

WHITE PAPER

**Strategic Collaboration:
Using Social Network Analysis to
Integrate Human Networks**

by

**Rob Cross & Andrew Parker
IBM Institute for Knowledge Management
Steve Borgatti, Boston College**

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IKM Executive Director: Laurence Prusak

Editor: Don Cohen (doncohen@rcn.com); (617) 693-4606

Design and Production: AARTPACK, Inc. (www.aartpack.com)

Institute for Knowledge Management

55 Cambridge Parkway, LDB 3E

Cambridge, MA 02142

<http://ikm.ihost.com>

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Abstract

With efforts to de-layer organizations and reduce functional boundaries, coordination and work of importance increasingly occurs through informal relations rather than traditional hierarchical or functional channels. However, while organizations are moving to network forms through joint ventures, alliances and other collaborative relationships there has been little practical attention paid to the way in which human networks might be assessed and supported in organizations. Working with a consortium of Fortune 500 companies and several government agencies formed to study social aspects of knowledge management we investigated collaboration and knowledge sharing activities in twenty-six networks among twenty-two different organizations.

We found social network analysis (SNA) particularly effective in: 1) Identifying a network's ability to leverage its collective knowledge in response to new opportunities or problems; 2) Assessing cross-boundary collaboration in networks that cross functional, hierarchical or geographic boundaries and 3) Ensuring integration following restructuring or other change initiatives. This article outlines practical guidelines and a series of case studies to demonstrate the application of social network analysis to promote collaboration in strategically important groups such as top leadership networks, strategic business units, new product development teams, communities of practice, joint ventures or mergers. By assessing and supporting these important networks of relationships we have found that managers can improve effectiveness of their organizations.

Strategic Collaboration

We live in exciting times where wealth can be created, or opportunities missed, seemingly in the blink of an eye. As we move further into a knowledge-based economy we are finding that the pace of business is accelerating and the problems or opportunities that organizations encounter becoming more complex. Effective collaboration, both within and across organizations, is an important capability as it is increasingly a luxury of the past for any one employee to know enough individually to solve problems and react to novel opportunities. This business environment creates challenges for traditional organizational principles dating to Max Weber and Frederick Taylor. Rigid bureaucracies impede the flow of information across hierarchical boundaries and frequently slow decision-making. Excessive specialization fragments work processes, making integration of expert knowledge difficult and responsiveness to environmental demands sluggish. These management principles, useful in more staid times, are problematic in a business environment demanding innovation, flexibility and the capability to integrate specialist knowledge to solve increasingly complex problems.

Over the past decade or so significant restructuring efforts have resulted in organizations with fewer hierarchical levels and more permeable internal and external boundaries (Hirschhorn & Gilmore, 1992; Hammer & Champy, 1993; Mohrman, Cohen & Mohrman, 1995; Kerr & Ulrich, 1995; Denison, et al, 1996; Cross, Yan & Louis, 2000). While presumably promoting efficiency and flexibility, a byproduct of these restructuring efforts is that coordination and work increasingly occurs through informal networks of relationships rather than through channels tightly prescribed by hierarchy or organizational design. Our own research indicates that these networks often cross

functional, hierarchical, geographic or even company boundaries and are frequently unknowingly fragmented by hierarchy, policies and procedures, job design, performance management systems and even occupational sub-cultures within an organization.

Particularly in knowledge intensive work this is problematic as people rely very heavily on their network of relationships to find information and solve problems. Tom Allen (1977) found that engineers and scientists were roughly five times more likely to turn to a person for information than to an inanimate source such as a database or a file cabinet. In other settings, research has consistently shown that who you know has a significant impact on what you come to know as relationships are critical for informational purposes.¹

How do we best support effective collaboration and learning within critical networks of employees in organizations? Academics and practitioners have discussed shifts to network forms of organizing via mechanisms such as joint partnerships, strategic alliances, R&D consortia and a variety of other entities for some time now (Miles & Snow, 1986, 1994 & 1995; Handy, 1994; Heckscher, 1994; Galbraith, 1995). Such forms are presumed to result in ‘boundaryless’ organizations that allow for the effective integration of knowledge and capabilities across organizational entities. There has been much less practical attention paid to how the network of human relationships actually doing the work in these organizations either facilitates or impedes the success of these more abstract forms.² Certainly we can expect emerging collaborative technologies to

¹ Research has shown that relationships are critical for obtaining information (e.g., Simmel, 1950; Granovetter, 1973; Allen, 1977; Burt, 1992; Rogers, 1995; Szulanski, 1996; Shah, 1998) and learning how to do your work (e.g., Lave & Wenger, 1991; Brown & Duguid, 1991 & 2000; Orr, 1996; Wenger, 1998).

² Social network analysis has enjoyed a rich research tradition within the fields of anthropology, sociology, psychology, and epidemiology and increasingly in organization studies (Tichy & Fombrun, 1979; Nohria, 1992). Within this tradition, network analysis has helped advance our thinking on such theoretical constructs as power (Brass, 1984; Krackhardt, 1990; Burkhardt & Brass, 1990), communication (Monge & Eisenberg, 1987; Monge & Contractor, 2000), the diffusion of innovation (Rogers, 1995; Burt 1987), information flow (Granovetter, 1973; Allen, 1977) and formation and maintenance of belief systems

facilitate virtual work and skill profiling systems to help with the location of relevant expertise. However, as so poignantly demonstrated by reengineering, technology alone can only accomplish so much (Hammer & Champy, 1993; Hammer & Stanton, 1995). Just finding someone with relevant expertise in a skill profiling system does not ensure that they will respond to informational requests. Similarly, just putting a collaborative technology in place does not ensure its use. More often than not, use of these technologies hinges on the social foundation of relationships upon which the technology is placed.

Unfortunately, both practical experience and scholarly research indicates significant difficulty in ensuring that people with different expertise and backgrounds effectively and efficiently integrate their expertise.³ Two years ago we initiated a research program to determine how organizations can better support work occurring in such networks of people. Working with a consortium of Fortune 500 companies and several government agencies formed to study social aspects of knowledge management we investigated knowledge creation and sharing activities in twenty-six networks from twenty-two different organizations. In all cases the groups we studied provided strategic value to their organization in part by their ability to integrate their collective knowledge. We found social network analysis to be a valuable tool for assessing and promoting collaboration in strategically important groups such as top leadership networks, strategic

(Erickson, 1988). However, except for academic research, the application of SNA to actual business settings in a diagnostic and prescriptive way has been limited (See Krackhardt & Hanson, 1993 for exception). As a result, many practitioners we work with are initially unaware of the pragmatic applications of a social network analysis.

³ It is one problem to learn or act on knowledge with others who think like you (such as in a community of practice). 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 (Janis, 1982; Perrow, 1986; Vaughn, 1996). Further, organizational theorists have shown that a person's knowledge can be role constrained (March & Olsen, 1975; Pentland, 1992) or not acted upon due to motivational or cognitive impediments

business units, new product development teams, communities of practice, joint ventures and mergers. This article outlines practical guidelines and several case studies to demonstrate the business application of social network analysis. However, as social network analysis is often a new concept to managers, we first provide a quick overview and example.

