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Facilitating Strategic Change with Social Network Analysis

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Biography

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Abstract

Despite sound advice from both consultants and academics, large-scale change initiatives often consume significant organizational resources without yielding anticipated performance improvements. One reason is that the complex web of relationships that constitutes an organization's informal structure is increasingly important in work today but often not systematically addressed in change initiatives. These informal relationships can be critical to the execution of increasingly complex knowledge work yet are often unwittingly fragmented by improvement methodologies streamlining organizational processes or de-layering organizational hierarchies.

We have found a systematic approach to analyzing informal structure in change initiatives highly important in both the implementation process and the ongoing effectiveness of social and technical interventions. Framed in the classic unfreeze, transition and refreeze model of organizational change, the following article demonstrates how social network analysis --- a set of tools for mapping and analyzing relationships among people in an organization --- can facilitate design and implementation of interventions at various stages of a change process.

Facilitating Strategic Change with Social Network Analysis

In today's turbulent business environment, the prevailing wisdom suggests that organizations must learn and adapt faster or find themselves in any number of unenviable positions. Rapid technological change, shrinking product life cycles, increasing customer expectations and the never ending search for efficiency all demand that organizations frequently revisit not only their product offerings, but also the alignment of their organization's strategy, structure and processes (1; 2; 3; 4; 5; 6; 7; 8). As a result, managers are required to implement critical change initiatives in ever-tighter time frames with fewer organizational resources and less tolerance for error.

This, of course, is no surprise to executives today who have either been living this experience for some time or been inundated with the volumes written on ways to more effectively manage and survive in a world of continuous change. Work dating to Kurt Lewin (9) and Ed Schein (10) continues to offer insight into critical aspects of change processes such as leadership (11; 12, 8), participation (13; 14; 3; 15; 16; 17) and alignment of social and technical dimensions of organizations (18; 19; 20; 21). Yet despite the logic inherent in academics' models and consultants' methodologies, most practitioners we work with still find change processes highly unpredictable, and, in the words of one senior executive, highly "un-manageable."

Clearly there are a number of forces both within and outside of an organization's boundary that make a change process more or less controllable. However, we consistently find that a lack of attention paid to an organization's informal structure results in unnecessary resistance to change. By informal structure we mean the various patterns of interaction and types of relationships that exist among employees within an

organization. Taken together, these interactions and relationships form networks which powerfully affect the behavior and performance of an organization. Yet very often we find that managers overlook the power of the informal organization in a rush to implement new ideas or consider informal structure as part of the catch-all idea of 'organizational culture' and so too abstract or all encompassing to engage in a systematic manner.

Social network analysis (SNA) provides a rich and systematic ability to assess informal structure by mapping and analyzing relationships among people, teams or even departments within an organization.[1] Put an organizational chart (the formal structure) in front of almost any employee, from line-worker to executive, and they will tell you that the boxes and lines do not reflect the way that work gets done in their organization. These people intuitively acknowledge the existence, importance and power of the complex interrelationships that develop among a group of people over time. The significance of these informal structures is only increasing with trends toward 'boundaryless' and flat organizational structures. With efforts to de-layer organizations, reduce internal and external boundaries and employ team-based structures, more coordination and work occurs as a product of informal relations rather than through traditional hierarchical channels or established policies and procedures (34; 35; 36; 37).

Just as importantly, the movement toward a knowledge-driven economy is also increasing the importance of the informal structure and challenging traditional

[1] Social network analysis has enjoyed a rich research tradition within the fields of anthropology, sociology, psychology, and epidemiology and increasingly in organization studies (22; 23). Within this tradition, network analysis has helped advance our thinking on such theoretical constructs as power (24; 25; 26), communication (27), the diffusion of innovation (28; 29), information flow (30; 31) and formation and maintenance of belief systems (32). However, except for academic research, the application of SNA to actual business settings in a diagnostic and prescriptive way has been limited (See 33 for exception). As a

organizational principles dating to Max Weber and Frederick Taylor (38; 39; 40). Rigid bureaucracies impede the flow of information across functional and hierarchical boundaries. Extreme specialization fragments work processes, making integration of expert knowledge difficult and responsiveness to environmental demands sluggish. People often complement or bypass formal information channels by creating and leveraging informal networks of relationships that become integral to solving problems and thus both individual and organizational effectiveness.[2]

In short, **who we know** often has a significant impact on **what we come to know** as informal relationships are often critical in teaching us how to do our work, find information and solve problems. As a result, it is increasingly important to understand how process and organization redesigns and other strategic change initiatives potentially fragment a network' ability to share and create knowledge.

When managers attend to the informal network at all, it is usually by hashing out -- with the help of a handful of trusted colleagues -- who is in influential in the 'grapevine' and working out who will be for or against the initiative at hand. This is better than ignoring the informal structure, but is less than optimal. Often such cloistered conversations represent only one or a few people's view of the network of relationships, presenting a distorted view of what is really happening. Further, by virtue of their position in the hierarchy, these people 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. Though often adamant that they

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result, many practitioners we work with are initially unaware of the pragmatic applications of a social network analysis.

know the network of relationships around them, studies show that managers have very different levels of accuracy in understanding the networks around them (e.g., 50 & 25; 51). And the potential for inaccurate perceptions is only increased by our transition into a world of virtual work and tele-commuting where employees are engaged in work relationships increasingly invisible to superiors.

With minimal effort, social network analysis can be extremely instrumental in both the design and implementation of large-scale change processes.[3] Social network analysis allows managers to visualize and understand the myriad relationships that can either facilitate or impede planned organizational change. How does information flow within an organization? Which divisions or functional areas are collaborating to the degree expected? Who are the most influential opinion leaders within the organization? Which people or groups of people are disconnected from the main network and so might need targeted communication and training? How might reorganizations fragment relationships critical to the creation and sharing of knowledge in organizational settings? These are questions that can be answered through social network analysis, thereby informing important decisions made in the design and implementation of strategic change initiatives. As outlined in Exhibit 1, we have found social network analysis helpful at each stage of the classic unfreeze-transition-refreeze organizational change model (9, 10)[4]:

- Unfreeze: Motivating Change at the Group and Organizational Level
- Transition: Facilitating Transition Processes

[2] Extensive research in both sociology and organization studies has consistently demonstrated the importance of one's network of relationships as a conduit for information and knowledge (e.g., 41; 30; 31; 42; 29 & 43; 44; 45; 46 & 47; 28; 48; 49).
[3] 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.
[4] Though clearly recognizing that the concept of 'refreezing' is increasingly a transient one.

