



## Social network analysis and the evaluation of leadership networks

Bruce Hoppe<sup>a,\*</sup>, Claire Reinelt<sup>b</sup>

<sup>a</sup> Connective Associates LLC 1281 Massachusetts Ave., Suite 3, Arlington, MA 02476, United States

<sup>b</sup> Leadership Learning Community, 1203 Preservation Park Way #200, Oakland, CA 94612, United States

### ARTICLE INFO

### ABSTRACT

Leadership development practitioners are increasingly interested in social networks as a way to strengthen relationships among leaders in fields, communities, and organizations. This paper offers a framework for conceptualizing different types of leadership networks and uses case examples to identify outcomes typically associated with each type of network. Evaluating leadership networks is a challenge for the field of leadership development. Social network analysis (SNA) is an evaluation approach that uses mathematics and visualization to represent the structure of relationships between people, organizations, goals, interests, and other entities within a larger system. In this article we describe core social network concepts and the application of them to illuminate the value of SNA as an evaluation tool.

© 2010 Elsevier Inc. All rights reserved.

### 1. Introduction

Leadership networks are a response to a rapidly changing world that is increasingly interconnected – one requiring greater learning and collaboration for solving complex problems. Leadership networks provide resources and support for leaders, and increase the scope and scale of impact leaders can have individually and collectively. Nurturing and catalyzing leadership networks is increasingly a focus of leadership development efforts, especially those that seek to develop leadership with a capacity to influence policy and bring about social and systems change. Thus, understanding the nature of networks and changes in them is an increasingly important aspect of leadership development evaluation.

In this paper we examine four types of leadership networks: peer leadership networks, organizational leadership networks, field-policy leadership networks, and collective leadership networks. These types of networks are commonly the focus of leadership development efforts. Social network analysis (SNA) is used to increase the awareness of leaders about the power of networks, to further catalyze relationships and connections, and to strengthen the capacity of the network to act collectively. In this article we focus on understanding and measuring the difference leadership networks make. We begin by describing our classification of four different types of leadership networks. We then provide an overview of network metrics that can be used to examine leadership networks and the general categories of questions that can be used to explore various dimensions of leadership networks. Each type of leadership network, including its defining characteristics, its value, appropriate evaluative methods, and examples are then described. We conclude by discussing issues and risks of SNA and leadership network evaluation, and outlining areas for future research.

Before proceeding it is important to note our research approach. We actively co-design research projects with our clients to answer their questions about initiatives (Ospina, Schall, Godsoe, & Dodge, 2002). This approach does not conform to research studies that test hypotheses about leadership network development with experiments and control groups. However, our approach leads to a rich understanding of networks in context. We hope that our study will provide a framework that can be tested and further developed through additional research.

\* Corresponding author.

E-mail addresses: [bruce@connectiveassociates.com](mailto:bruce@connectiveassociates.com) (B. Hoppe), [claire@leadershiplearning.org](mailto:claire@leadershiplearning.org) (C. Reinelt).

## 2. Classifying leadership networks

Our leadership network classification framework is influenced by the work of [Borgatti and Foster \(2003\)](#), [Plastrik and Taylor \(2006\)](#), and [Milward & Provan \(2006\)](#), all of whom have developed classifications of networks. We have used terms we believe are more intuitively understood and consistent with language used in the leadership development field.

The classification scheme, provided in [Table 1](#), is intended to help individuals better understand how to strengthen, use, and evaluate leadership networks effectively. Leadership networks may be intentionally created, or they may emerge from a strong need or desire among leaders to connect. In every category of our framework, we find examples of leadership networks across the spectrum from intentional to emergent. Some networks may fit neatly into one of these categories, and others may be hybrids of multiple categories. The framework provides a tool for network analysis, not an ideal towards which networks should strive.

## 3. Introducing social network analysis

Social network analysis (SNA) is a set of theories, tools, and processes for understanding the relationships and structures of a network. The “nodes” of a network are the people and the “links” are the relationships between people. Nodes are also used to represent events, ideas, objects, or other things. SNA practitioners collect network data, analyze the data (e.g., with special-purpose SNA software), and often produce maps or pictures that display the patterns of connections between the nodes of the network. The maps in this article were created using SNA computer programs by [Borgatti \(2002\)](#) and [Brandes and Wagner \(2004\)](#).

Many mathematical techniques are available to measure networks ([Wasserman & Faust, 1994](#)); below we highlight a few particularly relevant to those interested in leadership networks. We will also demonstrate how to use these metrics to understand and evaluate specific leadership networks.

### 3.1. Bonding and bridging

Bonding and bridging are two different kinds of connectivity. Bonding denotes connections in a tightly knit group. Bridging denotes connections to diverse others. See [Fig. 1](#) for an illustration. These terms are commonly used in the social capital literature ([Putnam, 2001](#)). In the SNA literature, bonding and bridging are often called “closure” and “brokerage” respectively ([Burt, 2005](#)); also, “strong ties” and “weak ties” are important related SNA concepts that we incorporate into our bonding–bridging usage ([Granovetter, 1983](#)). Analyzing network data to measure bonding and bridging helps to predict important outcomes such as efficiency and innovation: bonding indicates a sense of trusted community where interactions are familiar and efficient; bridging indicates access to new resources and opportunity for innovation and profit ([Burt, 2005](#)). The extent to which bonding or bridging occurs in a network often represents an intermediary outcome of leadership development.

### 3.2. Clusters

A cluster is a tightly knit, highly bonded, subgroup. Identifying clusters is one of the most important applications of SNA, because it illuminates important previously unrecognized subgroups. Clusters can be displayed visually with a network map, as

**Table 1**  
Leadership network classification framework.

Type of network	Description of network
Peer leadership network	A system of social ties among leaders who are connected through shared interests and commitments, shared work, or shared experiences. Leaders in the network share information, provide advice and support, learn from one another, and occasionally collaborate together. Peer leadership networks provide leaders with access to resources that they can trust. Leadership development programs often seek to create and catalyze peer leadership networks to expand the trusted ties that leaders have with one another. At other times peer networks emerge when leaders with something in common find personal benefit in sharing and connecting their experiences.
Organizational leadership network	A set of social ties that are structured to increase performance. These ties are often informal and exist outside the formal organizational structure, such as when an employee seeks advice from a colleague other than her supervisor to help solve a problem more quickly. At other times, teams or communities of practice are intentionally created to bridge silos within organizations that interfere with performance, profit, or delivering on one's mission. At the inter-organizational level, leadership networks support organizations with shared interests to produce a product or deliver a service more efficiently.
Field-policy leadership network	A network connecting leaders who share common interests and who have a commitment to influencing a field of practice or policy. These networks seek to shape the environment (e.g., the framing of an issue, underlying assumptions, and standards for what is expected). Effective field-policy leadership networks make it easier for leaders to find common ground around the issues they care about, mobilize support, and influence policy and the allocation of resources.
Collective leadership network	A self-organized system of social ties among people attracted to a common cause or focused on a shared goal. Network members exercise leadership locally. As the number of local groupings grows and there is increasing interaction, these groups begin to align and connect to form larger networks. These networks are often rooted in a sense of community and purpose; they may be driven by a desire to achieve a specific goal, or simply by the desire of each member to belong to something larger than oneself.

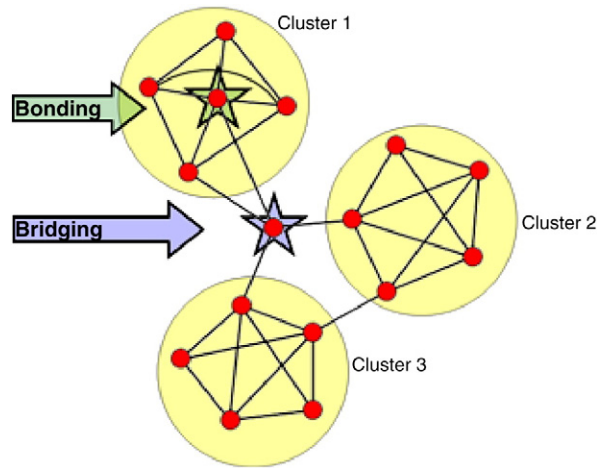


Fig. 1. Bonding, bridging, and clusters.

shown by the three highlighted clusters in Fig. 1. Algorithms that identify clusters measure variations in density and links per node. Density and links per node and core and periphery structures are fundamental network metrics described below.

### 3.3. Core and periphery

Many networks feature a core/periphery structure. The core is a dominant central cluster, while the periphery has relatively few connections (Borgatti & Everett, 1999). See Fig. 2 for an illustration. Nodes 31 and 29 are on the periphery, while nodes 23 and 28 are in the core.

### 3.4. Directed and undirected links

Links can be undirected (e.g., “shares information with”) or directed (e.g., “seeks advice from”). Directed links can be one-way or two-way. Social network analysis addresses both undirected and directed networks. See Fig. 3 for an illustration of the directionality of links.

### 3.5. Density and links per node

Density is the number of links that exist in a network divided by the maximum possible number of links that could exist in the network. All of the social network analysis metrics in this paper assume that the numbers of nodes and links that exist in a network are known; we use  $N$  to refer to the number of nodes and  $M$  to refer to the number of links. The maximum possible number of links in a network depends on  $N$  and on whether the network is undirected or directed. For an undirected network, the maximum possible number of links is  $N(N-1)/2$ ; for a directed network it is  $N(N-1)$ . The density of an undirected network is illustrated by Fig. 4.

Roughly speaking, density helps to define clusters. A cluster is a local region in a network with relatively high density and relatively few links to other clusters. Formal mathematical definitions of clusters and algorithms for finding clusters are reviewed

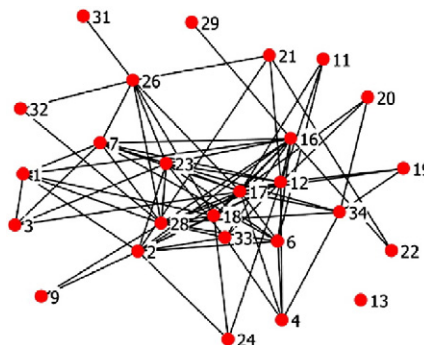


Fig. 2. Core/periphery structure.