Social Network Analysis

Social network analysis (SNA) provides a rich and systematic ability to assess human networks by mapping and analyzing relationships among people, teams, departments or even entire organizations. With modest effort, SNA can be used as a critical managerial tool to help leaders understand the myriad relationships either facilitating or impeding work.⁴ Though often adamant that they know their organization, studies are showing that managers have very different levels of accuracy in understanding the networks around them (e.g., Krackhardt, 1987, 1990; Casciaro, 1998). By virtue of their position in the hierarchy, managers are frequently far removed from the day-to-day work interactions that generate the informal structure and so may have a very inaccurate understanding of the actual patterns of relationships. And the potential for inaccurate perceptions is only increased by our transition into a world of virtual work and telecommuting where employees are engaged in work relationships increasingly invisible to superiors. A network diagram can provide an x-ray of the way in which work is or is

resulting from introducing knowledge into diverse social contexts (Dougherty, 1992; Fiol, 1994; Boland & Ramkirshnan, 1995; Szulanski, 1996).

⁴ In general, very useful network diagrams and analyses can be generated by conducting a 10-minute survey of participants and spending a few hours analyzing the results.

not occurring in these informal networks and so help manager's improve the effectiveness of their organization.

For example, consider the network below for a virtual leadership group supporting the software development efforts of a Fortune 100 organization.

Editor's Note: Insert Exhibit 1 About Here

There are several important features to note about this diagram. First, it represents a single aspect (or dimension) of the informal structure in this group --- in this case, what we call the "advice" network, which was elicited by asking each person in the group 'Who do you turn to for information to get your work done?' We normally use separate maps to diagram each aspect of the informal structure (such as trust, influence, and friendship), because each of these relationships can have a different structure and different effects on a group. The kinds of relations one chooses to assess is an important decision as most relationships are multi-dimensional -- a given pair of employees may be simultaneously friends, members of the same department and boss-subordinate.

A second point of interest in viewing network diagrams is the extent to which the group is connected or split into sub-groups, which can indicate political problems or an inability to move information from one area of the network to another. In this specific example, although the leadership network has an overall mission to facilitate the software development process for the organization, one can fairly clearly see two distinct subgroups that have less interaction between than amongst themselves. It turns out that existing knowledge and skill sets account for these two sub-groups -- the group on the

left has a highly technical orientation whereas the group on the right has a strategic and organizational focus. While John is technically the formal leader of the group, the diagram indicates that the sub-group on the left is focused on Helen and Lisa while the one on the right, although not as tightly knit, is focused on Nikki and Kate. The functional orientation of the two teams plus the fact that the group is virtual has been a partial block to effective integration. This is a common finding in social networks as functional, geographic or hierarchical differences often fragment informal relations.

Third, the diagram has arrowheads to indicate the direction of the relationship. For example, we can tell that Bill seeks advice from Lisa, but Lisa does not seek advice from Bill. In contrast Helen and Jane have a reciprocal relationship in which each seeks advice from the other. Social relations that can be asymmetric, such as “seeking advice from.” are known as *directed* relations. They contrast with *undirected* relations, such as “works with” or “communicates with,” which are necessarily always symmetric and are usually diagrammed without arrowheads. Directed relations can be particularly helpful diagnostically as here we find that Helen is fairly influential in this network—six people turn to her for advice—whereas Sue, Bill and Jack are fairly non-influential in terms of advice (no one asks them for advice). As a result, though Helen is relatively low in the organizational hierarchy (John is the head of the group) she would clearly be considered an influential opinion leader.

Finally, in addition to understanding which people are central, it is often important to better understand people who are peripheral in a network. These people often represent an under-utilized asset for the group. For example, in this network, we find that Jane and Sue are both on the periphery of the network and Bob is completely

isolated. It is often the case that peripheral people are new to an organization or team and haven't been fully assimilated. Given the increased turnover many companies experience today, it is important to find ways to move people into the central part of the network more and more quickly. This is often a process that can be improved by focusing on the way that new people are brought into a group. 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 (or new groups in merger scenarios) know. This is a critical shortcoming since, with work increasingly being project-based, people will be brought into the center of the network primarily as a result of what other people understand about their knowledge and skills.

Application of Social Network Analysis

In our work with various organizations, we have found social network analysis to be a particularly helpful tool for understanding collaboration and the social fabric of an organization. By making visible where key collaborations are or are not occurring, SNA makes it possible to apply technical or organizational interventions to improve important networks. We have found SNA particularly effective in three ways:

- Identifying a specific group's ability to leverage its collective knowledge.
- Assessing cross-boundary collaboration (e.g., functional integration, merger & acquisition scenarios or joint ventures).
- Ensuring integration following restructuring or other change initiatives.

Identifying a specific group's ability to leverage its collective knowledge.

SNA can be very effective in helping to assess the extent to which a given group is effectively leveraging its collective knowledge. When applying SNA, the overarching concern is to find a group that provides strategic advantage to the organization as a product of its ability to leverage its collective knowledge. 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 consultants. This group was composed of people with advanced degrees and/or extensive industry experience in the emerging field of knowledge management --- a market in which the consulting organization wanted to develop a capability. By integrating highly specialized skill sets the executive leadership of this 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 virtual group felt intuitively that the team was not leveraging its abilities in as effective a fashion as possible.

Social network analysis confirmed his intuition. As shown in the top half of Exhibit 2, when we looked at the advice network for this group, what we found was not one group at all but two distinct sub-groups. Interestingly enough, the group had become divided on precisely the dimension they needed to be connected as it was their unique skill sets that turned out to account for the separation 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.

[Editors Note: Insert Exhibit 2 About Here]

Over time, members of these two sub-groups had gravitated to each other based on their 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 one group did not know what the other knew. This is despite the fact that integrating these unique skill sets in sales efforts and project work might have presented a competitive advantage in relation to other firms that tended to focus heavily on only the technical or organizational front.

Conducting the social network analysis 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 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 whitepapers 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 group began to implement mixed revenue sales goals so that each of the managers were accountable for selling projects that included both a technical and organizational component. This also forced people to find ways to integrate their unique 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 of the group 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. And this integration often proved to differentiate this group from their competition in the sales process. Further, as can be seen in the bottom half of Exhibit 2, a network analysis conducted nine months later revealed a well-integrated group that was leveraging and seeking each other's knowledge much more effectively.

In this and many other situations we have found social network analysis to be a valuable tool for assessing informal structure of a given group. The key in these scenarios is to identify a network that supports the organization's strategy by effective collaboration. For example, we networked the organization design practice of one global consultancy and found problems with information flowing across national boundaries as well as very different patterns of collaboration in key offices. For this specific network it provided an opportunity to identify and transfer best practices from the higher to the lower performing offices. Alternatively, in another setting we networked a global group

of immunologists at a Fortune 250 pharmaceutical company and identified significant opportunities to improve collaboration across research sites. In addition to improving collaboration amongst this network of scientists, the network analysis also brought to light the risk of outside connections with universities and research organizations being too heavily concentrated among a small number of people. By selecting a strategically important group within an organization, we consistently find that applying SNA provides many opportunities to improve operations with both organizational and technical interventions.

Assessing cross-boundary collaboration. Social network analysis can also be an ideal tool for pinpointing problems of collaboration by mapping networks that must cross organizational boundaries of some form (e.g., merger or acquisition scenarios 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. Social network analysis provides an 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 1990s (Rummler & Brache, 1990; Hammer & Champy, 1993; Hammer & Stanton, 1995). 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 there is effective collaboration and where there is not.

For example, we were asked to look at the leadership network of a commercial bank. The CEO had a vision of creating a network that “knew what it knew” whereby people in the organization more dynamically tapped into the expertise and skills of their colleagues to respond to opportunities presented in the environment. He believed (and had stories to substantiate the point) that lending or fee-based opportunities were often overlooked by his employees simply because they did not know that the organization contained the relevant skill sets to address the opportunities. As a result, he asked us to conduct a social network analysis of information seeking and sharing behaviors among the top 62 executives of this organization (SVP level and above) to understand how this network was collaborating.