- Refreeze: Assessing Health of Informal Structure in the Changed Environment.

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Unfreeze: Motivating Change at the Group and Organizational Level.

Building a case for change is always a pre-requisite for engaging an organization's employees in a change process. Social network analysis can be a particularly powerful means of gaining collective agreement on the need to change, as well as on the dynamics underlying inefficiencies in a team or organization. In ways that standard cultural surveys or interview techniques simply do not accomplish, social networks often make very real various patterns of behavior in organizational settings. The tool can be used very differently to establish a need for change at the group and organizational level, so we have treated these interventions separately below.

Group Level. Employing social networks in facilitated sessions can serve to identify issues that are currently hindering a team as well as specific behaviors and design elements of an organization requiring modification to improve group efficiency and effectiveness. Rich facilitated sessions will often evolve quickly simply by putting network diagrams in front of a group and asking members of the group to diagnose the patterns they see as well as issues facilitating or impeding their effectiveness. Looking at any network diagram can be interesting; however, we can not underscore enough the extent to which these maps are meaningful and take on a life of their own when they represent your own relationships with your colleagues. Often 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.

For example, we worked with one team of consultants that were supposed to integrate highly specialized skill sets in delivering knowledge management solutions to the market. The newly-appointed leader felt intuitively that the team was not leveraging its abilities in as effective a fashion as possible but had no history with the group on which to base his intuition. He asked us to conduct a social network analysis of the team. The 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 group. The group on the left side of the network was skilled in the 'softer' issues of organizational learning, 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.

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Over time, members of these two groups had gravitated to each other based on their common interests. Members of each sub-group 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 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 despite the fact that integrating these unique skill sets in sales efforts and project work should have presented a competitive advantage in relation to other firms that tended to focus heavily on only the technical or organizational front.

Conducting a 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 group's 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 by the EA 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 involving the joint integration of each group's skills. And this integration of skills often proved to differentiate this group from their competition in the sales process. 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.

Organization Level. Social network analysis can also be an ideal tool for pinpointing problems of collaboration across an organization. We have found that it can be highly revealing to leadership within an organization to use social network analysis to map relationships that must cross organizational boundaries of some form (e.g., new product development teams, 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 yields similar purchase on performance improvement opportunities that process mapping did for reengineering in the early 1990s (52 53; 54). 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 collaborative activity and where there is not.

For example, we were asked to look at the leadership network of a commercial bank. We went in and mapped information seeking and sharing behaviors among the top 56 executives of this organization (SVP level and above) to understand how this group was collaborating. The CEO had a vision at that time of creating a network that "knew what it knew" whereby people in the organization more dynamically molded 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.

We performed a series of network analyses for the organization and as a result were better able to recommend 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 within and 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 with each other. 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,

have collaborative relationships. If everyone in the division were collaborating with everyone else in the division, the figure would be 100%. Now consider the ties between members of the Real Estate Lending division and members of the Commercial Lending division. Only 10% of all pairs in which one person is a member of Real Estate and the other is a member of Commercial are actually in a collaborative relationship.

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What is instructive about this kind of a view is that it helps us not only assess the quality of collaborative activity within a division but also targets the white space 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 startling lack of collaboration between the real estate and lending divisions given the organization's efforts to become more customer focused. Just as importantly we found a lack of integration between risk management and the lending divisions (real estate and commercial).

This same kind of analysis has also been highly fruitful in investigating newly merged organizations to truly understand the level of collaborative activity and ultimately the true level of merger integration. Particularly in companies that have grown by acquisition of some sort, this can be a very powerful means of understanding how various combinations of acquired companies are or are not collaborating. It is not necessary that

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

all newly merged divisions collaborate heavily with all other divisions. It is important though that points of connection likely to yield strategic advantage are made. So this view provides us with a more targeted means of improving critical collaboration in organizational settings --- rather than focus on an entire organization, network analysis allows us to target specific points more precisely and ultimately with more success.

Transition: Facilitating Transition Processes

As outlined above, network analysis can be a particularly powerful for designing interventions. In implementation, network analysis can be instrumental in understanding opinion leaders that one might target simply by identifying who is most central and connected in a network. While there are many ways to attempt to win the support of opinion leaders, the strategy we found most successful was simply to seek out these individuals' advice on certain design recommendations. By providing these influential people a voice in the process, we gained support for the initiative without having to design holistic programs to seek and incorporate input from all members of the organization. This of course is not a new concept in organizational change (e.g. 55). However, it is an activity that social network analysis allows us to do with greater precision than by identifying opinion leaders based on the biased perspective of one or a few people in the organization.

Perhaps more intriguingly, social network analysis can illuminate the pathways that change processes take as new practices are adopted or rejected by employees. For example, the diagram represented in Exhibit 4 illustrates how an innovation diffused within one organization in which we worked . In this case, we examined a number of

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

different social relationships (work, communication, friendship, etc.) within a systems/software development subsidiary of a Fortune 500 company. The firm was structured primarily in self-directed work teams, and was interested in understanding how relationships within and between teams influenced performance. In the case of two teams in particular, one of the software developers, Ken, discovered an innovative method for testing blocks of program code against very large transaction databases. This innovation resulted in significant time saving over 'standard' testing procedures that were in place and officially recommended by the organization. We found that the immediate dissemination of the new idea closely mirrored pattems of strong friendships within the organization (see Exhibit 4). For example, Ken maintained strong friendships with three of his teammates and with Henry, who worked on another team. These were the first people to adopt this new practice. In the second step of the diffusion of this best practice, Henry passed the innovation to his friends Tom and Dave in Team 2, who in turn passed it to their friends Alice and Vijay in the third step of the process. In the diagram, actors marked "time 4+" either adopted later or never adopted the innovation.