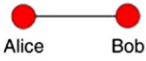

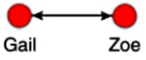
Link Type		Example Relationship
 <p>Alice      Bob</p>	Undirected	Alice and Bob have spoken with each other.
 <p>Craig      Daniel</p>	Directed One-way	Craig knows who Daniel is; Daniel does not know who Craig is.
 <p>Gail      Zoe</p>	Directed Two-way	Gail seeks advice from Zoe, and Zoe seeks advice from Gail.

Fig. 3. Directed and undirected links.

by Brandes and Erlebach (2005). Links per node is the total number of links divided by the total number of nodes in the network. Continuing with the example from Fig. 4, a network with a total of 6 links joining 5 nodes has 1.2 links per node.

### 3.6. Bridgers and betweenness centrality

Bridgers are individuals in a network who have connections to different clusters. Finding bridgers is the flip side of finding clusters. Bridgers can be highlighted visually just as clusters can; Fig. 1 illustrates a bridger. Bridgers in a leadership network provide valuable opportunities for innovation, growth, and impact because they have access to perspectives, ideas, and networks that are otherwise unknown to most network members. Bridgers are easy to overlook because the significance of their ties is not visible by counting the number of ties. Finding bridgers is an important application of SNA in leadership networks. Bridgers often make good key informants during an evaluation because of their access and knowledge of the larger network.

Finding bridgers in a network is typically done with the calculation called betweenness centrality (Freeman, 1979). This calculation indicates how often one individual is likely to be an important relay point between other network members. Another metric used to find bridgers is network constraint (Burt, 2004, 2005). An individual's network constraint measures the extent to which he links to others that are already linked to each other. Low network constraint means that an individual has links to others who are not already linked to each other. High betweenness centrality and low network constraint both indicate bridging.

### 3.7. Hubs and indegree centrality

Hubs are individuals in a network with the most influence. Whether hubs bridge across clusters or bond within a cluster (or some combination), they are highly sought-after by other network members. Hubs of influence in a network are best measured using directed links. Given a network of directed relationships, indegree centrality (or just “indegree”) counts how many relationships point towards an individual; this provides a simple measure of influence (Freeman, 1979). More advanced influence metrics build on indegree and consider not just how many others seek the advice of a particular person, but also how influential those other advice-seekers are. A person whose advice is sought by someone who is highly influential may have a higher influence

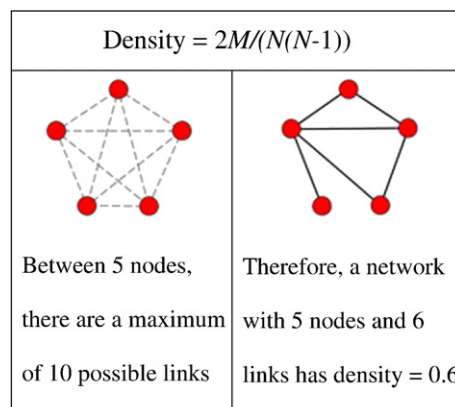


Fig. 4. An example of density in an undirected network: density =  $2M/(N(N-1))$ .

score than one whose advice is sought by many non-influencers. Bonacich and Lloyd (2001) overview several advanced influence metrics and explain how most of them compute nearly the same thing. In most cases, we recommend using indegree, because it communicates the basic point without unnecessary complications. In this way changes in influence as a result of leadership development can be measured.

### 3.8. Structural equivalence

Amazon.com made structural equivalence famous as the calculation behind its recommendations: “People who bought books A and B also bought books C and D.” This Amazon.com example considers both people and books as members of a single network. Links in this network join people to the books they have purchased. People who buy mostly the same books have high structural equivalence; people who buy mostly different books have low structural equivalence.

Structural equivalence in leadership networks is based not on shared reading lists but on shared activities, goals, or interests. For example, Fig. 5 displays members of a leadership network as circles and their professional activities as squares. Links indicate which people engage in which activities. The larger squares denote the more common activities. The layout of the map places people next to those who share the same activities, and it also places activities next to other activities that share the same participants (Borgatti, 2002; Gower, 1971; Hanneman & Riddle, 2005). There is a group of 13 people who engage in exactly the same set of activities; they are highlighted near the bottom left. The nodes in this group all have high structural equivalence with each other. Similarly, the three activities in the middle, “expand networks,” “design programs,” and “implement programs,” share many of the same participants; these three nodes have relatively high structural equivalence with each other. The degree to which there are changes in the alignment among individuals can be an indicator of the effectiveness of a leadership development initiative.

Structural equivalence is similar to finding clusters, in that both techniques illuminate important subgroups that were previously unrecognized. Unlike finding clusters, however, structural equivalence can work without any information about who knows whom. For example, Fig. 5 relies only on data about who engages in what activities; Amazon.com relies only on data about who buys what books. Amazon keeps its data private and uses it to recommend books, but the same kind of data can also be shared and used to introduce people who engage in similar activities (e.g., the 13 people highlighted in Fig. 5). For those seeking to bond or to bridge, this information is extremely useful.

Asking network members to report what relationships they have with all other network members can raise difficult challenges, which are discussed in the *Issues and Risks* section of this paper. By comparison, it is easier to collect data about which network members associate themselves with which activities, or what goals each person considers important as a member of the network. Because structural equivalence can make use of data that is easily collected, and other SNA techniques require data that is harder to obtain, it is especially valuable to have structural equivalence as a metric in one's SNA toolbox.

## 4. Evaluating leadership networks

Before demonstrating how to use social network metrics to evaluate different aspects of leadership networks, we provide an overview of evaluation questions that are frequently asked about leadership networks, and briefly highlight some additional methods of network evaluation that can be combined with SNA for a richer understanding of network impact.

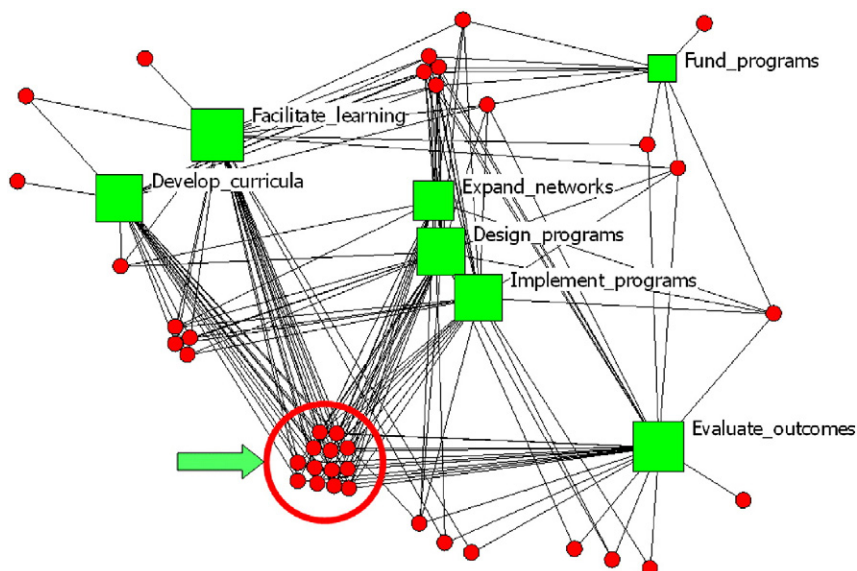


Fig. 5. Structural equivalence.

There is a growing body of research about what to evaluate when assessing networks (Durland & Fredericks, 2005). Some useful frameworks include those developed by Provan and Milward (2001) to evaluate the network effectiveness of public sector organizational networks; Nunez and Wilson-Grau (2003) and Church et al. (2002) to evaluate international social change networks; Diani (2003) to evaluate social movement networks; Plastrik and Taylor (2006) to evaluate production networks; and Gutierrez et al. (2006) and Umble, Diehl, Gunn, and Haws (2007) to evaluate leadership development program alumni networks. The context in which networks operate and the purpose for which they exist influence the focus of leadership network evaluation.

Some common evaluation topics are connectivity, overall network health, and network outcomes and impact. Below we give examples of questions that an evaluation of leadership networks might seek to address, and suggest how SNA can be used as a valuable assessment tool. SNA is particularly useful for assessing connectivity within leadership networks, although it also has applications for evaluating overall network health. There are fewer direct uses for SNA in evaluating network outcomes and impact, which is why we suggest using multiple evaluation methods.

#### 4.1. Connectivity

Potential evaluation questions to explore include:

- Does the structure of network connectivity enable efficient sharing of information, ideas, and resources?
- Is the network expanding and growing more interconnected over time? How far does the network reach?
- Does the network effectively bridge clusters (e.g., sectors, communities, fields, and perspectives)? Where in the network are there unlikely alliances?
- What changes in connectivity resulted from a leadership development intervention?

SNA highlights which individuals are core or peripheral members of the network; identifies where bonding and bridging are occurring; and points towards who has influence in the network. What is missing from a structural focus on connectivity is the story behind the connections (e.g., what did people do together). Social network maps can be used to stimulate people to tell these stories. There are a number of other methodologies that are also useful with groups, organizations, and communities to help them uncover the “collective story,” such as Photovoice (Wang, 2006), Q-methodology (Militello & Benham, 2010-this issue), Most Significant Change (Davies & Dart, 2005), Critical Moments Reflection (McDowell, Nagel, Williams & Canepa, 2005), and participatory story-building (Church et al., 2002). While we do not discuss these methods in this paper, we urge readers to explore and use a variety of different methods when evaluating network connectivity in order to get a full picture of where there are important relationships and connections.

#### 4.2. Overall network health

Potential evaluation questions to explore include:

- What is the level of trust among members in the network?
- How diverse is the network?
- Are people participating and exercising leadership as they are able to and would like?
- Is the structure appropriate for the work of the network?
- What are the power relationships within the network and how are decisions made? How well do networks manage conflicts?
- Is the network balanced and dynamic (e.g., capable of growing more inclusive while sustaining collaboration)?
- What changes in network health resulted from a leadership development intervention?