We performed a series of network analyses for the organization and recommended a variety of social and technical interventions to improve overall connectivity in the group.⁵ The network analysis was particularly instructive when we looked at the level of collaboration between critical departments. Exhibit 3 displays some of this information in a table format. The numbers in the table represent the percentage of pairs of people who had a working collaborative relationship out of 100% possible connections. The table is broken out by organizational divisions, so that we can assess the degree of collaboration within and between divisions. For example, we can read from the table that 49% of all pairs of individuals within the Real Estate Lending division had collaborative relationships. In stark contrast we found that only 10% of all

pairs in which one person is a member of Real Estate and the other is a member of Commercial Lending were collaborating.

[Editors Note: Insert Exhibit 3 About Here]

What is instructive about this type of view is that it helps us assess the quality of collaborative activity between divisions, functions or teams—and so helps us identify where necessary collaboration is not occurring. This is not a trivial issue in knowledge-based work where the medium of generating business often lies in a timely conversation. In this example we found a significant lack of collaboration between the real estate and commercial lending divisions given the organization’s efforts to integrate service offerings for key customers. Just as importantly we found a lack of integration between risk management and the lending divisions (real estate and commercial), another shortcoming given the institutions strategic efforts to integrate risk management into the lending processes earlier to avoid excessive re-work and cycle time.

This kind of cross-boundary view identifies points where collaborative activity is not occurring due to organizational boundaries and provides a more targeted view as to where interventions might be employed. It is often **not** the case that you want high collaborative activity amongst all departments within an organization. People have a finite amount of time to put into developing and maintaining relationships. Network analysis allows us to begin taking a portfolio approach to considering what constellation of relationships are worth investments in time, energy and in some cases collaborative

⁵ For example, on a technical front we introduced a skills repository and collaborative technology to help executives find relevant skill sets or recent experiences in the organization. On a social front we also

technologies. Rather than engage in a company-wide initiative to improve collaboration, more targeted and ultimately more successful interventions were employed at specific junctures where improving collaborative activity could yield benefit to the bank.

Of course another type of critical boundary within organizations is not functional in nature but hierarchical. Across the various companies we have studied, we have seen very different network patterns in relation to hierarchy. Some organization's network patterns are very similar to, and thus obviously constrained by, the organization's formal structure. Others are more fluid and seem to place less of a constraint on whether employees follow the chain of command to obtain information. Obviously 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 the functional structure, we can also assess where relationships are occurring or not occurring across formal hierarchy.

Alternatively, we can also assess how those in positions of formal authority are embedded in larger networks within their organization. For example, in the bank we were able to assess the pattern of relationships among the top nine executives (i.e., the CEO and his eight direct reports), as well as 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 amongst them, 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 (i.e., SVP and above), we could also see the extent to which the executive team tapped into the larger leadership network for

introduced action learning sets to help this group of people begin to connect around important issues.

informational purposes (or communicated decisions effectively back to this group).

Exhibit 4 shows a simplified graphic portrayal of this network that identifies connections between the CEO and the other 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 turns to.

[Editors Note: Insert Exhibit 4 About Here]

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 (Mintzberg, 1973). SNA allows us 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 are likely best understand issues and concerns of these groups)? Is the executive group seeking information from (or at least listening to) these people?⁶ Are 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

⁶ Of course by simply reversing the arrows in our analysis we can also get a sense of who amongst the executive group is effective at disseminating information to the rest of the organization.

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 communicate with people who are similar to themselves on a set of socially important attributes, such as race, gender and age (e.g., Marsden, 1988; Carley, 1991; Ibarra, 1992 & 1995; Brass, 1995). This makes conversation easier and often more satisfying; however, it also has the tendency to bias what executives learn, and so think important, about their organizations. 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 with his organization he made more concerted efforts to balance whom he sought out for information within and outside of the bank.

Ensuring integration following restructuring or other change initiatives

Finally, particularly in knowledge intensive work, SNA can play a powerful role in assessing the health of informal structure after a change has been implemented such as an organizational restructuring or merger. It is well known that performance does not

always improve as anticipated despite the implementation of technically sound solutions. Frequently, the claim is that the problem is a product of misalignment in some aspects of an organization's social and technical systems. Our own work points to a different issue that requires equal consideration: the distribution of knowledge embedded in peers and co-workers in a restructured setting.

Reorganizations often shift the location of expertise as well as access to specific expertise. For example, we worked with a commercial lending institution (different than the one outlined above) undergoing a transition from a functional to a team-based structure. To minimize inefficiencies resulting from cross-functional hand-offs in the commercial lending process, the organization shifted to a team-based structure that co-located lenders, analysts and servicers in industry-facing teams. Prior to the transition, these groups had been housed together in the same building and so were able to tap into each other's functional knowledge with relative ease. With the redesign, it was far more difficult for inexperienced people to learn the basics of their function and also for experienced lenders and analysts to engage in collaborative problem-solving efforts on the more creative aspects of commercial lending (e.g., structuring a specific transaction).

Social network analysis showed that four months after the transition to teams the individuals within each team were still communicating extensively with members of their prior functional department. In particular, we found that the people who were reputed experts in their area were tapped so frequently for advice that they were falling behind on their own work. While in the functional department these interactions were more controlled and observable, in the team-based environment it was difficult for the organization to see how instrumental these opinion leaders really were to the success of

the whole system. In fact, from a cursory review of their individual performance metrics (e.g., loans serviced or loans booked) these people experienced a fairly significant decline in productivity. Further, the longer hours that these people were working, in tandem with declining individual performance metrics that influenced their bonus calculations, served to undermine their own morale.

In a similar vein, network analysis can be quite revealing in understanding the true level of integration among key people after a change initiative. This can be particularly helpful in assessing large-scale change initiatives such as a significant merger or acquisition. For example, we worked with one Fortune 250 organization to assess the social network of key executives in the human resource department. The organization had recently engaged in several acquisitions and the head of this department was interested in understanding the extent to which the group, which included members from several different pre-merger organizations, collaborated and shared knowledge.

We mapped three key types of relationships that are important dimensions of knowledge sharing and creation in networks. When people turn to other people for information they tend to get some combination of three forms of advice that are helpful in creating and applying knowledge. First, sometimes people get lucky and the person they contact has a solution to the problem at hand and so they receive *specific answers* to specific questions. Second, and more frequently, people may turn to other people and not receive specific answers but find out about the location of relevant information --- whether in other people or in other databases. This *meta-knowledge*, or information about the location of information, is often critical to a person's ability to efficiently solve problems. Finally, people may turn to other people and end up engaging in a *problem-*

solving dialogue that turns out to help the person think about the problem in a new light—a critically important process that we have termed problem reformulation. Very often, this dialogue is important because it helps us solve the right problem.

When we looked at these three dimensions of advice in the newly merged human resources department, a very interesting pattern emerged (see Exhibit 5).

[Editors Note: Insert Exhibit 5 About Here]

What we see is that employees of this organization were very comfortable going to almost anyone for specific answers to specific questions. However, when we look at meta-knowledge and problem reformulation—two critical informational benefits needed to help create and apply knowledge in organizational settings—we found an interesting pattern. Despite having been ‘formally’ merged and under consistent performance management systems, it was painfully obvious that this group was disconnected when it came to the deeper forms of advice such as meta-knowledge or problem reformulation. Asking for or accepting these forms of advice may require more trust, in which case these data indicate that trust had still not developed across what used to be organizational boundaries. Thus as we increasingly look for knowledge-based synergies in mergers, joint ventures or internal restructurings, we have to consider the extent to which social aspects of such relationships facilitate different aspects of knowledge exchange.