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In this case, the paths taken by the innovation closely reflected the friendship ties among the organization's members. In contrast, work-based relationships, such as work flow and reporting relationships, were far less reflective of the actual pattern of diffusion. Diffusion of an innovation, whether it be a new product such as a Palm Pilot or best practice such as in the above coding example, is heavily influenced by the informal

structure of an organization. This likely resonates with examples of implementation efforts within your own organization and is one of the more robust and consistent findings in the social sciences literature. In his influential review of the diffusion literature, Rogers (28) summarizes the results of hundreds of studies and concludes that in deciding to adopt an innovation "individuals depend mainly on the communicated experience of others [which] mainly flow through interpersonal networks."

The important point is that by understanding that new ideas or work practices diffuse in your organization primarily via certain relationships, it becomes possible to design targeted interventions to speed implementation and overcome certain points of resistance. For example, one financial service organization we worked with was struggling with implementing a new organizational structure and enterprise resource planning system. As a key part of this initiative, we assessed people's use of the new system over time in relation to the informal structure of the organization. We found that despite the comprehensive nature of training and documentation accompanying the system implementation, most people actually learned how to use the system from accessible colleagues rather than from technical documentation, help lines or policy and procedure manuals.

By specifically assessing several different kinds of network relationships in tandem with use of and satisfaction with the new information system and work procedures, we were able to identify where systemic learning problems and opportunities existed. It quickly became apparent that virtual employees had a very difficult time learning all the nuances of the system because they did not have accessible peers who they could turn to for help. These people would frequently not use the system or employ

it in an inefficient manner that increased their frustration rather than wade through the extensive documentation accompanying the system (or contact the help desk). As one intervention for this group, tailored informational sheets and weekly e-mail tips were sent out that dramatically increased the use and reported satisfaction with the new system. The important point in this example is that these people and their resistance to the adoption of the innovation were 'invisible' until our social network analysis demonstrated their isolation from the larger group and helped us pinpoint systemic learning problems.

Refreeze: Assess Health of Informal Structure in the Changed Environment.

Finally, we also find that -- particularly in knowledge intensive work -- social network analysis can play a particularly powerful role in assessing the health of informal structure after a change has been implemented. It is well known that performance does not always improve as anticipated despite the implementation of technically sound solutions. This problem is frequently claimed to be 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.

In today's information intensive environment, only rarely will any one person know enough to solve increasingly complex problems. Usually, when we think of where people turn for information we think of databases or other sources of information such as policy and procedure manuals. However, a significant yet often overlooked component of an individual's knowledge environment is composed of the relationships to which one

is able to turn to for various informational needs. Studies have shown that people are far more likely to turn to friends or colleagues for answers than other sources of information despite ubiquitous technical solutions that are prevalent today (31; 56). Important relationships develop from experience as a consequence of working with members of a project team or functional department. Two important features of these relationships make them useful in helping people to solve problems at work. First, time spent interacting on work tasks helps establish a sense of reciprocity and trust with specific colleagues. This social capital is what allows employees to turn to those colleagues for help on future initiatives and actually get useful assistance or advice. Second, by working closely together colleagues build up an understanding of each other's unique knowledge and skills. It is this understanding that allows one to tap other organizational members at appropriate times in future efforts.

Reorganizations often shift the location of expertise as well as access to specific expertise. For example, we worked with one commercial lending organization in 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.

Though not done in this particular case, social network analysis could have been employed to predict this situation before restructuring. Rather than assessing the advice network within the organization, a more productive view would have been to look at the advice networks in relation to subsets of critical activities performed. For example, in the commercial lending scenario, the key activities include: sales/transaction structuring, credit analysis, loan closing/booking and servicing. Assessing advice networks within each of these problem domains would have likely shown how central to solving specific problems certain people had become. From there it is an obvious inference to understand how overloaded these people may become in the new structure when they were asked to develop more intensive relationships within their cross-functional teams while at the same time helping to support colleagues from the old functional departments.

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 acquisitions, collaborated and shared knowledge.

We mapped three key types of flows that were found in a prior study to be important components of knowledge sharing and creation in groups (37). Specifically, we found that 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, they can receive specific answers to specific questions. Second, they can get help in thinking through a problem --- a critically important process of engaging that we have termed problem reformulation. Very often these kinds of people are important because they help ensure you are solving the right problem. Finally, they can receive affirmation that their thinking or plans are sound. While seemingly not important on the surface, we found that receiving such affirmation was often very important in the recipient's ability and confidence in introducing ideas at critical junctures of a project.

What was interesting in this study was that people reported having networks of individual relationships that provided them with all three of these benefits. However, when we looked at these three dimensions of advice in the newly merged human resources department, a very interesting pattern emerged (see Exhibit 5).

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What we see is that employees of this organization were very comfortable going to almost anyone for specific information or answers. However, when we look at problem reformulation and affirmation --- two critical things received 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 problem reformulation and affirmation. 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.

Lessons from the Field

Network data can be enormously compelling and useful in managing both large and small scale change processes. However, there are some important considerations to ensure that network analysis has the desired impact. As outlined above, one of the earliest and most important considerations lies with determining the objective of employing network analysis as an intervention. In organizational change scenarios, framing issues in terms of the classic three-phase model of organizational change is particularly helpful in ensuring desired outcomes. On a more tactical level we have also found that three key principles ensure that a network analysis has the desired impact: 1)

targeting a strategically important group; 2) mapping relationships that will yield actionable findings and 3) conducting compelling analyses.

Targeting a strategically important group. In change initiatives already targeted to specific divisions or functional units in organizations this is often less of an issue. However, when applying network analysis in order to motivate organizational change it is critical to identify groups in which interventions will yield significant benefit for the organization. Typical areas where collaborative activity is critical to organizational success include: top management networks, research and development functions, merger and acquisition scenarios, joint venture or alliance interfaces and communities of practice.