In evaluating the overall health of a leadership network, it is important to gather perspectives from a diverse group of network members. SNA can help inform this process. For example, the core and the periphery of a leadership network may be quite distinct, and people located in a variety of positions across the network should be included in an evaluation. Network maps can also be used by participants to stimulate conversation about how well the network is functioning. Other useful assessment tools for evaluating network performance are provided by Nunez and Wilson-Grau (2003) and Gajda and Koliba (2007). Gajda and Koliba have developed a framework for assessing the quality of dialogue, decision-making, action, and evaluation by communities of practice that is equally applicable to leadership networks, especially those that are goal-oriented.

#### 4.3. Network outcomes and impact

Potential evaluation questions to explore include:

- Is there evidence of greater coordination or collaboration among leaders?
- Does the network promote higher levels of civic participation and engagement in each of its members?
- Does the network make the most of scarce resources to produce desired results? Are more innovative products being developed?
- Is the network positively influencing policy decision-making or how resources are allocated?
- How do changes in network outcomes and impact relate to a leadership development intervention?

Network outcomes may be found in communities, organizations, fields, and individuals. At this stage there are few techniques for using SNA to evaluate network outcomes and impact. We recommend using interviews, case studies, and traditional survey methods to identify network outcomes. Evaluating network outcomes at the community level is more challenging because it is not

always as clear who to gather data from (Behrens & Benham, 2007; Plastrik & Taylor, 2006). Results-based evaluation approaches such as EvalUlead (Grove, Kibel, & Haas, 2007) and Results-Based Accountability (Friedman, 2005) have been used successfully by network-based leadership programs to focus attention on desired outcomes and to track progress towards those outcomes. While more research is needed, the Annie E. Casey Foundation has recently published a series of reports on how social networks link to family and community-level outcomes (Ahsan, 2007).

## 5. Evaluating peer leadership networks

Peer leadership is the capacity of people who share similar identities, circumstances, or contexts to provide each other with trusted and relevant information, advice, and support when it is needed most. Peer leadership prioritizes listening and problem-solving among leaders in a safe environment where peers can speak openly and honestly with each other, outside the structures of power and authority within which they live and work. In recent years there has been increased investment in developing and supporting peer leadership networks (Backer, 2008). Reasons for this increase include the increasing complexity of problems and challenges that confront leaders, and the loneliness and frustration they often feel shouldering the expectations of others. The best peer leadership programs recognize that leaders have as much to learn from each other as they do from outside experts.

Peer leadership networks support personal and professional growth, and leadership development. High-value peer leadership networks embrace diversity and inclusion without losing a sense of shared identity. They give leaders an opportunity to ask for advice—to admit what they do not know—without having to be concerned about negative consequences from those they supervise or from those who have power over them.

### 5.1. Sierra Health Leadership Network

The Sierra Health Leadership Network includes over 130 nonprofit executive leaders from 21 northern and central California counties who work on health-related issues. All of these leaders have participated in the Sierra Health Leadership Program, a nine-month program of retreats, leadership training sessions, team action learning projects, and an alumni network. Leaders bond with each other during their leadership program experience which includes many opportunities for self-reflection, clarification of core values, and finding one's "noble cause" in conversation with others. The foundation hosts retreats three times a year to reinvigorate relationships; reinforce core learning from the program; explore new topics and ideas; and expand connections to other cohorts. In an evaluation of the alumni network, Reinelt, Kubo, and Hoppe (2006), in their evaluation of the program, found the most important outcomes to be:

- *Peer support.* Listening to one another and providing support in order to reduce feelings of isolation
- *Peer coaching.* Acting as sounding boards for one another to share stories and advice about challenges like how to manage boards, how to achieve financial sustainability, or how to build alliances for broader impact.
- *Resources.* Sharing resources with each other, e.g., speaking at each other's event, trading or providing services, getting quick reliable information to a question.
- *Job assistance.* Providing each other with leads to new job opportunities and job references.
- *Introductions.* Introducing each other to people in each other's networks.
- *Collaboration.* Initiating joint inquiry or collaborations around shared issues and common problems.

The formation of close personal and professional relationships through bonding is a key characteristic of peer leadership networks. Peer networks can be intentionally facilitated in leadership development programs through face-to-face convenings that use tools such as Open Space (Owen, 1998) and World Café (Brown, 2005) to emphasize listening, dialogue, and storytelling; or by creating opportunities for leaders to work on projects together.

Potential evaluation questions to explore include:

- Has the number of connections between leaders in the network increased?
- Is there a strong network core that can sustain the network over time?
- Is the network diverse? Is the network inclusive of diverse elements?
- Is there a high level of trust among members in the network?
- Do members share advice with each other that supports their personal and professional development, and makes them more effective leaders?
- Does participating in the network correlate with greater career success or job satisfaction?

One use of SNA to assess peer leadership networks, especially those that form through leadership programs, is to take "before" and "after" snapshots of network connectivity. A "before" snapshot of relatively disconnected individuals indicates diverse recruiting; an "after" snapshot of more dense connections indicates that bonding has occurred and a trusted community has been formed.

Relationship questions such as "how well do you know this person" and "how often do you communicate one-on-one with this person" are useful survey questions for this type of assessment. Allowing respondents a range of options is especially helpful (e.g., "I don't know this person," "I know this person somewhat," and "I know this person well"). Successful peer leadership networks will transform many "don't know" relationships into "know somewhat" relationships. "Know well" relationships are more likely to develop when peers collaborate on a project.

With social network frequency data, several interesting inquiries are possible. For example, the maps of Fig. 6 show communication between members of a single peer leadership network. The maps all show the same snapshot in time, two years after the original formation of the network; however, each map highlights a different frequency of communication.

Each level of communication pictured in Fig. 6 provides different insights about relationships in the network. The “at few times a year or more” level is the least interesting: it confirms that everyone is showing up. The “at least once a week” level helps outsiders and/or newcomers get a quick sense of where strong relationships exist in the network; however, these relationships are usually obvious to network insiders. The most interesting map filters out both low and high extremes and presents only the mid-range, in this case “about once a month.” This mid-range map reveals the heart of the peer leadership network and its core/periphery structure. A large network core can be a sign of strength—it is likely to hold together even if one or two people leave. A well-populated network periphery can be a sign of network adaptability—it brings new ideas and resources into the core and offers burned-out members of the core a place for sabbatical. In the “Issues and Risks” section of this paper, we describe the careful consideration required when interpreting core/periphery maps.

## 6. Evaluating organizational leadership networks

Organizational leadership is the capacity to set direction, create alignment and maintain commitment to get work done. (McCauley & Van Velsor, 2004). The exercise of leadership within organizations includes exploring new horizons, focusing collective attention, aligning and mobilizing resources, and inspiring others to participate (LeMay & Ellis, 2007). Organizational leadership also is the ability to plan, organize, implement and evaluate projects to maximize results.

Organizational leadership networks are the informal relationships that exist alongside the formal structure within an organization. They help improve innovation, efficiency, productivity, and growth by facilitating communication across departments, offices, and other boundaries (Borgatti & Cross, 2003; Cross & Thomas, 2009). Career success correlates strongly to one's position in the informal network (Burt, 2004). Also, the time one spends networking informally correlates to career success, whereas the time one spends convening more formally (e.g., meetings) can actually be counter-productive (Shipilov, Labianca, Kalnysh, & Kalnysh, 2007). Organizational leadership networks also refer to systems of multiple organizations that work together to more efficiently deliver services or produce a product.

Commonwealth Software (a pseudonym) is an example of an organizational leadership network. It is a young company with 50 employees that is planning for rapid growth. In order to grow effectively, the CEO of Commonwealth started an “Emerging Leaders” program. About a year later, Commonwealth used social network analysis to evaluate all its leadership development efforts, including the Emerging Leaders program.

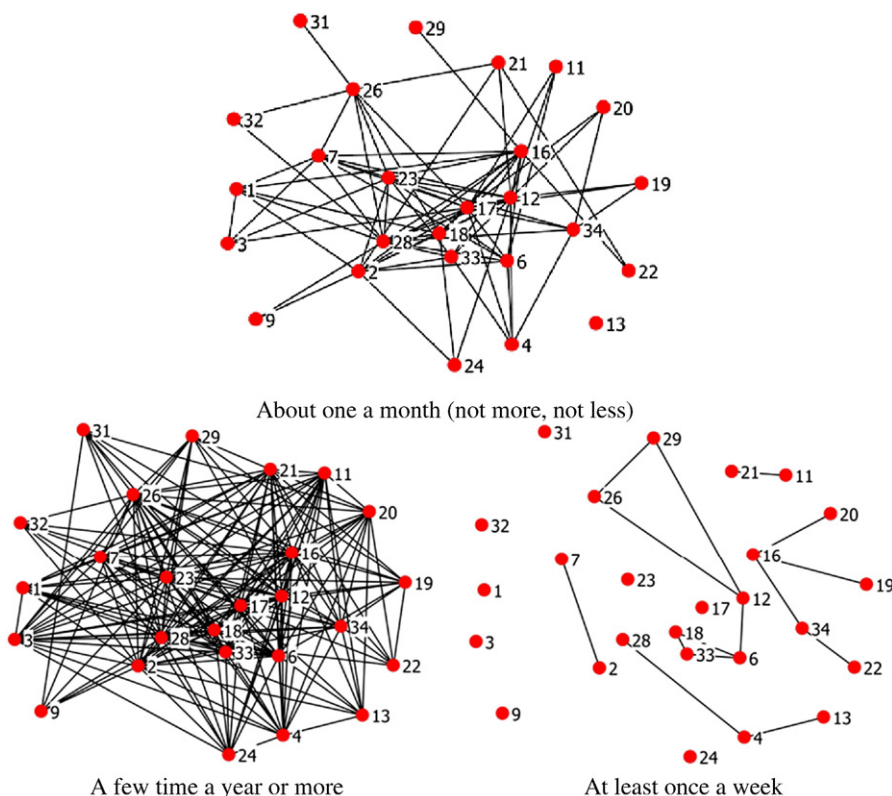


Fig. 6. Frequency of one-to-one communication in a peer leadership network (Tener, Nierenberg & Hoppe, 2007).



