives impair the effectiveness of established networks while at the same time doing little to help development of new relationships.

SNA can be a very useful means of assessing the impact of strategic restructuring initiatives on the informal structure of an organization. For example, we conducted an SNA of the global telecommunications practice of a major consulting organization. This firm was going through a significant restructuring initiative to combine the expertise of several groups into one industry practice in order to compete more effectively with other major consulting organizations. By combining smaller practices into one global network, partners felt that the firm would be better able to provide the best and most directly relevant expertise for both sales initiatives and consulting engagements. Further, significant efficiency benefits were anticipated as consultants would be able to leverage the work of others in this practice rather than continually starting from scratch.

Of course, deriving these strategic benefits hinged on this group's willingness and ability to share information and leverage each other's expertise. Almost

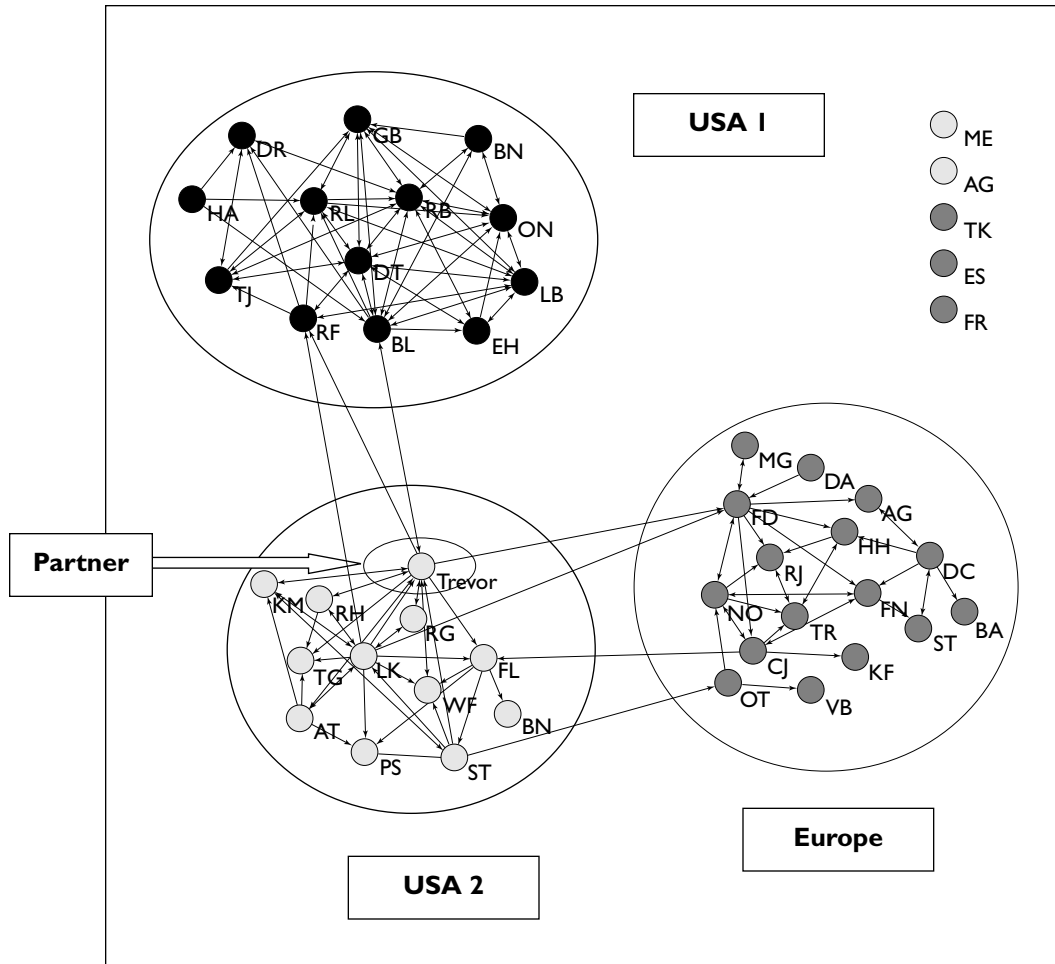
a year after the initial restructuring, the partner leading the practice had become increasingly concerned that the overall group was not integrating as effectively as it should. However, aside from some surface-level indicators of this problem based on sales and billable hour metrics, he had no true understanding of his practice's integration or where to begin in terms of corrective action. The practice was globally distributed and of such size that he had never even had the opportunity to meet many of the people. To get a better understanding of this network, he invited us in to conduct an SNA.