In addition to locating points where collaboration holds strategic significance, there are two other ways to consider mapping networks in an organization to maximize the effectiveness of interventions proposed. First, it is often instructive to map a certain hierarchical level within an organization where you can get the most out of improving collaborative activities. We generally find that this level consists of a middle management layer that is critical to the effective movement of information across hierarchical and functional boundaries. Second, those networks that cross-organizational boundaries of some sort are often particularly fruitful to assess as they help pinpoint where critical collaborative activities should be improved. For example, in Exhibit 3, we might conclude that risk management needs to be well integrated with both commercial and real estate lending; however, given a certain strategy, it might not be so critical that those particular divisions interact. Just being able to pinpoint these areas allows us to

more efficiently propose interventions than if we sought to intervene uniformly across an entire division or organization.

Mapping relationships that will yield actionable findings. Most relationships are multi-dimensional. For example, a given pair of co-workers may share work-related information, socialize outside of work, consider each other political allies, and so on. Another pair of co-workers may have a different set of relationships, such as being competitive with each other, and working for the same boss. The number of different kinds of relations that may bind individuals in an organization is quite large, ranging from task-related ties to inappropriate relations such as sexual harassment. Each However, the kinds of questions you decide to ask in mapping a network of relationships dictates what network structures you will be interpreting and working with. As a result, it is very important to ensure that the kinds of relationships mapped in a social network analysis are informative for the task at hand. This requires asking the group well targeted questions as well as devising response scales that are meaningful to the specific concerns being addressed. We have outlined several networks as well as specific reasons for targeting these networks when faced with issues of organizational change in Appendix 1.

In considering which questions to ask, one of the most important issues to address concerns anonymity and confidentiality in the survey process. As we have seen, 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, we pay considerable attention to designing questions that are not only helpful to the specific issue

an organization is grappling with but also not unnecessarily disruptive to existing relationships.

Social network analysis is potentially inflammatory because the diagrams make specific people and their perceptions of specific others visible in a way that standard survey methods or interview techniques often do not. For example, while culture surveys may indicate that a lack of trust exists among a group, social network analysis moves the next level down and specifically points out who trusts whom. Pragmatically, this means that despite the potential usefulness of asking questions in relation to trust or friendship, the political or cultural dynamics of an organization often dictate that you focus only on communication, influence, advice or information flows.

Conducting compelling analyses. The visual display of social network data can be an extremely powerful tool to effect personal and organizational change. Simply reviewing these diagrams can often result in profound diagnoses and recommendations as people immersed in the patterns of relationships define and resolve issues impeding effective performance. Social network researchers have developed a number of drawing algorithms that help reveal a network's structure and which can be combined with information about the individuals (such as gender, department, level, age, and so on) to reveal patterns of interaction. Some of the things easily noticeable from the visual review of social network analysis data include:

- Information or decision bottlenecks (e.g., "bowtie" structures).
- Density of links (insufficient or excessive) between 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

Visual displays of social networks are highly effective when dealing with sufficiently small groups. However, as group size increases, the visual display can become overly busy and cease to be helpful in analyzing complex networks of relationships. To deal with this, network researchers have developed sophisticated algorithms, based on matrix algebra and graph theory, which provide quantitative analyses of network data, at both the level of the individual and the whole network[6]. Many of the techniques of this discipline are extremely sophisticated; however, we have found that more often than not, a series of fairly straightforward measures conducted at the individual, sub-group and network levels can be highly informative (see Appendix 2 for a brief overview of specific techniques).

Conclusion

In strategic change initiatives, the informal structure of an organization is consistently a force that must be reckoned with. In their entirety, these complex structures are typically hidden from the view of most managers and change agents but can be highly influential in both facilitating and impeding organizational change efforts. Social network analysis allows us to shift our attention to the informal structure and

[6] For example, the software program UCINET 5 for Windows can perform a wide range of these analytical routines (57).

recognize the significant influence that informal communication channels and opinion leaders have on organizational change processes.

Perhaps even more importantly, today's knowledge intensive economy requires organizational principles different from those espoused by Frederick Taylor and Max Weber. Specialization and bureaucratic controls fragment work processes, making integration of expert knowledge difficult and impeding responsiveness to shifting environmental demands. Social network analysis can help us better understand how the various types of relationships (work and social) comprising an organization facilitate or impede the effectiveness of new technologies, organizational structures and work practices.

REFERENCES

1. Stalk, G. & Hout, T. (1990). Competing Against Time: How Time-Based Competition is Reshaping Global Markets. New York, NY: Free Press.

2. Meyer, C. (1993). Fast Cycle Time: How to Align Purpose, Strategy and Structure for Speed. New York, NY: Free Press.

3. Conner, D. (1993). Managing at the Speed of Change: How Resilient Managers Succeed and Prosper Where Others Fail. Villard Books.

4. Miles, R. & Snow, C. (1994). Fit, Failure and the Hall of Fame. New York, NY: Free Press.

5. Nolan, R. & Croson, D. (1995). Creative Destruction: A Six-Stage Process for Transforming the Organization. Boston, MA: Harvard Business School Press.

6. Galbraith, J. (1995). Designing Organizations: An Executive Briefing on Strategy, Structure, and Process. San Francisco, CA: Jossey-Bass.

7. Treacy, M. & Wiersema, F. (1995). The Discipline of Market Leaders: Choose Your Customers, Narrow Your Focus, Dominate Your Market. New York, NY: Addison Wesley.

8. Nadler, D. 1998. Champions of Change. San Francisco, CA: Jossey-Bass.

9. Lewin, K. (1947). Group decision and social change. In Maccoby, Newcomb & Hartley (Eds.) Readings in social psychology. New York, NY: Holt, Reinhardt & Winston.

10. Schein, E. (1964). The Mechanisms of Change. In W.G. Bennis, E.H. Schein, F.I. Steele & D.E. Berlew (Eds.) Interpersonal Dynamics. Homewood: Dorsey Press.