Figs. 7 and 8 display some of the basic data that informed the evaluation: the weekly advice network of Commonwealth Software. Node shapes correspond to formal departments: circles are members of administration, sales, and marketing departments; triangles are members of the software engineering department; and squares are members of the product development department. Two distinct teams within the product development department are indicated as two different shades of squares. Node sizes indicate betweenness centrality (i.e., bridging).

To succeed, organizational leadership networks need formal executive support without an imposed formal reporting structure (e.g., Rizova, 2006). Interdepartmental links are key: high-performance in organizations correlates strongly to bridging. Promotions, pay raises, and good ideas all happen more often to those who are brokers between different network clusters (Burt, 2004;2005). Sometimes deliberate bonding is critical: for example, communities of practice cultivate interdepartmental bonding (Wenger, McDermott, & Snyder, 2002). Also, junior-level employees and disadvantaged outsiders (e.g., minorities) are two groups for which early bonding with the help of strong mentors is critical for long-term leadership development. As organizations change more rapidly, however, these special exceptions become rarer and organizational leadership networks grow increasingly focused on bridging (Brass & Krackhardt, 1999). Questions for evaluating the impact of leadership development on organizational leadership networks include the following

- Are there appropriate bridgers in the network who connect disparate locations, specialties, and silos?
- To what extent do leaders use organizational networks to foster innovation?
- Does information and knowledge flow easily through the network so that it is accessible to people when they need it?
- Do organizational leaders effectively learn from projects and experiences and share that information with others?

SNA has many uses for organizational leadership networks. Perhaps the most common is to reveal where bridging is happening. SNA also helps to evaluate formal organizational structures. To illustrate these uses, we return to the Commonwealth Software case study.

The first goal of the Commonwealth Software evaluation—and the goal most directly related to its Emerging Leaders program—was to check the CEO's assumptions about who were the emerging leaders. Fig. 7 confirmed the emerging leadership perceived by the CEO, especially the leadership of one new employee, node 36 in the map.

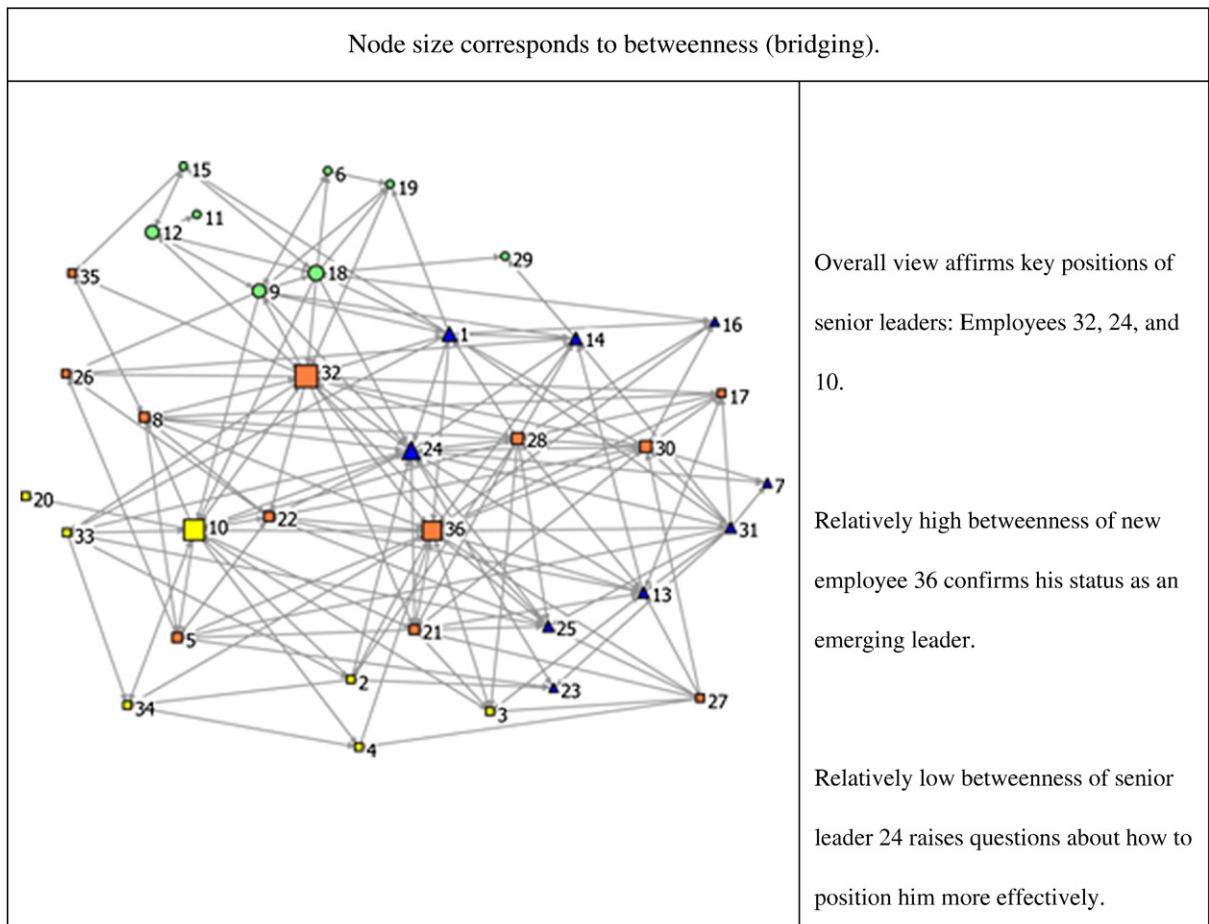


Fig. 7. Weekly advice network of Commonwealth Software. Node size corresponds to betweenness (bridging).

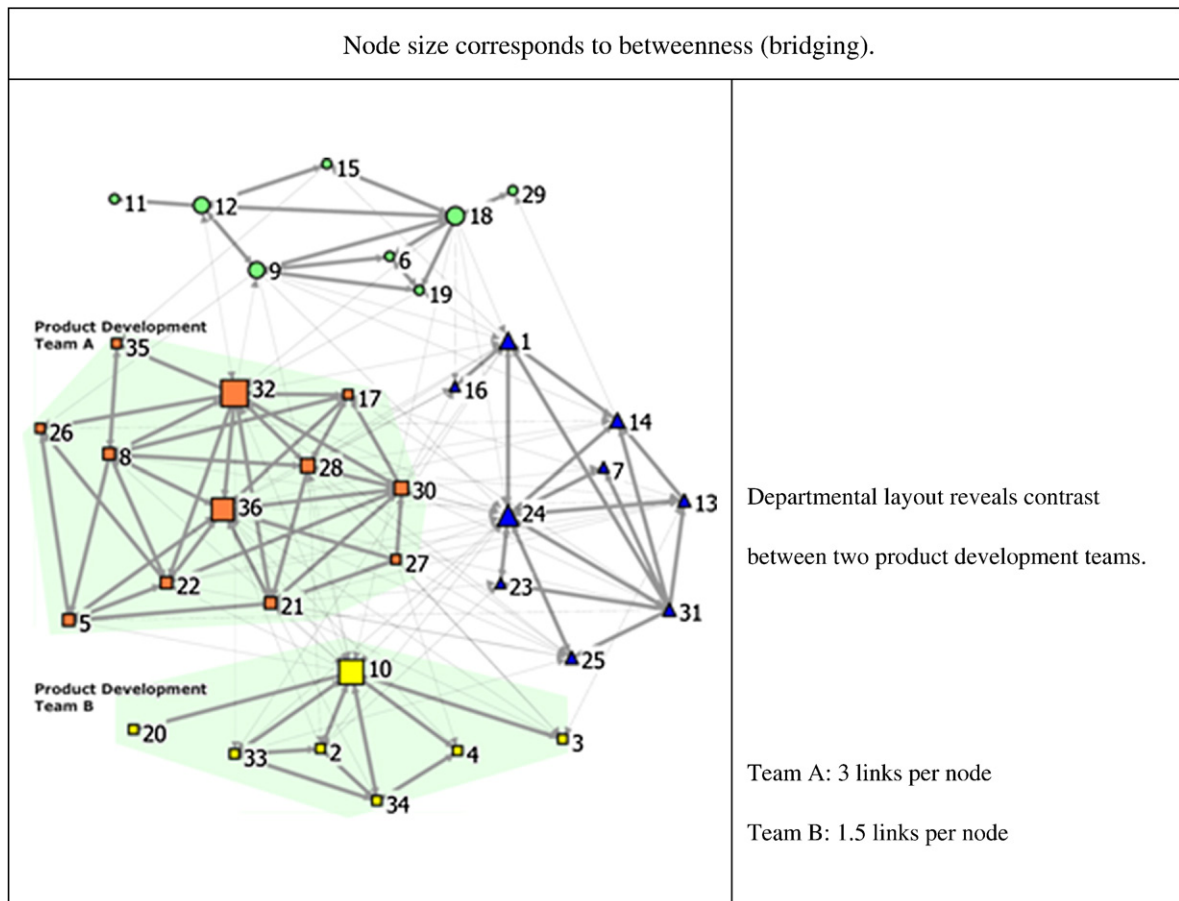


Fig. 8. Weekly advice network of Commonwealth Software. Node size corresponds to betweenness (bridging).

Further analysis of the advice network and related data revealed an overtaxed senior leader in the organization (node 24 in Fig. 7). Members of this leader's own department reported that he was frequently busy and inaccessible. Members of other departments reported relatively little interaction with him. These data highlighted a specific area for improvement in the existing leadership network and underscored the need for the Emerging Leaders program.

Another goal of the social network analysis was evaluating the collaboration between the two product development teams of Commonwealth, one of which occupied a different office than the rest of the company. Fig. 8 shows the advice network of Commonwealth, with specific focus on formal organizational boundaries. The network map is drawn so that employees in the same department are close to each other; thick links show intra-departmental advice and thin links show inter-departmental advice.

The network map of Fig. 8 revealed a surprising gap in the company's existing leadership development efforts. Because Product Development Team A worked in the same office as the rest of the company, and Product Development Team B worked in an office many miles away, the CEO was concerned that Team B might be isolated. In fact, the network evaluation revealed that Team B was not isolated from the rest of the company; instead, members of Team B were relatively isolated from each other.