Improving Collaboration with Social Network Analysis

In the above case examples and many other situations we have found social network analysis a valuable managerial tool largely because it offers the ability to make visible various patterns of communication and information sharing within and across groups. Rather than treat collaboration, learning and knowledge exchange as a cultural issue that is invisible and of such magnitude that nothing can truly be done, SNA helps make large group interactions visible and so actionable. This is particularly important in virtual work or where networks cross organizational boundaries of some sort and so contend with differing performance metrics or cultures that impede a network's ability to integrate expertise. Such boundaries might be hierarchical, functional, geographical or even organizational as in joint venture or merger and acquisition scenarios. However, understanding how information flows (or more frequently does not flow) across these various boundaries within an organization can yield critical insight into where management should target efforts to promote collaboration that has a strategic payoff.

The visual display of social network data can be an extremely powerful tool to effect personal and organizational change. Simply reviewing these diagrams with managers results in myriad recommendations as people immersed in the patterns of relationships define and resolve issues affecting group performance. Some of the patterns easily noticeable from a visual review of social network analysis data include:

- Information or decision bottlenecks (e.g., "bowtie" structures).
- Density of links (insufficient or excessive) between people, teams or departments that must coordinate effectively.

- Isolates that have not integrated well into a group and so represent both untapped skills and a high likelihood of turnover.
- Highly expert people not tapped appropriately.
- Organizational subgroups or cliques that can develop their own subcultures and negative attitudes toward other groups.

Following the adage of a picture being worth a thousand words, it is almost always the case that people are interested in engaging with network diagrams of their group or organization. Employing social networks in facilitated sessions can serve to identify issues that are currently hindering a team and the specific behaviors and organizational design elements requiring modification to improve group efficiency and effectiveness. Rich discussion will often evolve quickly simply by showing network diagrams to the members of a group and asking them to diagnose the patterns they see as well as issues facilitating or impeding their effectiveness. One of the most effective interventions is simply to ask people to spend five minutes, either on their own or in groups of two or three, to identify what they 'see' in the map and the performance implications for the group. This process of collectively identifying issues impeding group performance is a very powerful technique for defining behavioral and structural changes to improve effectiveness.

However, it is also important to be cautious about over-correcting with groups. One organization we looked at had realized that their department would function more efficiently if there was greater interaction across geographical regions. There had been a concerted effort by senior management to ensure that members of the department worked more closely with people in other locations within the organization. After we performed

the network analysis it was noticeable that as a whole the department had integrated very well across the various geographical locations but functions within the department were not well connected with each other despite sometimes being in the same building. 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.

Finally, one must take care to ensure that the kinds of relationships sought out are informative for the task at hand but also not unnecessarily inflammatory. We have found organizations to be very different in their tolerance for disclosure of different networks. 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 benign ones such as who works with whom). One of the most powerful ways to apply SNA as a diagnostic tool 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 touchy, depending on the kinds of network questions asked and the culture of the specific organization. As a result, one must 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. We have outlined several networks as well as specific reasons for targeting these networks in Appendix 1.

Conclusion

In today's fast paced and knowledge intensive economy, mission-critical work is increasingly occurring within informal networks that are often not well supported by the organization. Social network analysis provides a set of tools with which to assess the health of strategically important networks within an organization. By making these seemingly 'invisible' patterns of interaction visible it becomes possible to work with important groups to ensure more effective integration. Further, by targeting networks that hold strategic relevance for an organization it is much more feasible to propose interventions that improve specific points where investments in collaboration yield strategic payoff for the organization. Rather than engage in organization-wide initiatives, more targeted and ultimately more successful efforts can be undertaken.

REFERENCES

- Allen, T. (1977). *Managing the Flow of Technology*. Cambridge, MA: MIT Press.
- Boland, R.J.Jr. & Ramkirshnan, V.T. (1995). "Perspective Making and Perspective Taking in Communities of Knowing." *Organization Science*, 6(4): 350-372.
- Brass, D. (1984). "Being in the Right Place: A Structural Analysis of Individual Influence in an Organization." *Administrative Science Quarterly*, 29, pp. 518-539.
- (1995). A Social Network Perspective on Human Resources Management. *Research in Personnel and Human Resources Management*, 13, pp. 39-79.
- Brown, J.S. & Duguid, P. (1991). "Organizational Learning and Communities-of-Practice; Toward a Unified View of Working, Learning and Innovation." *Organization Science*, 2(1) pp. 40-57.
- (2000). *The Social Life of Information*. Cambridge, MA: Harvard Business School Press.
- Burkhardt, M. & Brass, D (1990). "Changing Patterns or Patterns of Change: The Effects of a Change in Technology on Social Network Structure and Power." *Administrative Science Quarterly* 35, 104-127.
- Burt, R. (1987). "Social Contagion and Innovation: Cohesion versus Structural Equivalence." *American Journal of Sociology*, 92, pp. 1287-1335.
- (1992). *Structural Holes*. Cambridge, MA: Harvard University Press.
- Carley, K. (1991). "A Theory of Group Stability." *American Sociological Review*, 56, pp. 331-354.
- Casciaro, T. (1998). "Seeing Things Clearly: Social Structure, Personality and Accuracy in Social Network Perception." *Social Networks*, 20, pp. 331-351.
- Cross, R. (2000). "Looking Before You Leap: Assessing the Jump to Teams in Knowledge-Based Settings." September-October, *Business Horizons* pp. 29-36.
- Cross, R., Yan, A. & Louis, M. (2000). "Boundary 'Activities' in Boundaryless Organizations: A Case Study of a Transformation to a Team-Based Structure." *Human Relations*.
- Denison, D.R., Hart, S.L., & Kahn, J.A. From Chimneys to Cross-Functional Teams: Developing and Validating a Diagnostic Model. *Academy of Management Journal* (1996), 39(4): 1005-1023.
- Dougherty, D. (1992). "Interpretive Barriers to Successful Product Innovation in Large Firms." *Organization Science*, 3(2), pp. 179-202.