11. Vaill, P. (1989). Managing as a Performing Art: New Ideas for a World of Chaotic Change. San Francisco, CA: Jossey-Bass.

12. Katzenbach, J. (1995). Real Change Leaders. New York, NY: Free Press.

13. Weisbord, M.R. (1987). Productive workplaces. San Francisco, CA: Jossey-Bass.

14. Weisbord, M. (1992). Discovering Common Ground. San Francisco, CA: Berret-Koehler.

15. Pasmore, W. (1994). Creating Strategic Change: Designing the Flexible, High Performing Organization. New York, NY: John Wiley & Sons.

16. Bunker, B. & Alban, B. (Eds) (1992). Large Group Interventions (Special Issue). Journal of Applied Behavioral Science, 28(4).

17. Bunker, B. & Alban, B. (1997). Large Group Interventions. San Francisco, CA: Jossey-Bass.

18. Emery, F. (1959). Characteristics of socio-technical systems. In F. Emery (ed.) The Emergence of a New Paradigm of Work. Canberra: Center for Continuing Education.

19. Ackoff, R. & Emery, F. (1972). On Purposeful Systems. Chicago, IL: Aldine-Atherton.

20. Ledford, G., Mohrman, S., Mohrman, A. & Lawler, E. (1989). Large Scale Organizational Change. San Francisco, CA: Jossey-Bass.

21. Nadler, D., Gerstein, M., Shaw, R. and Associates (1992). Organizational Architecture: Designs for Changing Organizations. San Francisco, CA: Jossey-Bass.

22. Tichy, N. & Fombrun, C. (1979). Network analysis in organizational settings. Human Relations, 32, 923-956.

23. 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.

24. Brass, D. (1984). Being in the Right Place: A Structural Analysis of Individual Influence in an Organization. Administrative Science Quarterly, 29, pp. 518-539.

25. Krackhardt, D. (1990). Assessing the political landscape: Structure, cognition, and power in organizations. Administrative Science Quarterly, 35, pp. 342-369.

26. 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.

27. Monge, P.R. & Eisenberg, E.M. (1987). Emergent communication networks. In Jablin, Putnam, Roberts, Porter (Eds.) Handbook of Organizational Communication. Newbury Park, Sage Publications.

28. Rogers, E. (1995). Diffusion of Innovations (4th ed.). New York, NY: Free Press.

29. Burt, R. (1987). Social Contagion and Innovation: Cohesion versus Structural Equivalence. American Journal of Sociology, 92, pp. 1287-1335.

30. Granovetter, M. (1973). The Strength of Weak Ties. American Journal of Sociology, 78, pp. 1360-1380.

31. Allen, T. (1977). Managing the Flow of Technology. Cambridge, MA: MIT Press.

32. Erickson, B. (1988). The Relational Basis of Attitudes. In B. Wellman & S. Berkowitz (Eds) Social Structures: A Network Approach pp. 99-121.

33. Krackhardt, D. & Hanson, J.R. (1993). Informal Networks: The Company behind the Chart. Harvard Business Review, 71, pp. 104-111.

34. Hirschhorn, L., & Gilmore, T. The new boundaries of the "boundaryless" company, Harvard Business Review (1992), May-June: 104-115.

35. Kerr, S. and Ulrich, D. Creating the Boundaryless Organization: The Radical Reconstruction of Organization Capabilities. Planning Review (1995), 23(5), p. 41-45.

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.

37. Cross, R. (2000). Looking Before You Leap: Assessing the Jump to Teams in Knowledge-Based Settings. Forthcoming Business Horizons.

38. Drucker, P.F. (1993). Post Capitalist Society. Oxford: Butterworth Heineman.

39. Nonaka, I. & Takeuchi, H. (1995), The Knowledge-Creating Company. London: Oxford University Press.

40. Davenport, T. & Prusak, L. (1998). Working Knowledge. Boston, MA: Harvard Business School Press.

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

42. O'Reilly, C. (1982). Variations in Decision Makers Use of Information Sources: The Impact of Quality and Accessibility of Information. Academy of Management Journal, 25, pp. 756-771.

43. Burt, R. (1992). Structural Holes. Cambridge, MA: Harvard University Press.

44. Orr, J.E. (1990). Sharing Knowledge, Celebrating Identity. In D.S. Middleton & D. Edwards (Eds) Collective Remembering (pp. 169-189). Newbury Park, CA: Sage.

45. Lave, J. & Wenger, E. (1991). Situated Learning: Legitimate Peripheral Participation. Cambridge, UK: Cambridge University Press.

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46. 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.

47. Brown, J.S. & Duguid, P. (1998). Organizing Knowledge. California Management Review, 40(3), pp. 90-111.

48. 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.

49. 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.

50. Krackhardt, D. (1987). Cognitive Social Structures. Social Networks, 9, pp. 109-134.

51. Casciaro, T. (1998). Seeing Things Clearly: Social Structure, Personality and Accuracy in Social Network Perception. Social Networks, 20, pp. 331-351.

52. Rummler, G. & Brache, A. (1990). Improving Performance: How to Manage the White Space on the Organization Chart. San Francisco, CA: Jossey-Bass.

53. Hammer, M. & Champy, J. (1993). Reengineering the Corporation: A Manifesto for Business Revolution. New York, NY: HarperBusiness.

54. Hammer, M. & Stanton, S. (1995). The Reengineering Revolution: A Handbook. New York, NY: Harperbusiness.

55. Beckhard, R. & Harris, R. (1987). Organizational Transitions: Managing Complex Change. Reading, MA: Addison-Wesley.

56. Cross, R. (2000). More than an Answer: How Seeking Information through Other People Facilitates Knowledge Creation and Use. Paper to be presented at the 2000 Academy of Management Meetings (Toronto).

57. Borgatti, S., M. Everett, & L. Freeman, 1999. UCINET 5 for Windows: Software for Social Network Analysis. Natick: Analytic Technologies.