The CEO used the results of the network evaluation to reorganize the formal leadership structure of Commonwealth Software. The overtaxed senior leader was repositioned and additional leadership resources were added in order to help wean employees from their dependence on him. Realigning Team B—a team with strong historical ties to this same senior leader—was an integral part of this effort.

When interviewed after the evaluation and restructuring, the CEO of Commonwealth reported that, even though the evaluation proceeded as he had hoped, its most important benefits to him were entirely unanticipated. Maps such as those in Figs. 7 and 8 gave him a new perspective on how the pieces of Commonwealth fit together. He reoriented his leadership development focus from individuals to the collective leadership system.

Other ways SNA is used to evaluate organizational leadership networks include assessing communities of practice and mapping organizational expertise. Evaluating a community of practice is similar to assessing a peer leadership network, which we described in the preceding section of this paper. Mapping organizational expertise is quite similar to assessing the network roles of a field-policy network, which we describe in the next section.

## 7. Evaluating field-policy leadership networks

Field-policy leadership is the capacity to influence how problems are framed and solutions envisioned, to mobilize people to take action around a shared vision, to develop and enact innovative solutions to complex problems, and to participate actively in policy decision-making. According to a PolicyLink report (2003), “policy determines the way society organizes its resources, conducts its business, and expresses its values.”

The field can be understood as the cultural and political landscape within which policies are made and implemented. Fields produce frames, approaches, norms, standards, and methods that guide practitioners and shape how problems are defined and researched, and what solutions are developed. We combine field and policy to emphasize both the cultural and political work of leadership that is required to influence policy decisions and transform systems. An increasing number of organizations and foundations are supporting programs and initiatives to develop field-policy leaders because they recognize that systems change requires bridging and working across boundaries of community, culture, and sector.

Field-policy leadership networks enable leaders to work across boundaries more effectively. They have the capacity to mobilize large numbers of people around a common cause, influence the cultural and political discourse, and bring diverse perspectives into the policymaking process. Well-developed field-policy networks can influence systems change by better aligning frames, interests, and people across sectors, cultures, and communities in ways that have the potential to produce policy changes, the re-allocation of resources, regulations governing practice, and professional standards, among others.

### 7.1. CAYL Schott Fellowship for Early Care and Education

The CAYL Schott Fellowship for Early Care and Education is building a cadre of public policy leaders from diverse communities who are committed to working for policy changes that improve the quality and availability of early education and care for all young children and families in communities across Massachusetts. The fellowship takes 12 leaders each year through a process of identifying policy problems, researching and proposing policy solutions, writing policy papers, and advocating for policy change. Through this process, participants develop relationships with leaders who work in different regions of the state, different racial and ethnic communities, different levels of governance (city and state), different fields (e.g. education, public health) and different sectors (e.g., academic, government, and nonprofits).

The CAYL Schott Fellowship Network is more than a peer support network because its purpose is to influence early childhood policy and practice in Massachusetts. The Network meets formally three times a year to focus collectively on how to work together more effectively to produce positive policy results that improve access to, and quality of, early care and education. While the network is still in its early phases of becoming a field-policy leadership network, there is growing awareness among leaders about the power of weaving their professional networks together, identifying influential actors outside the fellowship (e.g., state and local officials, advocates, service providers, funders, those in the media and business), and intentionally building relationships with them.

Successful field-policy leadership networks help members find common cause with unexpected allies. They rely on bridgers who reach out and connect across diverse communities, cultures, sectors, and disciplines. Building alliances often starts slowly. Leaders first need to learn each other's language and stories, find common ground, and establish trust. Field-policy networks often start as peer leadership networks. Once trust is established, leaders are better positioned to tap into and mobilize their networks around a common cause. Some of the questions that can be asked in an evaluation of the impact of leadership development efforts on field-policy leadership networks include:

- Is there evidence of greater sharing and collaboration across communities and sectors, at national, state, and local levels?
- Who are the bridgers in the network?
- Is the network expanding to include likely and unlikely alliances?
- Are diverse leaders aligning their priorities and working together towards common goals?
- Do people across the network share common frames (e.g., language and metaphors they use to describe problems, explanations for why they exist, and ways to address them)?
- Do members of the network coordinate their efforts to mobilize large numbers of citizens to engage in policy activism?
- Do members gain access to policy and field leaders through the network?
- Do networks contribute to positive policy changes? Do they contribute to creating more coherent fields of practice?

When using SNA to evaluate the influencing capabilities of a field-policy leadership network, it is especially helpful to expand the boundaries of the network analysis beyond the formal membership of the leadership network. One straightforward way to expand the network analysis is to conduct a two-phase survey. In the first phase, members of the leadership network report who the key external players are outside the membership. The second phase is a network survey; this survey asks network members to report not only their relationships with each other but also their relationships with key external players identified during the first phase. Even without any input from the key external players, this two-phase approach still provides a useful measure of how outside actors connect to the network membership.

The map in Fig. 9 shows members of the CAYL Schott Fellowship as circles (labeled with numbers) and key external players as unlabeled small squares. Links represent professional collaboration between people; links between Fellows have been removed to focus attention only on which Fellows have working relationships with which key external players.

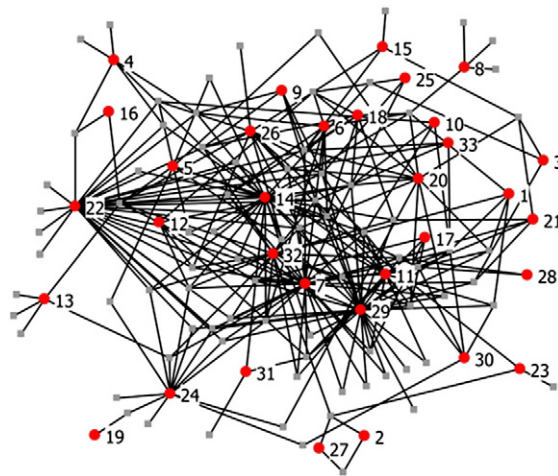


Fig. 9. Collaboration network of the CAYL Schott Fellows (labeled dots) and key external players (unlabeled dots).

An evaluation based on the above map would of course include the names of all the external actors. The evaluative information provided by such a map includes (1) the key bridging role of network member 22, at left, who is the only member connected to four key external players, and (2) the extent to which some external actors (i.e., the small squares in the center of the map) are already woven informally into the Fellowship network, while other external players are accessible to only one Fellow. This kind of network information can help Fellows to access key external players who have connections to other members in the network.

Another way to link Fellows to external key players is presented in Fig. 10. Each external key player in Fig. 9 was categorized by the CAYL Schott Fellowship program staff into one of eight sectors. A new map was created (Fig. 10), with each link indicating that a network member has worked with at least one external key player in that sector.

The layout of the map uses structural equivalence to help the CAYL Schott Fellowship Program to evaluate which people in its leadership network have similar network assets and similar network weaknesses. For instance, the leftmost grouping in the map has strong connections to early education and care services, advocacy organizations, and statewide elected and appointed officials. They are likely key players in mobilizing early care and education resources to influence the policy agenda and how policies get implemented through state agencies. This group does not, however, have contacts with city government and public schools and so may be unaware of policy ramifications at the local level. The grouping in the middle of the map would be useful allies in understanding local impact and mobilizing local resources. They would also have the greatest insight into how local and state governments are coordinating efforts to maximize their impact and where there are conflicts and challenges that need to be addressed.

In reviewing this map, Fellowship staff observed that no media people had been named. Little attention had been given to developing relationships with the media to help spread the network’s policy messages. Identifying key media people and adding their names to future network surveys may be used as a catalyst for network members to focus on developing those relationships.

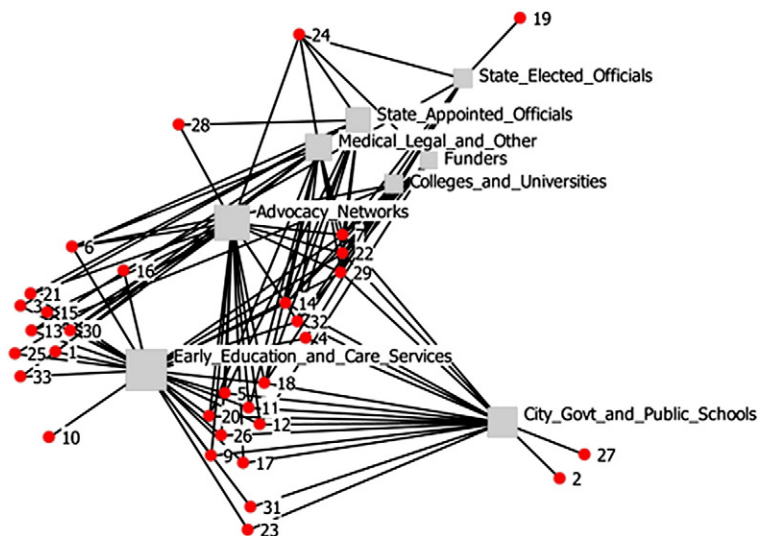


Fig. 10. Collaboration network of CAYL Schott Fellows, summarizing connections of each fellow to eight different sectors.

## 8. Evaluating collective leadership networks

Collective leadership is “the capacity of a group of leaders to deliver a contribution in service of the common good through assuming joint and flexible leadership, according to what is perceived and required” (Kunkel, 2005). Collective leadership “embraces diversity of people and perspectives, unleashes self-organizing and the collective intelligence that exists when people come together to act” (Gauthier, 2006). At the heart of collective leadership are groups of diverse people who are connected and taking actions that positively affect themselves and their communities.

Collective leadership networks rely on self-organizing of members who share a common goal. The value of collective leadership networks is in their capacity to solve problems quickly in an environment of uncertainty and complexity (Watts, 2004). Collective leadership networks also provide each member with a sense of purpose that comes from the feeling of belonging to something bigger than oneself.