- Erickson, B. (1988). "The Relational Basis of Attitudes." In B. Wellman & S. Berkowitz (Eds.) *Social Structures: A Network Approach*, pp. 99-121.
- Fiol, C.M. (1994). "Consensus, Diversity and Learning in Organizations." *Organization Science*, 5(3).
- Galbraith, J. (1995). *Designing Organizations: An Executive Briefing on Strategy, Structure, and Process*. San Francisco, CA: Jossey-Bass.
- Granovetter, M. (1973). "The Strength of Weak Ties." *American Journal of Sociology*, 78, pp. 1360-1380.
- Hammer, M. & Champy, J. (1993). *Reengineering the Corporation: A Manifesto for Business Revolution*. New York, NY: HarperBusiness.
- Hammer, M. & Stanton, S. (1995). *The Reengineering Revolution: A Handbook*. New York, NY: Harperbusiness.
- Handy, C. (1994). *The Age of Paradox*. Boston, MA: HBS Press.
- Heckscher, C. (1994). Defining the Post-bureaucratic Type." In C. Heckscher & A. Donnellon (Eds.) *The Post-Bureaucratic Organization: New Perspectives on Organizational Change*. Thousand Oaks, CA: Sage.
- Hirschhorn, L. & Gilmore, T. (1992). "The New Boundaries of the "Boundaryless" Company." *Harvard Business Review*, May-June: 104-115.
- Ibarra, H. (1992). "Homophily and Differential Returns: Sex Differences in Network Structure and Access in an Advertising Firm." *Administrative Science Quarterly*, 36, pp. 471-501.
- (1995). "Race, Opportunity and Diversity of Social Circles in Managerial Networks." *Academy of Management Journal*, 38, pp. 673-703.
- Janis, I. (1982). *Groupthink: Psychological Studies of Policy Decisions and Fiascoes*. Boston, MA: Houghton-Mifflin.
- Kerr, S. and Ulrich, D. (1995). "Creating the Boundaryless Organization: The Radical Reconstruction of Organization Capabilities." *Planning Review*, 23(5), pp. 41-45.
- Krackhardt, D. (1987). "Cognitive Social Structures." *Social Networks*, 9, pp. 109-134.
- (1990). "Assessing the Political Landscape: Structure, Cognition, and Power in Organizations." *Administrative Science Quarterly*, 35, pp. 342-369.
- Krackhardt, D. & Hanson, J.R. (1993). "Informal Networks: The Company Behind the Chart." *Harvard Business Review*, 71, pp. 104-111.

- Lave, J. & Wenger, E. (1991). *Situated Learning: Legitimate Peripheral Participation*. Cambridge, UK: Cambridge University Press.
- March, J. & Olsen, J. (1975). "The Uncertainty of the Past: Organizational Learning Under Ambiguity." *European Journal of Political Research*, 3, pp. 147-171.
- Marsden, P. (1988). "Homogeneity in Confiding Relations." *Social Networks*, 10, pp. 57-76.
- Mintzberg, H. (1973). *The Nature of Managerial Work*. New York, NY: Harper Row.
- Miles, R. & Snow, C. (1986). "Network Organizations: New Concepts for New Forms." *California Management Review*, (28) pp. 62-73.
- (1994). *Fit, Failure and the Hall of Fame*. New York, NY: Free Press.
- (1995). "The New Network Firm: A Spherical Structure Built on a Human Investment Policy." *Organizational Dynamics*, 23(4), pp. 5-18.
- Mohrman, S., Cohen, S., & Mohrman, A. (1995). *Designing Team-Based Organizations: New Forms for Knowledge Work*. San Francisco, CA: Jossey-Bass pp. 63, 82-87, 181-185 & 231.
- Monge, P. & Contractor, N. (2000). "Emergence of Communication Networks." Forthcoming in F. Jablin and L. Putnam (Eds.), *Handbook of Organizational Communication* (2nd Edition). Thousand Oaks, CA: Sage.
- Monge, P.R. & Eisenberg, E.M. (1987). "Emergent Communication Networks." In Jablin, Putnam, Roberts, Porter (Eds.) *Handbook of Organizational Communication*. Newbury Park, Sage Publications.
- Nohria, N. (1992). "Is a Network Perspective a Useful Way of Studying Organizations?" In N. Nohria & R.G. Eccles (Eds.), *Networks in Organizations: Structure, Form, and Action*. Boston: Harvard Business School Press.
- Orr, J.E. (1996). *Talking About Machines*. Ithaca, NY: Cornell University Press.
- Pentland, B.T. (1992). "Organizing Moves in Software Support Hot Lines." *Administrative Science Quarterly*, 37(4) pp. 527-548.
- Perrow, C. (1986). *Complex Organizations: A Critical Essay*. Chicago, IL: McGraw Hill.
- Rummler, G. & Brache, A. (1990). *Improving Performance: How to Manage the White Space on the Organization Chart*. San Francisco, CA: Jossey-Bass.
- Shah, P. (1998). "Who are Employee's Social Referents? Using a Network Perspective to Determine Referent Others." *Academy of Management Journal*, 41(3), pp. 249-268.

Simmel, G. (1950). *The Sociology of Georg Simmel*. New York, NY: Free Press.

Szulanski, G. (1996). "Exploring Internal Stickiness: Impediments to the Transfer of Best Practices Within the Firm." *Strategic Management Journal*, 17 (Winter Special Issue), pp. 27-43.

Tichy, N. & Fombrun, C. (1979). "Network Analysis in Organizational Settings." *Human Relations*, 32, 923-956.

Vaughn, D. (1996). *The Challenger Launch Decision: Risky Technology, Culture and Deviance at NASA*. Chicago, IL: University of Chicago Press.

Wenger, E. (1998). *Communities of Practice*. Oxford, UK: Oxford University Press.

Wenger, E. & Snyder, W. (2000). "Communities of Practice: The Organizational Frontier." *Harvard Business Review*, 137, pp. 139-145.

Exhibit 1

Advice Network: Who Do You Turn to for Information to Get Your Work Done?