Exhibit 1

Applying Social Network Analysis to Organizational Change

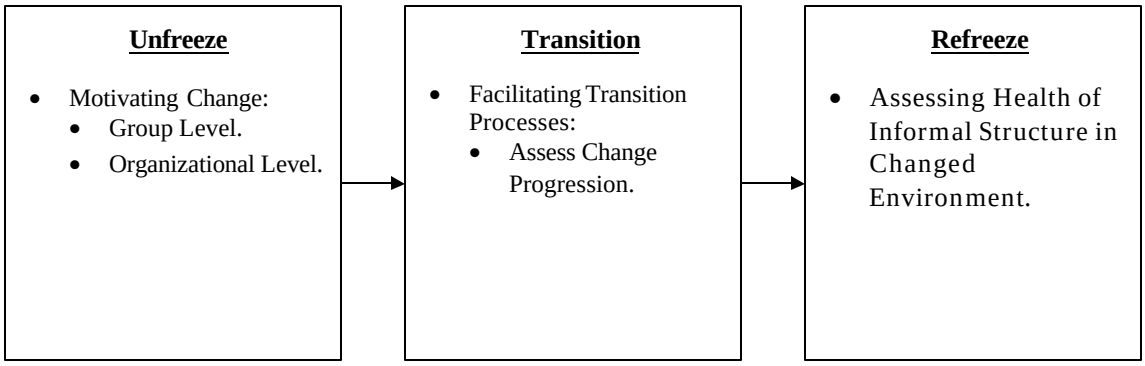
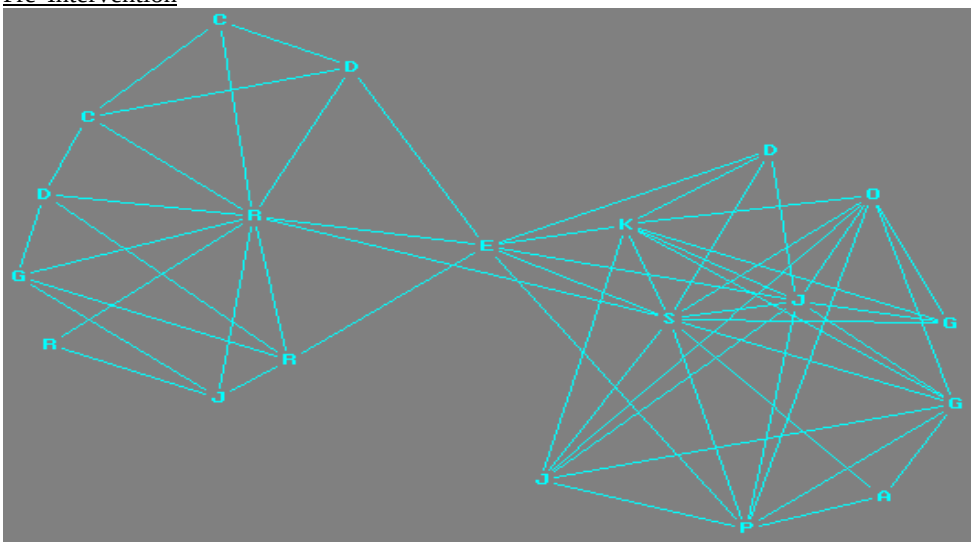
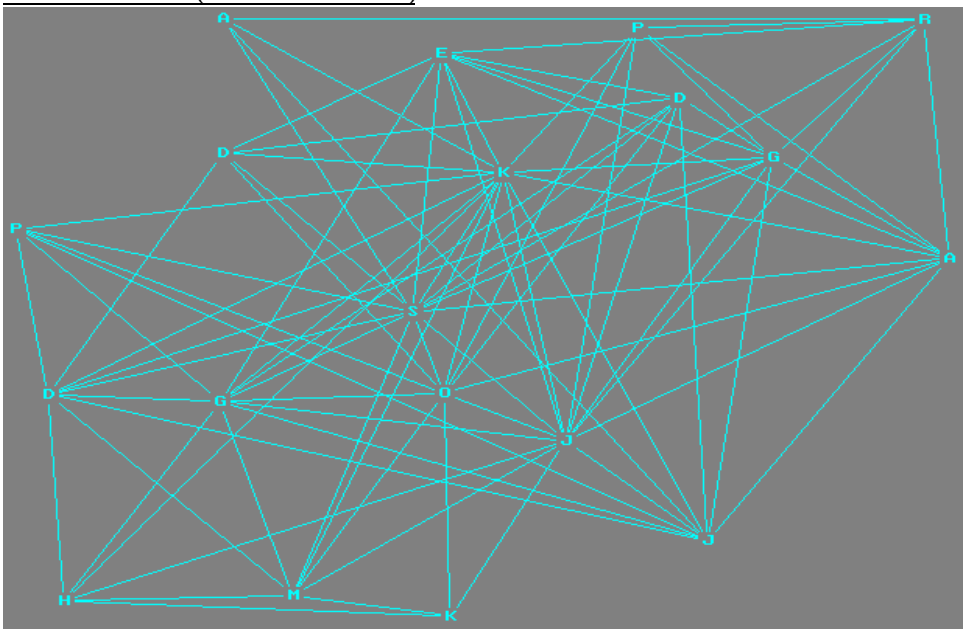


Exhibit 2
Advice Network of Internal Consulting Group[7]

Pre-Intervention



Post-Intervention (Nine Months Later)



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

Exhibit 3

Assessing Collaboration Within and Across Organizational 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 3
Diffusion of an Innovation via Social Network