### 8.1. Lawrence Community Works

Lawrence Community Works (LCW) is using the power of networks to restore Lawrence, Massachusetts, an industrial city that is one of the poorest urban centers in America. Bill Traynor, a veteran community development practitioner, returned to his hometown of Lawrence to become a catalyst for transforming his community. Instead of setting up a traditional community development corporation to tackle local problems, Traynor thought in network terms. The challenge, according to Traynor, was to build a constituency that was not based on organizations and roles but instead was focused on getting things done (Plastrik & Taylor, 2004).

LCW created an “open architecture”—“a flexible structure that provides numerous opportunities for community residents to engage in civic life and connect with each other” (Plastrik & Taylor, 2004). At the heart of these connections is the opportunity residents have to share their stories and what they value about the community. Through these connections, they find common ground, and discover ways to work together to transform their community. Over 1000 people have committed themselves to Lawrence’s revitalization by volunteering in everything from community outreach to youth development. The assumptions of LCW’s theory of change are the following: Civic health depends on civic engagement. If people do not know and understand each others’ stories they will not trust each other enough to work together for the common good. When they do trust each other they can quickly solve local problems.

### 8.2. Cancer Information Service Partnership Program

The Cancer Information Service (CIS) Partnership Program is run by the National Cancer Institute (NCI) to reduce the burden of cancer in minority and underserved populations, by reaching the public with information that helps people take action. CIS applies a collective leadership network approach to its mission by reaching out to partners that are dedicated to serving minority and underserved populations and have an established and trusted presence within their communities. CIS provides national resources to help regional cancer prevention efforts by offering expertise in areas such as program planning and coalition building on cancer-related topics.

Since the inception of the CIS Partnership Program in 1984, the number of organizations involved in cancer control has increased substantially. In response, the CIS has tailored their outreach strategies to meet the needs of minority and underserved populations. In 2008, the National Cancer Institute used SNA to gain a better understanding of the capacity of the CIS Partnership Program network and the partner organizations within that network. SNA illuminated the key role that state programs now play in the cancer prevention network. With this new information in hand, the National Cancer Institute is re-examining how federal programs such as the CIS Partnership Program can further the efforts of those state programs. This type of re-examination is common: as a collective leadership network matures, the original sponsors and facilitators of that network must adapt—often by focusing more on general goals and less on specific programs (Krebs & Holley, 2002).

A successful collective leadership network relies on balancing two key characteristics. Control of the network must be in the hands of its users; this is a prerequisite for healthy self-organizing. Sometimes, however, core members of the network must be able to exercise veto power and keep control out of the hands of rank and file users; this is a prerequisite for long-term preservation of the group’s mission. Shirky (2003) describes why and how online communities must manage participation for the sake of long-term effectiveness, including requirements such as establishing and protecting the notion of “member in good standing.”

When collective leadership networks successfully empower users and preserve their core values, they can grow very large as networks of clusters. Clusters form around specific issues, local problems, or promising practices to tap the power of the collective wisdom and energy that exists within groups. The power of collective leadership networks grows when clusters are connected. An important role in connecting network clusters is the network weaver. Network weavers bridge between many clusters, as illustrated in Fig. 1. They form relationships with each of the clusters, discover what they know and what they need, and then connect individuals and clusters that can assist one another (Krebs & Holley, 2002). Network weavers are highly connected to other people, have knowledge of the wider network, and are motivated to help others use the network to get their needs met (Plastrik & Taylor, 2006). To assess the impact of leadership development efforts on a collective leadership network, it is important to look at both the health of the network itself and the effects that the network is having on community health and well-being.

In 2005, Lawrence Community Works undertook an evaluation of its network approach to community development. Network members, network weavers, and funders were interested in what difference the network was making. Members of the LCW met to

discuss how they would know if their network was healthy and what conditions were needed for the network to achieve its long-term goals (Plastrik & Taylor, 2006). Below is a list of the types of questions they asked:

- Is network membership growing?
- Is the proportion of members who are active in the network growing?
- Is network membership increasingly diverse?
- Are members engaging in multiple kinds of activities provided by the network?
- Are members coming together in different combinations in the network?
- Are members both bonding and bridging in the network?

Beyond assessing the health of the network, it is also important to look at network outcomes. LCW has documented a number of network outcomes in the Lawrence community. These include increasing civic participation, building community infrastructure (e.g., housing, parks), leveraging additional resources, improving governance and decision-making, and engaging broader participation in policymaking and budgeting.

Evaluating collective leadership networks with SNA is challenging. Membership in the network can be very large and fluid. Clusters form for a purpose but may dissolve with members joining other clusters or becoming inactive. Collecting network data in this context is hard, and making sense of the data (e.g., mapping) is even harder. Network size and dynamics conspire against the usual approach of taking network snapshots.

For many collective leadership networks, including Lawrence Community Works, SNA concepts such as bridging and bonding are introduced, but SNA tools are not used to make maps or measurements. Introducing bridging and bonding to organizational leadership networks has been rigorously demonstrated to improve leadership performance (Burt & Ronchi, 2007). We have informally observed similar benefits in other leadership network settings.

When planning a long-term investment strategy, the sponsor of a collective leadership network can use SNA as an effective evaluation tool. NCI is using SNA in this way: the evaluation of its \$9-million-per-year investment in the CIS Partnership Program is informed by 24 years of history and an equally long-term vision of continued support.

The day-to-day support of a healthy collective leadership network does not demand such deep consideration; it merely requires ensuring that members can find one another and form the groups they need to get things done. This is the task of a weaver. In our work with collective leadership networks, we have assisted the weaving process using SNA-based methods, often without explicitly stating that SNA is being used. Our approach is influenced by Web sites such as eBay, which acts as a virtual network weaver, making expert introductions between buyers and sellers of various products. In our simplified adaptation of this approach, we help people in collective leadership networks find those with whom they share a common passion or desire to learn, and we help identify where there are resources and expertise in a network.

One simple way to implement this approach is to ask network members what problems they care about, and what problems they are willing to help others work on. The results of such a survey can be mapped using the same structural equivalence techniques illustrated in Figs. 5 and 10; however, in many cases it is far simpler and more effective to publish a list. For example, the list can report the overall interest in each topic as well as names of people who are available to help for each topic. Such a list equips network members to find the people they need to form groups around shared issues.

A challenge in administering this kind of survey is knowing what questions to ask. Ideally, a survey would include a relatively short and specific list of all the issues that network members most care about; then the survey would invite members to indicate next to each issue their relative interest and energy. Such a survey is only successful if these questions tap the diverse passions of the members and respect the values of the core. In order to discover what these questions are, we usually conduct some sort of open-ended inquiry before defining the specific language of the actual survey.

## 9. Issues and risks of SNA

In the preceding sections of the paper we have demonstrated how SNA can be used to evaluate the impact of leadership development using four types of leadership networks. The use of SNA is not, however, without risks. Careful consideration needs to be given to these issues by anyone who uses SNA as an evaluation tool. We highlight four of them here: lack of privacy and related ethical issues; making evaluations from incomplete data; oversimplification and misreading; and misuse of network measures. Our categorization of issues and risks is similar to that of Bender-deMoll (2008). Below we briefly elaborate on each category. For each one, we emphasize its implications for leadership networks and compare our perspective to Bender-deMoll's.

### 9.1. Lack of privacy and related ethical issues

Borgatti and Molina (2005) discuss ethical guidelines for using SNA to evaluate leadership networks. In Table 2 we highlight three distinct ways that network surveys lack privacy compared to traditional surveys:

We focus our discussion primarily on the third issue, visibility; then remark on the other two issues. Fig. 11 shows two maps: the advice and trust networks of a single organization studied by Krackhardt and Hanson (1993). Consider the advice network (a). Someone like Swinney (far left) might prefer that others not notice that his advice is sought by no one in the network, while Calder (center), who is perhaps overwhelmed by the number of people seeking his advice, might wish to be invisible so that others would not seek him out.

**Table 2**  
Lack of privacy in network surveys.

	Traditional survey	Network survey
Questions: 1st-person vs. 3rd-person	Each individual reports information about himself.	Each individual reports information about others by name.
Results: averages vs. specifics	Responses are aggregated so that individual respondents and non-respondents cannot be distinguished.	The presentation of results reveals specific responses attributed to specific individuals.
Visibility: informed consent vs. leap of faith	Survey results allow each individual to compare himself silently with the group average. Each individual can then decide what to share about himself with whom.	Survey results expose how each individual is seen by others. Each individual has no ability to preview what others have said about him before it is published.

Two factors exacerbate the risk of exposing people like Swinney and Calder. First, they have no way of previewing what others have reported about them before those reports are published (a matter we will revisit in the “Future Research” section). Second, they may assume, incorrectly, that not responding will keep them out of the survey results. For example, suppose Calder chooses not to participate in the next survey; then those results will not show that Calder seeks advice from Leers and Harris, but they will still show who reports that they go to Calder for advice (and there will probably still be many such people). Calder’s ability to remove himself from the network map depends on the survey administrator, who must be clear that “opting out” and “not participating” are two entirely different things.

The above risks faced by participants in a network survey can be mitigated with the following steps. The first step is to educate people about the value of network data, as it benefits both each individual and the network as a whole. The second step is to explain clearly who will see the network data and what will be done with the data. The third step is to design the survey to be consistent with its intended use. For example, asking “whom do you trust” as mapped in Fig. 11(b) would probably be counterproductive if the survey results were to be shared openly with network members, but would be extremely valuable if the survey results were shown only to a trusted advisor who is not herself in the map.

The overall goal of the above three steps is to provide network members the ability to exercise informed consent. Clarity and transparency increase participation in the survey and acceptance of the results. Fig. 12 shows how we typically use the introduction and first question of a network survey to implement these steps and respect privacy with clarity and transparency.

There are also steps that can be taken to mitigate the other two privacy risks of network maps listed in Table 2. The specificity of network survey results can be masked so that individuals’ names cannot be inferred from the presented maps. This approach is quite practical when results are presented as an anonymized case study (i.e., the audience does not know what specific network is being displayed); however, this kind of network anonymity is extremely difficult to ensure when the results are shared with the network members themselves.