Our SNA revealed fragmentation of the network and provided some useful insights and information to work with in helping integrate his practice. What we immediately noticed was significant clustering in the network despite the entire practice reporting to one overall partner and being embedded within a common organizational context (i.e., strategy, performance metrics, technical infrastructure). As can be seen in Exhibit 4, we found three tightly knit sub-groups rather than one integrated network—two in North America and one in Europe. In fact, apart from the partner, only a handful of hierarchically lower-level employees served to bridge these sub-groups because they had developed relationships when staffed on projects together.

A first intervention for this partner was to use the network diagram to create common awareness of the lack of integration among the leaders of this practice. One of the more important benefits of SNA is that it helps to make visible, and therefore actionable, ways that work is occurring within organizations. We have worked with global groups ranging up to almost 300 people with only 3 or 4 levels of hierarchy. Clearly, the span of control combined with the physical dispersion of such groups makes it close to impossible for any one person or group of people to know what is going on or how executive decisions are affecting the work and effectiveness of these networks. SNA provides a snapshot for executives that can be used to gain agreement on what problems need to be addressed in such a distributed group, what appropriate interventions need to be taken, and also provides the ability to conduct a follow-up network analysis to ensure that interventions are having the desired impact.

In this case, though formal aspects of the organization were aligned, we learned that there were no initiatives in place to help employees learn others' expertise. As a result, the organization took a number of steps to help build this awareness of "who knows what." First, they redesigned their approach to staffing both client projects and internal initiatives to help integrate people from the different locations. On a technical front, they implemented a skill-profiling system and a virtual environment to promote collaboration on consulting engagements. On a social front, a series of face-to-face meetings were conducted to help people meet and learn the projects that other people were working on and the expertise that they held. This was critical to the group's integration as it was not until people actually met face to face that the skill-profiling system began to be used. Finally, a shift in skills targeted in recruiting as well as performance

EXHIBIT 4. Information Sharing in a Global Consulting Practice



measurement was made to encourage joint problem solving and de-emphasize individual expertise and task accomplishment.

The two groups in the U.S. represented another challenge for management. It turned out that the majority of people in these two groups not only had offices in the same building, but were interspersed along the same corridor. What we discovered in interviews was a political problem that had emerged and resulted in tensions between two sub-groups. While the partner leading the practice knew there were problems, the visual representation of the network diagram clearly showed the extent to which these issues were impeding the overall network. Various steps were taken to help resolve the problem, including: executive coaching, revised performance management practices, and an

extensive off-site planning session with organizational development interventions to help the group integrate.

In addition to altering various aspects of organizational design, other more pointed interventions unfolded with various people in the network, depending on whether they were highly central or highly peripheral. For example, central people were interviewed to see if certain aspects of their job could be parceled out to others so that they were not over-burdened and in danger of becoming a bottleneck. Alternatively, various approaches were taken with peripheral people to help get them integrated more effectively (depending on the specific issue that seemed to result in their being peripheral). A driving concern was to help develop relationships throughout the overall practice to improve knowledge sharing and the location of relevant expertise for both sales efforts and client engagements. Increasing connection within the network also reduced the extent to which the practice was exposed by the potential of central people leaving. In this and many other examples, we consistently find that a network view makes it clear that should certain central people in a network leave, they take more than just what they know, they also fundamentally affect the connectivity of the entire group.

Lessons from the Field

Throughout our research, we have consistently found SNA a powerful managerial tool largely because it makes visible the patterns of information sharing within and across strategically important networks. Simply reviewing these diagrams with managers usually results in myriad recommendations, as people immersed in the patterns of relationships define and resolve issues affecting group performance. In short, a picture really is worth a thousand words. Using social network diagrams as prompts in facilitated sessions can serve to identify issues that are currently hindering a group and the specific behaviors and organizational design elements requiring modification to improve group efficiency and effectiveness. Rich discussions will often evolve simply by showing network diagrams to the members of a group and asking them to diagnose the patterns they see, as well as the issues facilitating or impeding their effectiveness. Often this process simultaneously creates common awareness of problems, helps define solutions, and gains agreement on actions—all critical steps to effecting organizational change.