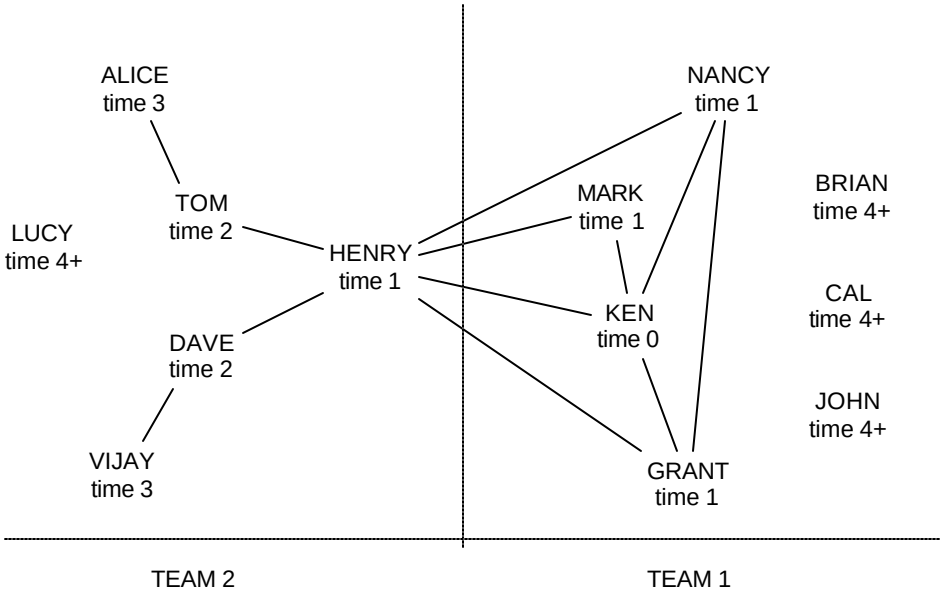
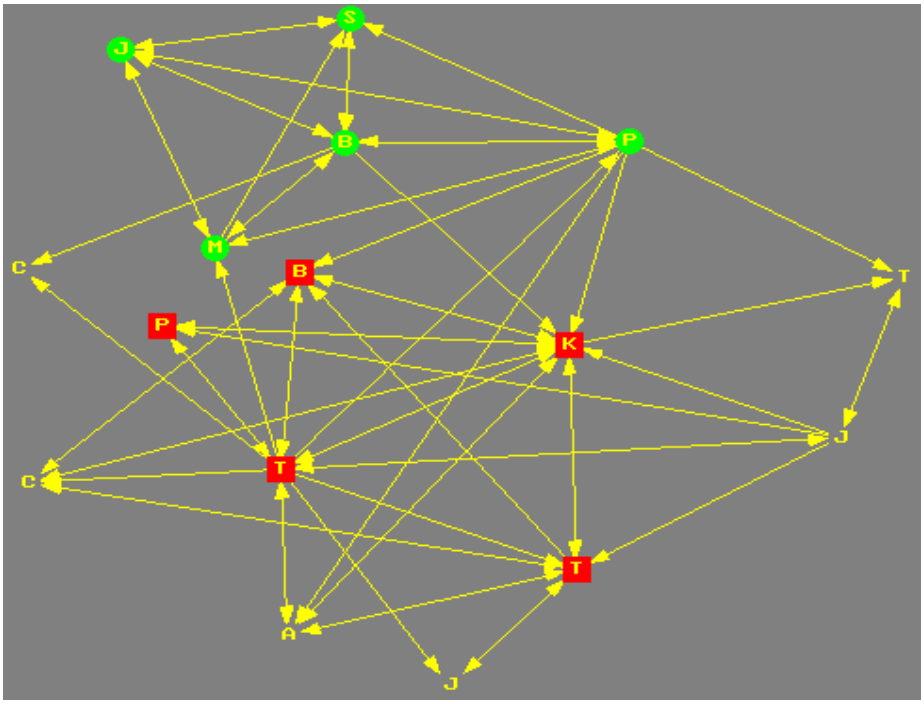


Exhibit 4a

Social Network of Merged Divisions of a Human Resource Department

Q1) Who do you turn to for answers to fairly specific or detailed questions to do your work?



= Original Organization

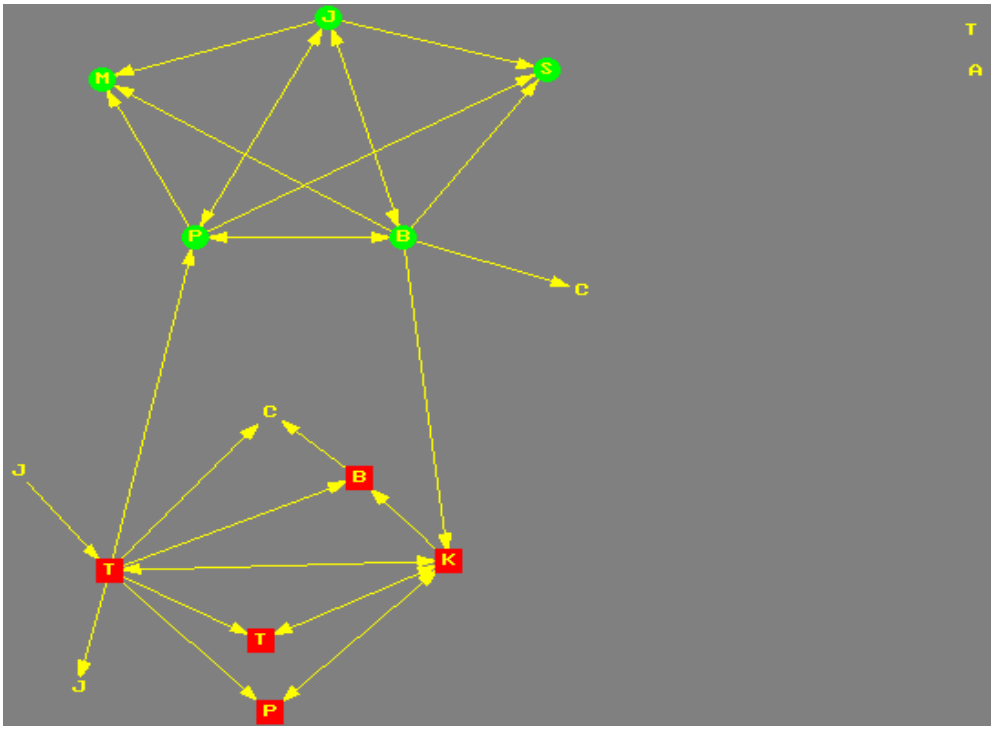
= Large Acquisition

Clear = Other Acquisitions

Exhibit 4b

Social Network of Merged Divisions of a Human Resource Department

Q2) We often turn to other people for their ability to help us think through a problem even when they may not have specific information that we need. To what extent do you turn to these people to help you think through a problem?