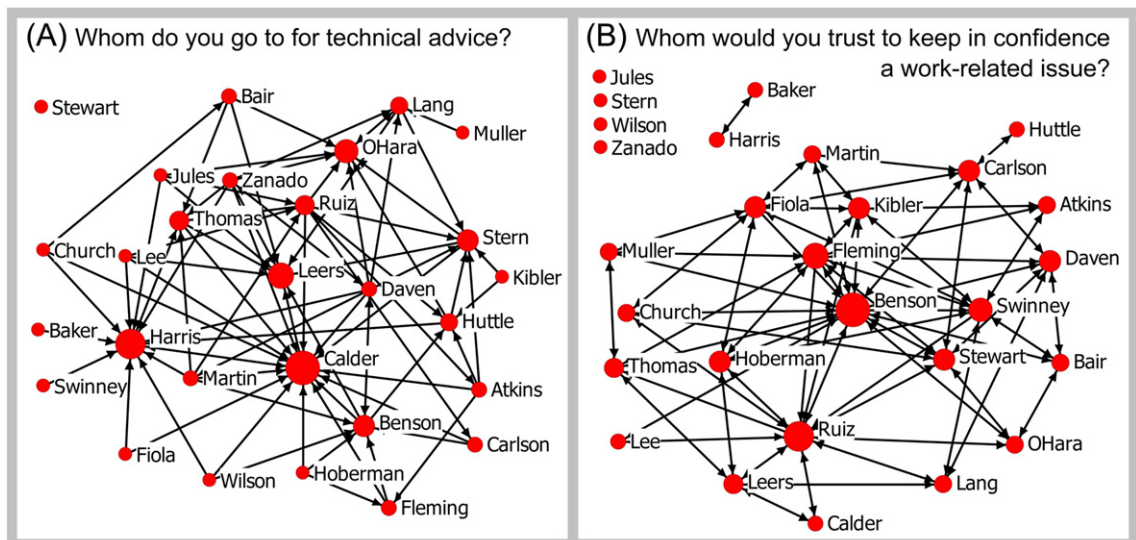


Fig. 11. Two views of one organization (Krackhardt & Hanson, 1993).

Welcome to the Peer Leadership Network Survey.

One of the goals of our Peer Leadership Program is to strengthen the connections among those who are working to help children of low-income families in our state. Your participation in this survey will enable us to gain a deeper understanding of the current leadership network. The survey will take about 15 minutes to complete.

In order for this survey to be effective, we need participation from as many people as possible. The primary result of this survey will be a network map of who communicates with whom. The results of the survey will be shared with current network participants at our next meeting, when we will interpret and discuss them collectively. Results will also be shared with Foundation staff.

In order to participate in this kind of network survey, you must identify yourself. Even if you do not respond to this survey, you may still appear in the resulting network map based on others' reported connections to you. If you do not wish to appear in the network map, please indicate so below.

Do you grant permission to have your name appear in the network map?

Yes

No

Fig. 12. Sample network survey introduction.

Finally, we consider that each respondent to a network survey is asked to report information about others by name, rather than reporting information purely about him or herself. When trust among network members is in doubt, any question designed in this way can be difficult to ask. In such a situation, we recommend survey questions that elicit purely first-person information. The resulting data can then be used to create a network map of the group based on structural equivalence (as in Figs. 5 and 10).

### 9.2. Making evaluations from incomplete data

Network survey results are more sensitive to data omissions than other kinds of surveys. In order to produce a network map that provides network members with accurate pictures of bridging and bonding, a survey response rate of at least 75% is typically required (Borgatti, Carley, & Krackhardt, 2006). Smaller population samples can be surveyed in some situations, but evaluators usually cannot assess a large network by surveying small randomized samples in the same way they can with non-network surveys.

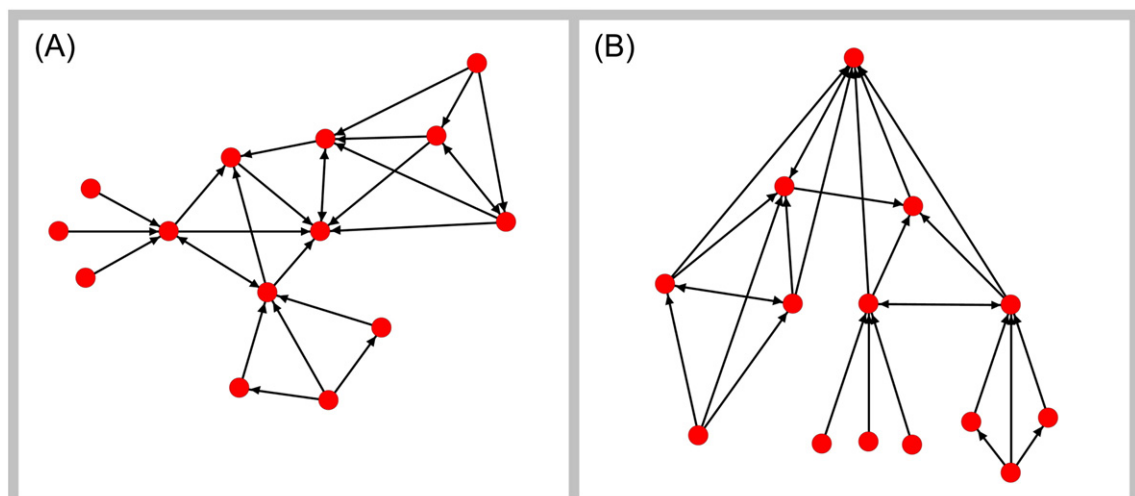


Fig. 13. Which organization is more adept at change? (McGrath & Blythe, 2004).



### 9.3. Oversimplification and misreading

We caution people who use network maps to look for multiple interpretations of the data. The work of [McGrath and Blythe \(2004\)](#) illustrates why. They showed subjects the two organizational advice networks in [Fig. 13](#) and asked, “All other things being equal, which organization is more adept at change?”

Responses were mixed: some thought the less hierarchical left group (A) would be better at change, because of the wealth of informal connections. Others thought the more hierarchical right group (B) would be better at change, because of the influence of the central authority figure. Very few came up with the correct answer: that networks (A) and (B) are identical. [Bender-deMoll \(2008\)](#) indicates that “Viewers are not used to thinking critically about network images. Like any statistical graphic, they can be manipulated to convey a viewpoint that would not hold up well to rigorous analysis.”

One helpful rule of thumb is to rely on network maps more for raising questions than for answering them. For example, it is easy to jump to negative conclusions about peripheral members of a network, such as Swinney in [Fig. 11\(a\)](#). It is important to withhold premature judgment and instead ask: Why is Swinney at the periphery of the map? Possible answers include: Swinney is new; he is disengaged, or he is a vital source of expertise and innovation who bridges to a group not drawn on the map. Network data has the potential to be misused if it is not presented and discussed by skilled analysts.

### 9.4. Misuse of network measures

Some network metrics are prone to misuse. One of the most common mistakes we observe is the misuse of density, which is a seemingly intuitive metric that is in fact very easily misinterpreted. Density is especially prone to misinterpretation when comparing networks of different sizes. For example, the three networks of [Fig. 14](#) all have exactly the same density, even though the maps indicate how connectivity differs significantly between them. We recommend links per node as a measure of network connectivity that behaves much more intuitively than density.

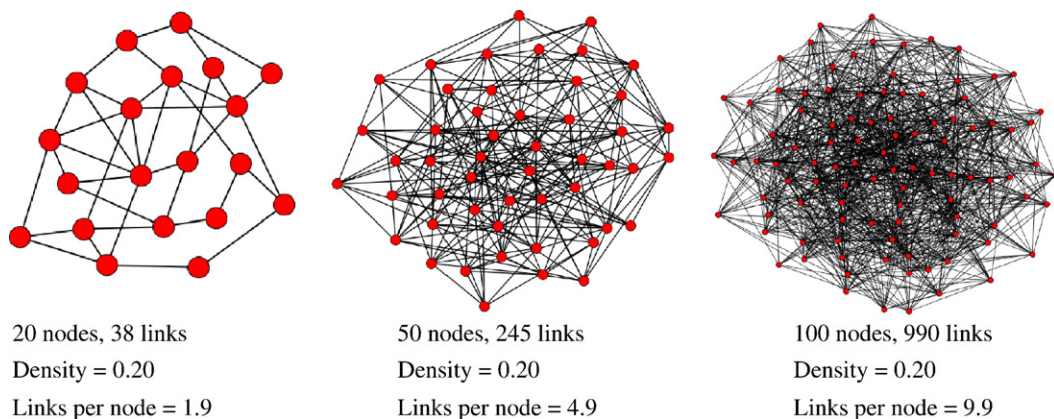
[Anderson, Butts, and Carley \(1999\)](#) explain that many network metrics, in addition to density, interact “powerfully and subtly” with network size. Leadership networks are often changing in size or being compared to other networks of different sizes. Therefore, it is critically important that practitioners account for the interaction of network size with other network measures.

[Bender-deMoll \(2008\)](#) emphasizes another misuse of network measures: applying a measure designed for one kind of network to a set of data involving a different kind of network. For example, centrality means something different in an affiliation network than it does in a communication network.

## 10. Future research

SNA has become a popular methodology for a wide variety of applications, and so one major challenge facing researchers is to make sense of the proliferation of network-related results. [Bender-deMoll \(2008\)](#) synthesizes a wide spectrum of SNA research as it pertains to human rights programs. [Kilduff and Tsai \(2003\)](#) provide an even more extensive synthesis of SNA research; they go deeper into the science of SNA and outline fruitful avenues for future research pertaining to organizational networks. We recommend both of the above sources to anyone interested in the opportunities for future research that we list below.

“The jury is still out as to whether social capital measured at the individual level does indeed have effects at the community level” according to [Kilduff and Tsai \(2003\)](#). Despite the increasing number of leadership network case studies, there is little comparative research looking at network effects, or systematically linking those effects to desired outcomes ([Provan & Milward, 2001](#)). Studies have conclusively linked network effects to individual-level outcomes (e.g., pay-raises and job-promotions), but the contribution of network effects to organization- and community-level outcomes remains unclear. As with other approaches to leadership development evaluation, it is important to recognize that attributing changes in communities to network effects is



**Fig. 14.** When comparing connectivity of different networks, Links per Node is more intuitive than Density.

often difficult. Nevertheless, we think comparative leadership network case studies will significantly strengthen our capacity to understand how networks evolve and function in different contexts, and how they contribute to achieving desired leadership development outcomes.