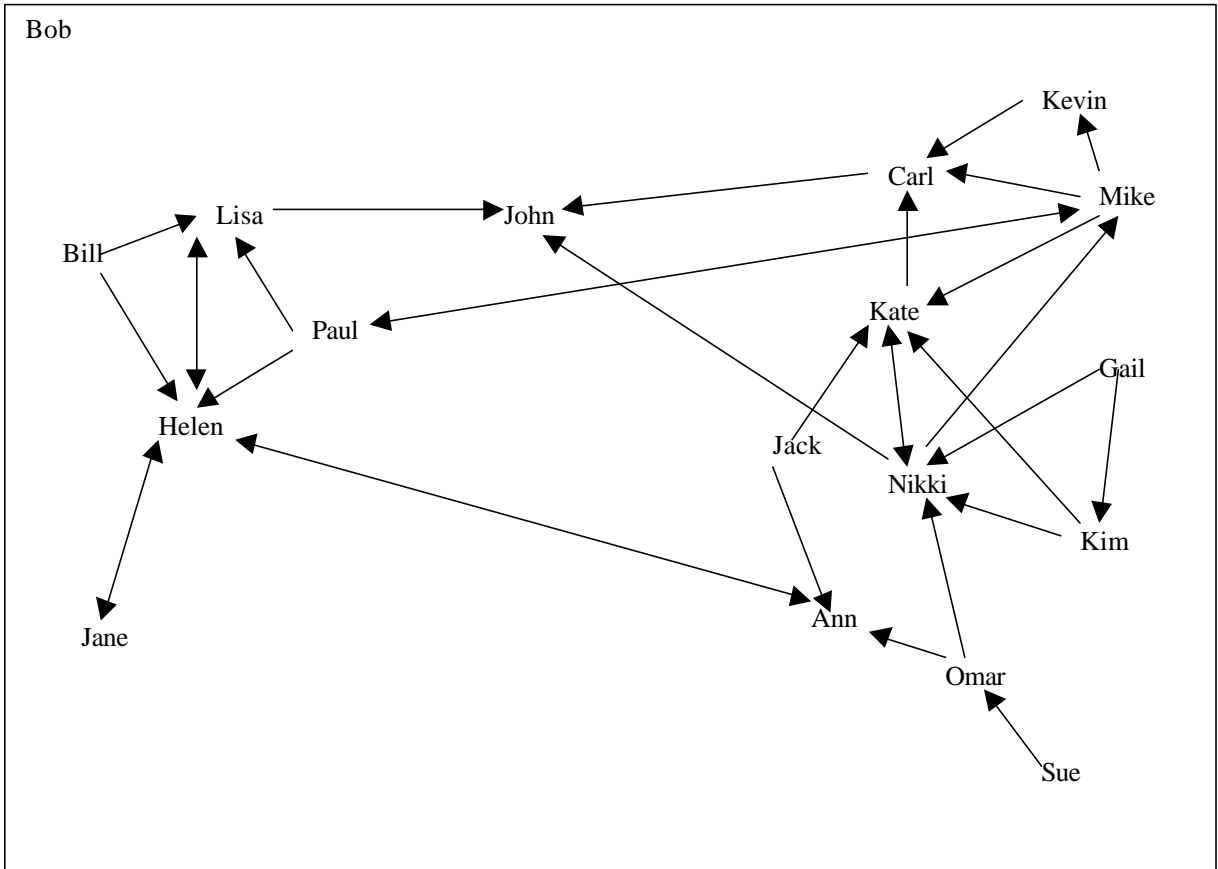
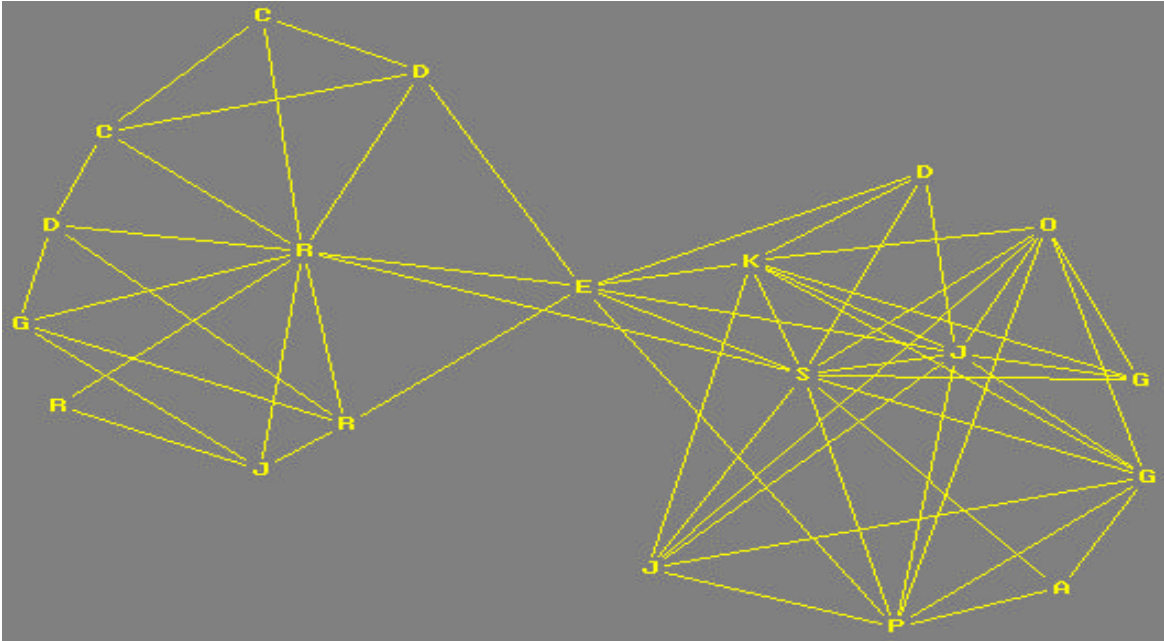
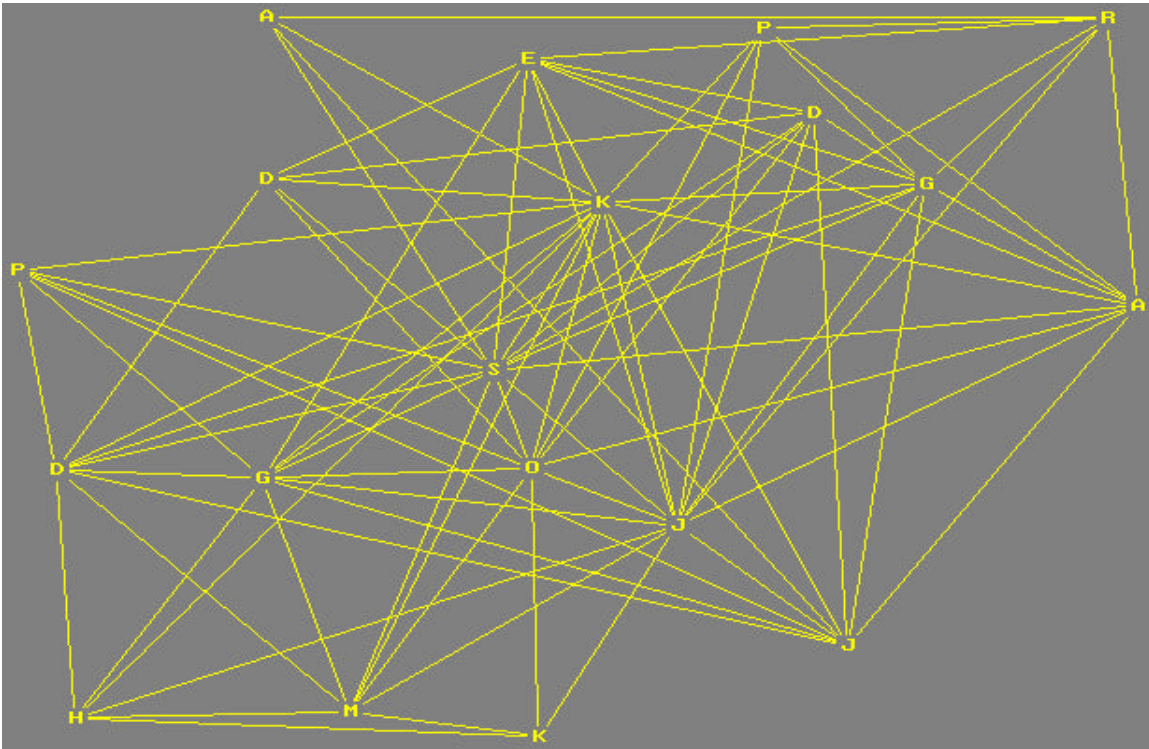


Exhibit 2
Advice Network of Internal Consulting Group⁷

Pre-Intervention



Post-Intervention (Nine Months Later)



⁷ Names were disguised in this example at the request of the organization.

Exhibit 3

Collaboration Within and Across Functional Boundaries

	Commercial Lending	Commercial Real Estate Lending	Credit and Risk Assessment	Finance/ Accounting/ IT/ HR
Commercial Lending	16%			
Commercial Real Estate Lending	10%	49%		
Credit and Risk Assessment	8%	7%	25%	
Finance/ Accounting/IT/ HR	8%	6%	40%	62%