= Original Organization

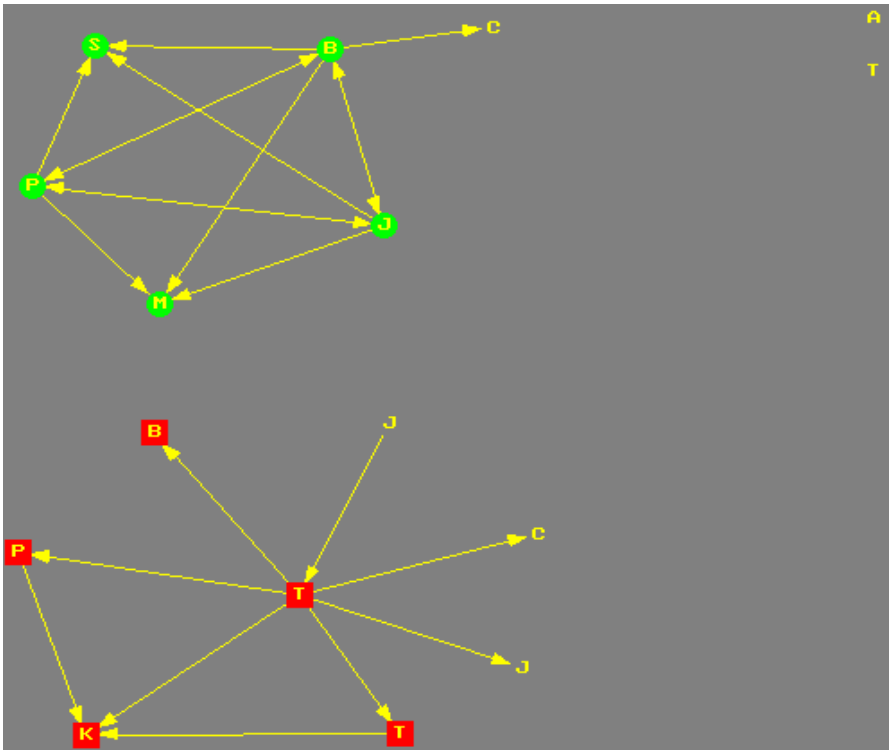
= Large Acquisition

Clear = Other Acquisitions

Exhibit 4c

Social Network of Merged Divisions of a Human Resource Department

Q3) Often we turn to other people and do not receive any information whatsoever. However, being able to talk through ideas with another person bolsters self-confidence and thinking and makes you more willing to introduce your ideas to others and more confident in expressing them. Indicate the extent to which you have turned to each of the following people within the last month for such a purpose.



= Original Organization

= Large Acquisition

Clear = Other Acquisitions

Appendix 1

Collecting Network Data: What Questions to Ask

If Trying to Discover…	These Kinds of Questions Can Help…
Communication network – The pattern of interactions, either in general or with respect to a given issue. Rationale – Identify transmitters, isolates and bottlenecks; Assess potential speed of diffusion.	• How often do you talk with the following people regarding <topic x>? (Likert response scale) • Who do you typically talk to in order to get your work done? (check off names) • How much do you typically communicate with each person relative to others in the group? (Likert-type scale)
Information network -- Who goes to whom for advice on work-related matters. Rationale – Identify key individuals, culture carriers, and overburdened organizational members. Change implementations must be careful not to overlook central players in this network.	• How frequently have you acquired information necessary to do your work from this person in the past month? • How willing is this person to share their knowledge with you? • On average, information I receive from this person is very 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?
Support Networks – Who goes to whom for career advice or when having personal problems. Rationale – People who feel well supported have a tendency to be both better performers and more likely to stay within an organization. Strong personal support networks enhance reliability because the individual can access multiple resources to solve problems that would otherwise impair work performance.	• Who do you talk to when you are frustrated at work? • Do you care for the personal well-being of <person name>? • Who do you call when you need career advice? • Who calls you when they need career advice?
Trust Network – Who trusts whom to act in their best interests. Rationale – People talk more openly and develop similar attitudes toward organizational events with those they trust. Individuals who are central in the trust network are potential leaders and change agents. Networks with many factions in the trust network require that change efforts be tailored for each group.	• 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?

Appendix 2

Helpful Network Measures in Organizational Change Initiatives[8]

Individual	
Degree Centrality	The number of ties a person has for a given relation (such as friendship, influence, etc.) Degree is an indicator of direct influence, as well as the probability of receiving any information that may be flowing through the network.
Closeness Centrality	The average path length linking a person to every other person in the network. On average, persons highly central with respect to closeness centrality tend to hear information sooner than others.
Betweenness Centrality	The number of times a person lies along the shortest path between two others. Persons high in betweenness are structurally positioned to be brokers, liaisons, and boundary spanners – or bottlenecks and gatekeepers. Networks that contain individuals with high betweenness are vulnerable to having information flows disrupted by power plays or having key individuals leave.
Collective	
Cohesive Subgroups	Sets of individuals who have closer ties with each other than with others. Cohesive subsets tend to develop their own culture and identity, and may have more influence on individuals' behavior than the organization as a whole. The existence of multiple subgroups can create difficulties for change efforts due to conflicting perspectives and allegiances.
Density	The number of individuals who have a given type of tie with each other, expressed as a percentage of the maximum possible. Networks with high density are cohesive. Individuals in dense networks tend to share a common culture, communicate information quickly and face stronger pressures to conform to group norms.
Multiplexity	The relationship between two individuals is multiplex to the extent that there is more than one kind of tie that binds them (e.g., they are not only business partners, but friends and neighbors). Networks with many multiplex ties can be difficult to change because changes have ramifications for so many different relationships.

[8] These are only measures we have found particularly helpful in organizational change initiatives. For further depth and insight into a host of measures see Scott (1990) and Wasserman & Faust (1994).