We have consistently found it important for groups to identify and work with people who are highly central. Often these people are central for legitimate reasons, based on, for example, workflow demands or unique expertise that a person brings to bear. Alternatively, we also find people who are central and affecting an overall network's effectiveness by virtue of either becoming over-burdened by their job or having a tendency to hoard information. Network diagrams can help determine who these people are and what might be done to both

allow other connections and work to occur around them as well as protect the organization should these people decide to go elsewhere.

It is just as important to use the network diagrams (or metrics) to identify peripheral people and find ways to improve their connection where appropriate. These people are often under-utilized by the group and are also frequently at the highest risk for turnover. Given the difficulty in attracting and retaining talented employees today, we have found it highly important to find ways to move people into the central part of the network more quickly. Unfortunately, it is rare to find practices where a new person has systematic opportunities to know what other people know in the organization and almost unheard of to find practices that teach the group what new individuals know. This is a critical shortcoming because as work becomes increasingly project-based, people are being drawn into the center of networks primarily as a result of what central people understand about their knowledge and skills when new opportunities arise.

We have also found social network diagrams to be a powerful tool for individuals to actively shape their personal networks. While certain managerial decisions and actions can be important to facilitate development of a network, an equally critical means of effecting change is for each person in the network to actively work on improving their own connectivity. Where possible, a key component of our debriefing sessions focuses on getting people to use the network diagrams to assess the effectiveness of their personal network along two dimensions. First, in terms of composition, we focus on the diversity within each person's network (e.g., "Do you rely too heavily on people from a specific functional area, a hierarchical level, or those that are simply closest to you?"). Second, in terms of content, we focus on the resources that people derive from these relationships (e.g., career advice, information, or other resources). Focusing on these two issues generally helps people recognize a need to invest in the development of specific kinds of relationships (and often times reduce an investment being made in existing relationships).

Of course, social network analysis is not a cure all. In our experience, it is important to be cautious about over-correcting with groups. One organization we worked with believed that a group of research scientists would function more efficiently if there were greater interaction across geographical regions. As a result, they put in place several interventions to ensure that members of the department worked more closely with people in other locations within the organization. After we performed the network analysis, we noticed that as a whole the department had integrated very well across the various geographical locations but functional units within the department were not well connected with each other despite sometimes being in the same building. This over-correction had resulted in a series of effectiveness and efficiency problems for the group. Thus, as managers consider interventions, it is important to take a balanced approach and always realize that improving some connections likely takes time away from the development and maintenance of others. People have only so much relational energy to expend.

Conclusion

In today's fast-paced knowledge-intensive economy, work of importance is increasingly accomplished collaboratively through informal networks. As a result, assessing and supporting strategically important informal networks in organizations can yield substantial performance benefits. In addition, network relationships are critical anchoring points for employees, whose loyalty and commitment may be more to sets of individuals in their network than to a given organization. Our research (and that of others) has found that these informal networks are increasingly important contributors to employee job satisfaction and performance. Yet despite their importance, these networks are rarely well-supported or even understood by the organizations in which they are embedded. Social network analysis provides a means with which to identify and assess the health of strategically important networks within an organization. By making visible these otherwise "invisible" patterns of interaction, it becomes possible to work with important groups to facilitate effective collaboration.

Perhaps just as importantly, social network diagrams often serve to focus executive attention on informal networks that can be critical to organizational effectiveness. Scarce resources—ranging from funding and technology support on the one hand to executive recognition on the other—tend to go to those units that can be found on an organizational chart. Despite often not being reflective of how work is done, organizational charts and reporting relationships are the agreed on currency of executive decision makers and their trusted advisors. Network diagrams, such as the ones shown here, can be very compelling tools with which to re-focus executive attention on how organizational design decisions and leadership behaviors affect the relationships and information flows that are at the heart of how work is done. Our research has consistently shown that while social relationships cannot be mandated by management, they are strongly affected by elements under management control, such as hierarchical levels, horizontal departments, office location, project staffing, and so on. With social network analysis, managers have a means of assessing the effects of decisions on the social fabric of the organization.