Exhibit 4

Collaboration Across Hierarchical Boundaries

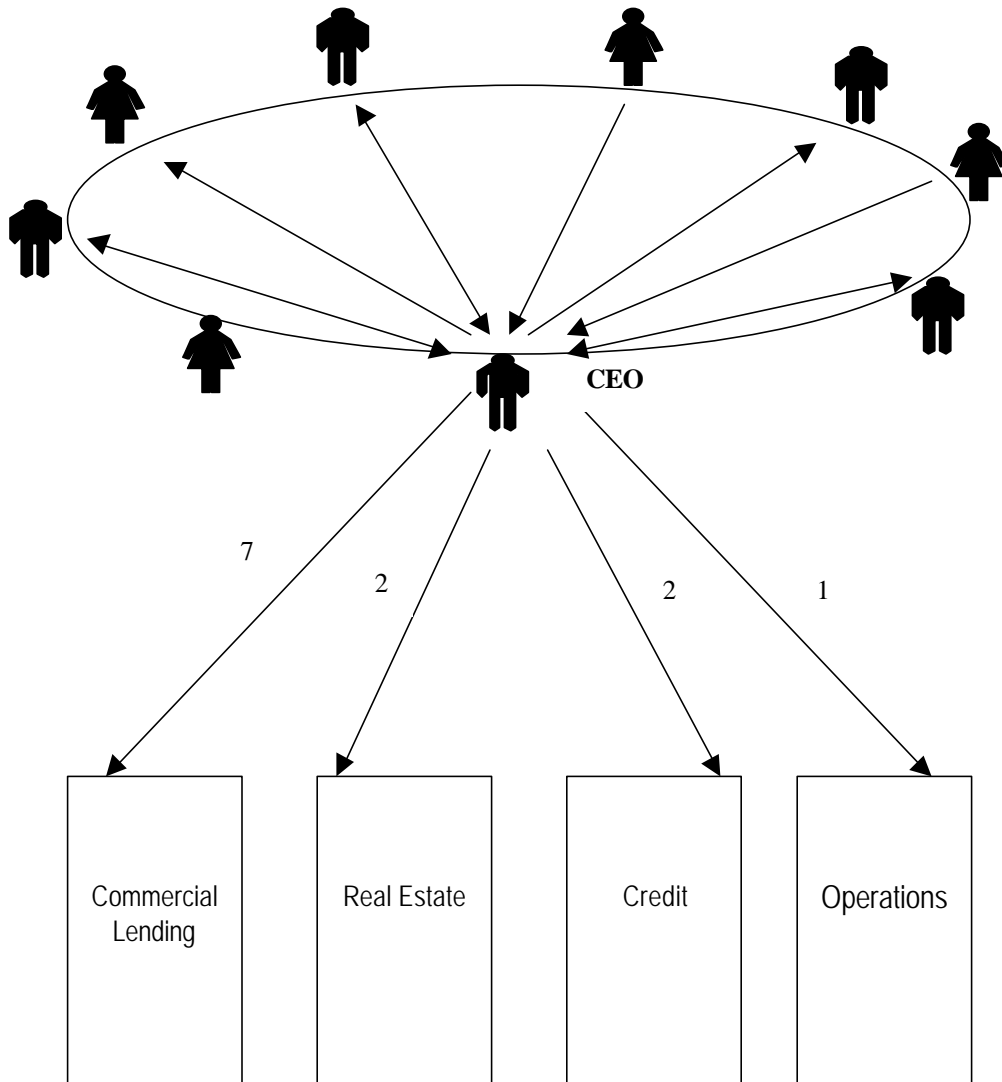


Exhibit 5a
Social Network of Merged Divisions of a Human Resource Department

Q1) Sometimes when we turn to people for information we benefit from their ability to provide specific answers to our question or solutions to our problems. Please indicate the extent to which you typically turn to each of the following people for information and receive answers to your questions or solutions to your problems.

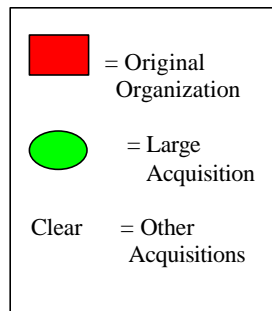
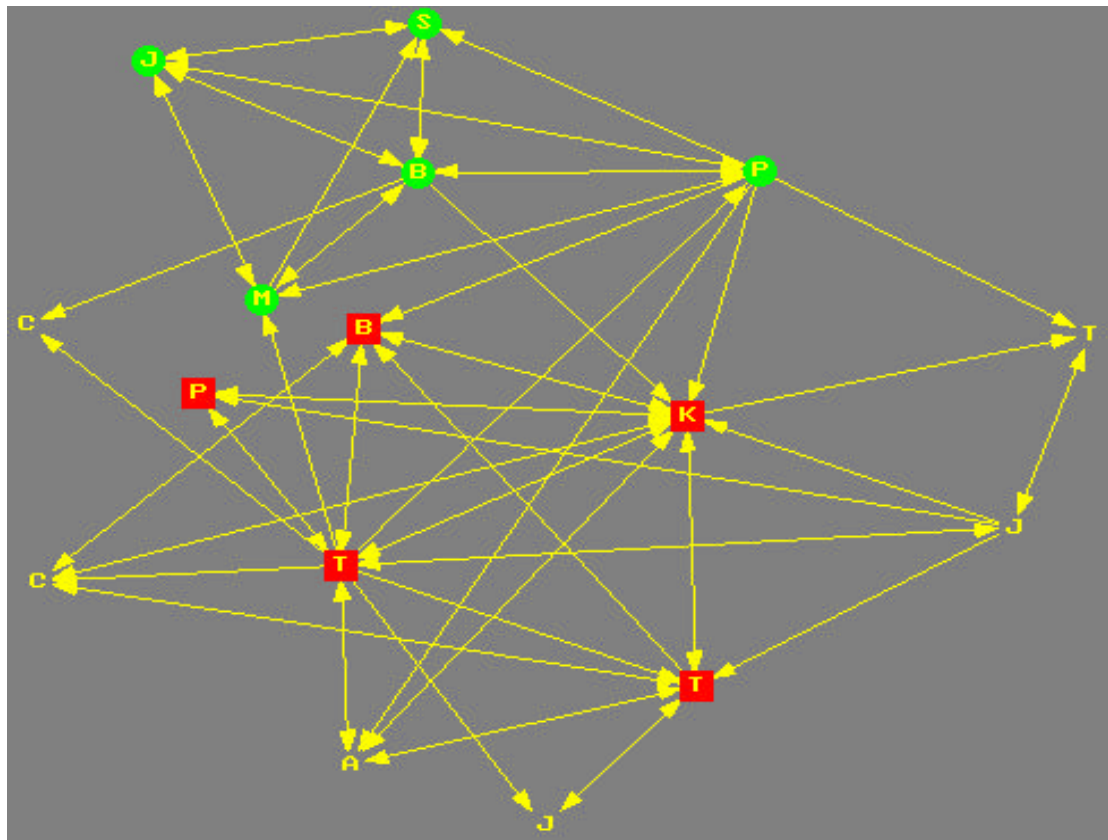


Exhibit 5b
Social Network of Merged Divisions of a Human Resource Department

Q2) Sometimes when we turn to other people for information we benefit from their ability to point us to relevant sources of information such as other people, paper archives or databases. Please indicate the extent to which you typically turn to each of the following people for information and receive knowledge of other sources of information.