APPENDIX I

Collecting Network Data: Some Questions to Ask

<i>If Trying to Discover . . .</i>	<i>These Kinds of Questions Can Help . . .</i>
<p>Communication Network—The informal structure of an organization as represented in ongoing patterns of interaction, either in general or with respect to a given issue.</p> <p>Rationale—To understand the informal structure. It can be particularly helpful to identify sub-groups or cliques that might represent political problems or individual roles in these networks such as highly central parties, isolates and bottlenecks.</p>	<ul style="list-style-type: none"> ▪ How often do you talk with the following people regarding (topic x)? ▪ How much do you typically communicate with each person relative to others in the group?
<p>Information Network—Who goes to whom for advice on work-related matters.</p> <p>Rationale—Just assessing who communicates with whom does not guarantee that the interactions reflect exchanges of information important to do one's work. Particularly in efforts that require a collective to effectively pool its knowledge (e.g., new product development), it is important to understand the effectiveness with which a group traffics in information.</p>	<ul style="list-style-type: none"> ▪ How frequently have you acquired information necessary to do your work from this person in the past month? ▪ Information I receive from this person is useful in helping to get my work done. ▪ Who do you typically seek work-related information from? ▪ Who do you typically give work-related information to?
<p>Problem-Solving Network—Who goes to whom to engage in dialogue that helps people solve problems at work.</p> <p>Rationale—Interactions with other people help us think about important dimensions of problems we are trying to solve or consequences of actions we are considering. Strong problem solving networks often ensure that people are solving the right problem thus improving both individual and network performance.</p>	<ul style="list-style-type: none"> ▪ Who do you typically turn to for help in thinking through a new or challenging problem at work? ▪ How effective is each person listed below in helping you to think through new or challenging problems at work?

If Trying to Discover . . .

*These Kinds of Questions
Can Help . . .*

Know Network—Who is aware of whose knowledge and skills.

Rationale—Awareness of what someone else knows dictates whether and for what problems you are likely to turn to them for help. Strong knowledge networks are an essential basis for strong information networks.

- How well do you understand this person's knowledge and skills?

Access Network—Who has access to whose knowledge and expertise.

Rationale—Just knowing someone has relevant information or knowledge does not guarantee that they will share it with you in a way that is helpful. A strong access network is often critical to ensuring effective information sharing and problem solving in a sufficiently timely fashion.

- When I need information or advice, this person is generally accessible to me within a sufficient amount of time to help me solve my problem.

Notes

1. For example, research has shown that relationships are critical for obtaining information, learning how to do your work, and collectively solving cognitively complex tasks. For "obtaining information," see, for example, G. Simmel, *The Sociology of Georg Simmel*, translated by K.H. Wolff (New York, NY: Free Press, 1923, 1950); M. Granovetter, "The Strength of Weak Ties," *American Journal of Sociology*, 78 (1973): 1360-1380; T. Allen, *Managing the Flow of Technology* (Cambridge, MA: MIT Press, 1977); R. Burt, *Structural Holes* (Cambridge, MA: Harvard University Press, 1992); E. Rogers, *Diffusion of Innovations*, 4th edition (New York, NY: Free Press, 1995); G. Szulanski, "Exploring Internal Stickiness: Impediments to the Transfer of Best Practices Within the Firm," *Strategic Management Journal*, 17 (Winter 1996, Special Issue): 27-43. For "learning how to do your work," see, for example, J. Lave and E. Wenger, *Situated Learning: Legitimate Peripheral Participation* (Cambridge: Cambridge University Press, 1991); J.S. Brown and P. Duguid, "Organizational Learning and Communities-of-Practice: Toward a Unified View of Working, Learning and Innovation," *Organization Science*, 2/1 (1991): 40-57; J.S. Brown and P. Duguid, *The Social Life of Information* (Cambridge, MA: Harvard Business School Press, 2000); J.E. Orr, *Talking About Machines* (Ithaca, NY: Cornell University Press, 1996); E. Wenger, *Communities of Practice* (Oxford: Oxford University Press, 1998); E. Wenger and W. Snyder, "Communities of Practice: The Organizational Frontier," *Harvard Business Review*, 78/1 (January/February 2000): 139-145. For "collectively solving cognitively complex tasks," see, for example, K. Weick and K. Roberts, "Collective Mind in Organizations: Heedful Interrelating on Flight Decks," *Administrative Science Quarterly*, 38/3 (September 1993): 357-381; E. Hutchins, "Organizing Work by Adaptation," *Organization Science*, 2/1 (January/February 1991): 14-29; R. Moreland, L. Argote, and R. Krishnan, "Socially Shared Cognition at Work: Transactive Memory and Group Performance," in J. Nye and A. Brower, eds., *What's Social About Social Cognition* (Thousand Oaks, CA:

- Sage, 1996); A. Hollingshead, "Retrieval Processes in Transactive Memory Systems," *Journal of Personality and Social Psychology*, 74/3 (1998): 659-671.
2. It is one problem to learn or act on knowledge with others who think like you (such as in a community of practice), however, it is an entirely different problem to do this in diverse social contexts, such as cross-functional teams, where people often do not share a common vision, language, metrics of performance, or even understanding of the problem itself. For example, sociologists have poignantly demonstrated how correct information can have little or no impact on critical decision processes. I. Janis, *Groupthink: Psychological Studies of Policy Decisions and Fiascoes* (Boston, MA: Houghton-Mifflin, 1982); C. Perrow, *Complex Organizations: A Critical Essay* (New York, NY: McGraw Hill, 1986); D. Vaughn, *The Challenger Launch Decision: Risky Technology, Culture and Deviance at NASA* (Chicago, IL: University of Chicago Press, 1996). Further, organizational theorists have shown that a person's knowledge can be role constrained [J. March and J. Olsen, "The Uncertainty of the Past: Organizational Learning Under Ambiguity," *European Journal of Political Research*, 3 (1975): 147-171; 1975; B.T. Pentland, "Organizing Moves in Software Support Hot Lines," *Administrative Science Quarterly*, 37/4 (1992): 527-548] or not acted upon due to motivational or cognitive impediments resulting from introducing knowledge into diverse social contexts [D. Dougherty, "Interpretive Barriers to Successful Product Innovation in Large Firms," *Organization Science*, 3/2 (1992): 179-202; C.M. Fiol, "Consensus, Diversity and Learning in Organizations," *Organization Science*, 5/3 (May/June 1994); R.J. Boland, Jr., and V.T. Ramkirshnan, "Perspective Making and Perspective Taking in Communities of Knowing," *Organization Science*, 6/4 (July/August 1995): 350-372; Szulanski, op. cit.].
3. See, for example, J. Coleman, "Social Capital in the Creation of Human Capital," *American Journal of Sociology*, 94 (1988): S95-S120; R. Burt (1992), op. cit.; R. Burt, "The Contingent Value of Social Capital," *Administrative Science Quarterly*, 42/2 (June 1997): 339-365; M. Hansen, "The Search-Transfer Problem: The Role of Weak Ties in Sharing Knowledge Across Organization Sub-Units," *Administrative Science Quarterly*, 44/1 (March 1999): 82-111; J. Podolny and J. Baron, "Resources and Relationships: Social Networks and Mobility in the Workplace," *American Sociological Review*, 62/5 (October 1997): 673-693; J. Nahapiet and S. Ghoshal, "Social Capital, Intellectual Capital, and the Creation of Value in Firms," *Academy of Management Review*, 23/2 (April 1998): 242-266; R. Leenders and S. Gabbay, *Corporate Social Capital and Liability* (Boston, MA: Kluwer, 1999); D. Cohen and L. Prusak, *In Good Company: How Social Capital Makes Organizations Work* (Boston, MA: Harvard Business School Press, 2000); N. Lin, *Social Capital: A Theory of Social Structure and Action* (Cambridge: Cambridge University Press, 2001).
4. W. Baker, *Networking Smart: How to Build Relationships for Personal and Organizational Success* (New York, NY: McGraw-Hill, 1994); W. Baker, *Achieving Success Through Social Capital* (San Francisco, CA: Jossey-Bass, 2000).
5. See, for example, D. Krackhardt, "The Strength of Strong Ties: The Importance of Philos in Organizations," in N. Nohria and R. Eccles, eds., *Networks and Organizations: Structure, Form, and Action* (Boston, MA: Harvard Business School Press, 1992); D. Krackhardt, "Constraints on the Interactive Organization as an Ideal Type," in C. Heckscher and A. Donnellon, eds., *The Post-Bureaucratic Organization: New Perspectives on Organizational Change* (Thousand Oaks, CA: Sage Publications, 1994); D. Krackhardt and J.R. Hanson, "Informal Networks: The Company behind the Chart," *Harvard Business Review*, 71/4 (July/August 1993): 104-111.
6. To be sure, academics and practitioners have discussed shifts to network forms via mechanisms such as joint ventures, partnerships, strategic alliances, and R&D consortia for some time now. [R. Miles and C. Snow, "Network Organizations:

- New Concepts for New Forms," *California Management Review*, 28/3 (Spring 1986): 62-73; R. Miles and C. Snow, *Fit, Failure, and the Hall of Fame* (New York, NY: Free Press, 1994); R. Miles and C. Snow, "The New Network Firm: A Spherical Structure Built on a Human Investment Policy," *Organizational Dynamics*, 23/4 (Spring 1995): 4-18; C. Handy, *The Age of Paradox* (Boston, MA: Harvard Business School Press, 1994); C. Heckscher, "Defining the Post-Bureaucratic Type," in C. Heckscher and A. Donnellon, eds., *The Post-Bureaucratic Organization: New Perspectives on Organizational Change* (Thousand Oaks, CA: Sage, 1994); J. Galbraith, *Designing Organizations: An Executive Briefing on Strategy, Structure, and Process* (San Francisco, CA: Jossey-Bass, 1995).] Such forms are presumed to allow for the effective integration of knowledge and capabilities across organizational entities. However, there has been much less practical attention paid to how informal networks of employees in either traditional or networked organizations facilitate or impede organizational effectiveness.
7. See, for example, D. Krackhardt, "Cognitive Social Structures," *Social Networks*, 9 (1987): 109-134; D. Krackhardt, "Assessing the Political Landscape: Structure, Cognition, and Power in Organizations," *Administrative Science Quarterly*, 35/2 (June 1990): 342-369; T. Casciaro, "Seeing Things Clearly: Social Structure, Personality, and Accuracy in Social Network Perception," *Social Networks*, 20 (1998): 331-351.
 8. D. Krackhardt and J.R. Hanson, "Informal Networks: The Company behind the Chart," *Harvard Business Review*, 71/4 (July/August 1993): 104-111, at p. 104.
 9. J.L. Moreno, *Who Shall Survive?* (Washington D.C: Nervous and Mental Disease Publishing Company, 1934).
 10. S.F. Nadel, *The Theory of Social Structure* (New York, NY: Free Press, 1957); J.C. Mitchell, "The Concept and Use of Social Networks," in J. Clyde Mitchell, ed., *Social Networks in Urban Situations* (Manchester: Manchester University Press, 1969).
 11. H.C. White, *An Anatomy of Kinship* (Englewood Cliffs, NJ: Prentice-Hall, 1963); J.P. Boyd, "The Algebra of Group Kinship," *Journal of Mathematical Psychology*, 6 (1969): 139-167.
 12. F. Harary, *Graph Theory* (Reading, MA: Addison-Wesley, 1969).
 13. E. Durkheim, *The Division of Labor in Society*, translated by G. Simpson (New York, NY: Free Press, 1893, 1933); G. Simmel, *Conflict and Web of Group Affiliations*, translated by K.H. Wolff and R. Bendix (New York, NY: Free Press, 1922, 1955).
 14. See, for example, J. Lincoln, "Intra- and Interorganizational Networks," in Samuel B. Bacharach, ed., *Perspectives in Organizational Sociology* (Greenwich, CT: JAI Press, 1982), pp. 1-38; B. Wellman and S.D. Berkowitz, *Social Structures: A Network Approach* (Greenwich, CT: JAI Press, 1997); N. Nohria and R.G. Eccles, eds., *Networks in Organizations: Structure, Form, and Action* (Boston: MA, Harvard Business School Press, 1992); S. Andrews and D. Knoke, eds., *Networks In and Around Organizations, Research in the Sociology of Organizations*, 16 (Stamford, CT: JAI Press, 1999).
 15. P.R. Monge and E.M. Eisenberg, "Emergent Communication Networks," in F. Jablin, L. Putnam, K. Roberts, and L. Porter, eds., *Handbook of Organizational Communication* (Newbury Park, CA: Sage Publications, 1987); P. Monge and N. Contractor, "Dualisms in Leadership Research," in F. Jablin and L. Putnam, eds., *The New Handbook of Organizational Communication: Advances in Theory, Research, and Methods* (Thousand Oaks, CA: Sage, 2000).
 16. Homophily refers to the extent to which communicating individuals are similar. P. Lazarsfeld and R. Merton, "Friendship as a Social Process," in M. Berger, ed., *Freedom and Control in Modern Society* (New York, NY: Octagon, 1964).