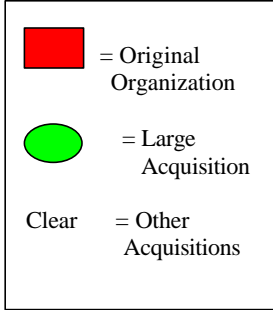
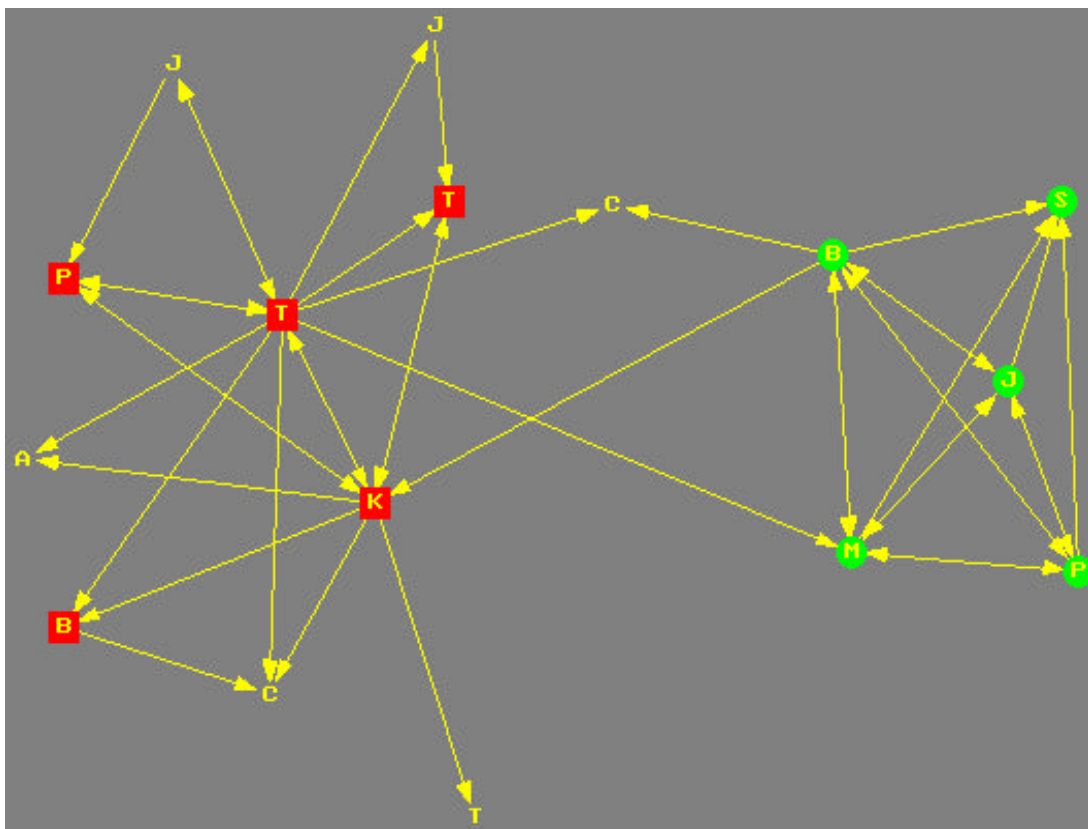
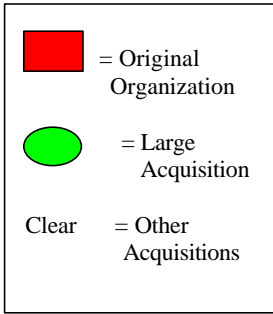
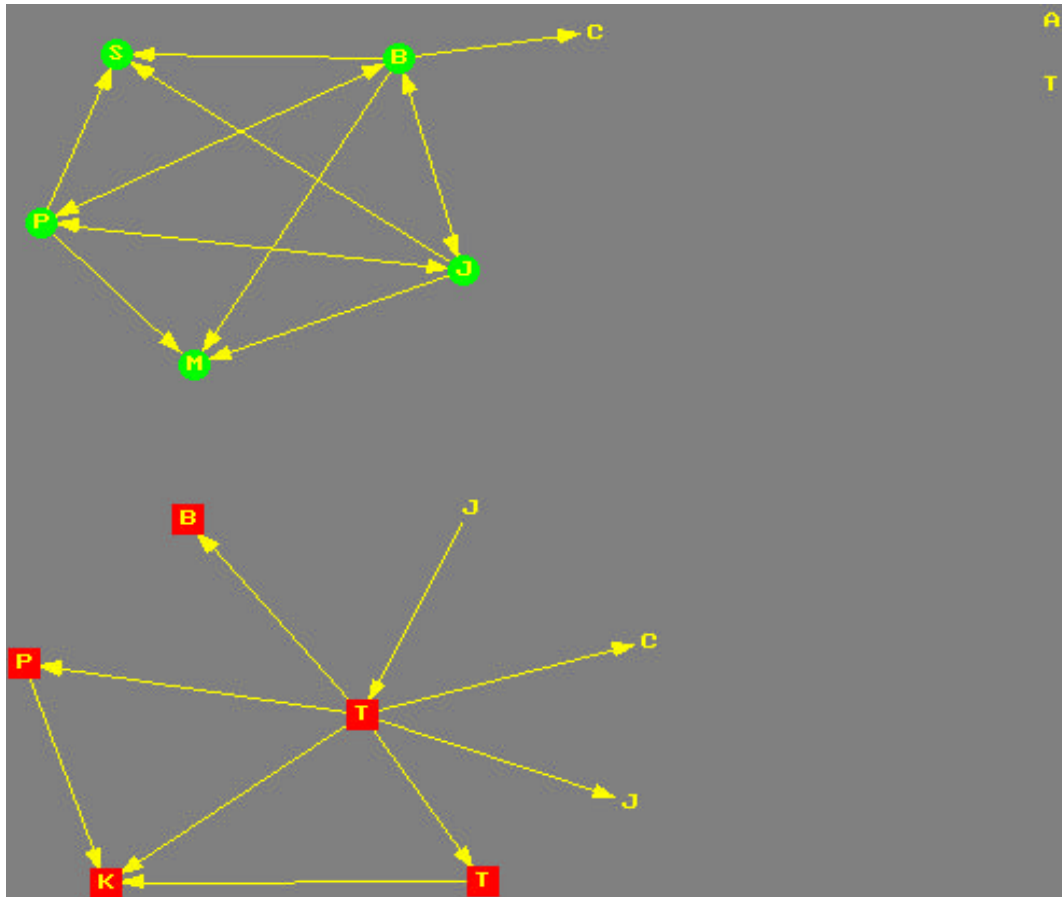


Exhibit 5c
Social Network of Merged Divisions of a Human Resource Department

Q3) Sometimes when we turn to other people for information we benefit from their helping us think through a problem (even when they may not have specific information that solves our original problem). These interactions may help us consider important dimensions of a problem and/or anticipate issues likely to appear in the future. Please indicate the extent to which you typically turn to each of the following people for information and engage in such problem solving.



Appendix 1
Collecting Network Data: What Questions to Ask

If Trying to Discover...	These Kinds of Questions Can Help...
<p><u>Communication Network</u> – The informal structure of an organization as represented in ongoing patterns of interaction, either in general or with respect to a given issue. <u>Rationale</u> – 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><u>Information Network</u> -- Who goes to whom for advice on work-related matters. <u>Rationale</u> – Just assessing who communicates with whom does not guarantee that the interactions reflect exchanges of information important to do one’s work. Particularly in top leadership networks or new product development teams, efforts that require a collective to effectively pool its knowledge, 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 get my work done. • Who do you typically seek work-related information from? • Who do you typically give work-related information to?
<p><u>Problem-Solving Network</u> – Who goes to whom to engage in dialogue that helps people solve problems at work. <u>Rationale</u> – 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?
<p><u>Trust Network</u> – Who trusts whom to act in their best interests. <u>Rationale</u> – People talk more openly and learn more in interactions with those they trust. Thus, a robust trust network is often critical to ensuring effective information seeking and problem solving.</p>	<ul style="list-style-type: none"> • How much do you trust each person (relative to other members of the group) to act in your best interests? • Whom would you trust to keep in confidence your concerns about a work-related issue?

<p><u>Access Network</u> – Whom has access to whose knowledge and expertise. <u>Rationale</u> – 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.</p>	<ul style="list-style-type: none">• 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.
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