17. See, for example, T. Zenger and B. Lawrence, "Organizational Demography: The Differential Effects of Age and Tenure Distributions on Technical Communication," *Academy of Management Journal*, 32/2 (June 1989): 353-376; H. Ibarra, "Homophily and Differential Returns: Sex Differences in Network Structure and Access in an Advertising Firm," *Administrative Science Quarterly*, 37/3 (September 1992): 422-447; H. Ibarra, "Race, Opportunity, and Diversity of Social Circles in Managerial Networks," *Academy of Management Journal*, 38/3 (June 1995): 673-703; M. McPherson, L. Smith-Lovin, and J. Cook, "Birds of a Feather: Homophily in Social Networks," *Annual Review of Sociology*, 27 (2001): 415-444.
18. See, for example, Lincoln, op. cit.; W. Stevenson, "Formal Structure and Networks of Interaction within Organizations," *Social Science Research*, 19 (1990): 113-131; W.B. Stevenson and M. Gilly, "Problem-Solving Networks in Organizations: Intentional Design and Emergent Structure," *Social Networks*, 22 (1993): 92-113; D. Brass, "Being in the Right Place: A Structural Analysis of Individual Influence in an Organization," *Administrative Science Quarterly*, 29/4 (December 1984): 518-539.
19. See, for example, Allen, op. cit.; P. Monge, L. Rothman, E. Eisenberg, K. Miller, and K. Kirste, "The Dynamics of Organizational Proximity," *Management Science*, 31/9 (September 1985): 1129-1141.
20. A. Bavelas, "Communication Patterns in Task-Oriented Groups," *Journal of Acoustical Society of America*, 22 (1950): 725-730; H. Leavitt, "Some Effects of Certain Communication Patterns on Group Performance," *Journal of Abnormal and Social Psychology*, 46 (1951): 38-50; M. Shaw, "Communication Networks," in L. Berkowitz, ed., *Advances in Experimental Social Psychology* (New York, NY: Academic Press, 1964).
21. Social network researchers have also developed a wide range of quantitative analyses and tools for assessing networks. While beyond the scope of this article, readers interested in more depth on this front should turn to Scott or to Wasserman and Faust for an introductory treatment. J. Scott, *Social Network Analysis*, 2nd Edition (Thousand Oaks, CA: Sage Publications, 2000); S. Wasserman and K. Faust, *Social Network Analysis: Methods and Applications* (Cambridge: Cambridge University Press, 1994).
22. G. Rummier and A. Brache, *Improving Performance: How to Manage the White Space on the Organization Chart* (San Francisco, CA: Jossey-Bass, 1990); M. Hammer and J. Champy, *Reengineering the Corporation: A Manifesto for Business Revolution* (New York, NY: HarperBusiness, 1993); M. Hammer and S. Stanton, *The Reengineering Revolution: A Handbook* (New York, NY: HarperBusiness, 1995).
23. A side benefit of our research program has been development of an extensive database that can be used for benchmarking purposes.
24. See, for example, P. Marsden, "Homogeneity in Confiding Relations," *Social Networks*, 10 (1988): 57-76; K. Carley, "A Theory of Group Stability," *American Sociological Review*, 56/3 (June 1991): 331-354; Ibarra (1992), op. cit.; Ibarra (1995), op. cit.; D. Brass, "A Social Network Perspective on Human Resources Management," *Research in Personnel and Human Resources Management*, 13 (1995): 39-79.

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