Established standards for evaluating networks do not currently exist. In order for SNA to become a tool that can be applied with validity across different contexts, we need more comparative research on how network metrics are being applied in different contexts and with what results. Such research will enable us to refine our metrics and increase the likelihood that data is being appropriately analyzed and interpreted (Bender-deMoll, 2008). This research will require integrating different network data sets, which is complicated by the proprietary nature of these data sets. Sharing network data sets can jeopardize both the privacy of individuals described by the data and the professional interests of those who collected the data. Sharing health information involves similar benefits and risks; we hope that efforts to promote health information liquidity (e.g., Lorence, Monatesti, Margenthaler, & Hoadley, 2005) will spur similar innovations in sharing network data.

Collecting network data remains problematic. Using standard survey tools to collect network data is not practical for large networks (e.g., over 200 members). Surveys are also problematic for longitudinal network evaluations, in part because they provide no easy way to manage changes to names. For example, if network member Jill Smith changes her name to Jill Jackson, then any longitudinal network evaluation must recognize that these two names refer to the same person. Whichever way she is named in a survey is open to misinterpretation by her extended network of professional contacts, who do not keep track of her personal status.

The two limitations above are being addressed to some extent by network-specific survey tools that are more streamlined than traditional survey tools and by data-mining techniques that avoid surveys altogether (Tyler et al., 2003). In addition, social software sites such as Facebook and LinkedIn are extremely effective at managing large sets of longitudinal network data; however, these sites tightly control their data, prevent downloading altogether, and so frustrate the would-be evaluator. Evaluators of leadership networks need the best qualities of surveys, data-mining, and social software, all combined in one affordable system.

Finally, we note that popular social software sites demonstrate a useful approach to one of the thorniest privacy issues of SNA: Facebook and LinkedIn users can preview information that others report about them before that information is published. (The “Issues and Risks” section of this paper describes how network surveys handle this issue.) This is another reason why we are hopeful that lessons learned in the social software space will help improve SNA data collection.

We lack constructive guidelines for creating network maps and have only begun to understand how people perceive them. We know of very few papers that have considered how people perceive network maps. Much can be done to expand on research such as that of McGrath and Blythe (2004), which we illustrated in Fig. 13. In order to advance our understanding of how people perceive network maps, researchers will first have to overcome three common shortcomings of software used to create network maps: lack of creative control over layouts, difficulty drawing large networks, and a tendency to create maps that are confusing or ambiguous (e.g., by drawing nodes on top of each other and thereby hiding all but the top-most node at that location). The fields of information visualization and human-computer interaction have much to offer this overall area of research. For example, Perer (2008), who addresses SNA from the perspective of these two fields, considers how people perceive network maps, provides tools to draw large networks, and proposes a well-defined process to replace the ad hoc techniques currently used to create network maps. We hope that Perer’s work invites more researchers from these fields to apply their skills to the open problems facing SNA.

Structural equivalence has received insufficient attention from the leadership network community, compared to network topics such as centrality and clustering. Netflix has famously offered a million-dollar prize to anyone who can improve its recommendation algorithm, which is just one indication of the large volume of work on structural equivalence that the leadership network community can draw upon. We hope that the examples in this paper of applying structural equivalence to leadership networks will motivate readers to explore the topic of structural equivalence and to build on our work. Mathematical literature on structural equivalence is extensive: Wasserman and Faust (1994) provide an excellent introduction to the topic, and an up-to-date reading list can be found in the bibliography of Luczkovich, Borgatti, Johnson, and Everett (2003). These sources are more mathematically advanced than typical social network literature. For those who prefer less technical reading, we suggest Hanneman and Riddle (2005) text and its section on visualizing “two-mode networks” as a helpful next step, in combination with the general introduction to two-mode networks by Borgatti and Everett (1997).

Many issues facing the field of SNA have implications for leadership development networks. These issues include the following:

- SNA represents a “structuralist” approach to organizations, fields, and communities, which complements an “individualist” approach. These two approaches have created two rival camps: “There is a pressing need for non-dogmatic research that explores issues concerning how individual differences in cognition and personality relate to the origins and formations of social networks” (Kilduff & Tsai, 2003).
- The most commonly used centrality metrics, strictly speaking, do not actually model sociological processes of interest; furthermore, many sociological processes that are interesting are not correctly modeled by any available centrality metrics (Borgatti, 2005).
- Further study is needed to understand the benefits and risks of measuring different kinds of network relationships. For example, Rizova (2006) has argued that measuring “seeks advice from” provides significant benefits in some contexts where measuring “works with” or “friends with” provides no benefit. Labianca and Brass (2006) have pointed out that negative relationships (e.g., “do not like”) are under-studied, even though they are often more informative than positive relationships. Cross, Baker, and Parker (2003) have shown that positive and negative energy relationships (e.g., “energized by,” “de-energized by”) are particularly informative.

The dynamics of collective leadership networks deserve further study. Interesting avenues of inquiry include the following:

- What kinds of issues/causes most effectively lead to the formation of collective leadership networks? The general question of what makes something contagious or popular extends beyond the scope of our research, but Salganik, Dodds, and Watts (2006) suggest that network dynamics make popularity harder to predict than previously thought.
- What kinds of property rights most effectively facilitate the emergence of collective leadership networks? The open source software community has debated this question at length: When someone receives open source property, what rights and responsibilities does that person have? Feller, Fitzgerald, Hissam, and Lakhani (2005) study this and other aspects of the open source community.
- What behavioral norms help build and sustain collective leadership networks? How do people communicate with each other? Evans and Wolf (2005) provide a good starting point for this inquiry. They discuss best practices of the open source software community and the Toyota Production System.
- What kinds of incentives help build and sustain collective leadership networks. How can a sponsor promote “good” behavior? Cheshire (2007) investigates the effects of incentives on information exchange, in the context of wiki contributions.

## 11. Conclusion

This paper offers two main contributions: (1) a framework of leadership networks, and (2) a discussion of how to use social network analysis to evaluate the impact of leadership development on leadership networks. The paper also describes numerous research opportunities related to leadership networks and SNA, including important issues and risks.

The fundamental goal of our research has been to provide a useful synthesis of SNA for the field of leadership development. In conducting our research, we have lived the experience of bridging and bonding. As a pair of authors, we are an unlikely alliance. Our common cause is a desire to learn from our clients: those who fund, run, and catalyze leadership networks. Our framework for leadership networks has helped us to understand their work and has helped us to determine when and how to use SNA as an evaluation and capacity-building tool.

To those who are dedicated to developing and supporting the emergence of leadership, it is essential to understand how to create, develop, and transform leadership networks. We hope this paper will inspire more evaluation research on leadership networks and on how to harness and use the power of SNA for the collective good.

## References

- Ahsan, N. (2007). Social networks make a difference: Family economic success Retrieved December 12, 2008 from the Annie E. Casey website: <http://www.aecf.org/KnowledgeCenter/Publications.aspx?pubguid=%7BAEFF5FBA-2B92-429E-9752-8F08D8624F59%7D>
- Anderson, B., Butts, C., & Carley, K. (1999). The interaction of size and density with graph-level indices. *Social Networks*, 21(3), 239–267.
- Backer, T. (2008). Peer networking and community change: Experiences of the Annie E. Casey Foundation Retrieved January 12, 2009 from the Annie E. Casey website: <http://www.aecf.org/KnowledgeCenter/Publications.aspx?pubguid={0CD3059D-4D57-4FBF-A57F-62A87DFE855B}>
- Behrens, T., & Benham, M. (2007). Evaluating community leadership programs. In K. Hannum, J. Martineau, & C. Reinelt (Eds.), *Handbook of leadership development evaluation*. San Francisco: Jossey-Bass.
- Bender-deMoll, S. (2008). Potential human rights uses of network analysis and mapping: A report to the Science and Human Rights Program of the American Association for the Advancement of Science Retrieved on July 25, 2008 from the AAAS Science & Human Rights Web site: [http://www.shr.aaas.org/networkmapping/Net\\_Mapping\\_Report.pdf](http://www.shr.aaas.org/networkmapping/Net_Mapping_Report.pdf)
- Bonacich, P., & Lloyd, P. (2001). Eigenvector-like measures of centrality for asymmetric relations. *Social Networks*, 23(3), 191–201.
- Borgatti, S. P. (2002). *NetDraw: Graph visualization software*. Harvard: Analytic Technologies.
- Borgatti, S. P. (2005). Centrality and network flow. *Social Networks*, 27(1), 55–71.
- Borgatti, S. P., Carley, K., & Krackhardt, D. (2006). Robustness of centrality measures under conditions of imperfect data. *Social Networks*, 28, 124–136.
- Borgatti, S. P., & Cross, R. (2003). A relational view of information seeking and learning in social networks. *Management Science*, 49(4), 432–445.
- Borgatti, S. P., & Everett, M. G. (1997). Network analysis of 2-mode data. *Social Networks*, 19(3), 243–269.
- Borgatti, S. P., & Everett, M. G. (1999). Models of core/periphery structures. *Social Networks*, 21(1), 375–395.
- Borgatti, S. P., & Foster, P. (2003). The network paradigm in organizational research: A review and typology. *Journal of Management*, 29(6), 991–1013.
- Borgatti, S. P., & Molina, J. L. (2005). Toward ethical guidelines for network research in organizations. *Social Networks*, 27(2), 107–117.
- Brandes, U., & Erlebach, T. (2005). *Network analysis: Methodological foundations*. New York: Springer.
- Brandes, U., & Wagner, D. (2004). *Visone: Analysis and visualization of social networks*. In Michael Jünger, & Petra Mutzel (Eds.), *Graph Drawing Software* (pp. 321–340). New York: Springer-Verlag.
- Brass, D., & Krackhardt, D. (1999). The social capital of twenty-first century leaders. In J. G. Hunt, & R. L. Phillips (Eds.), *Out-of-the-box leadership challenges for the 21st century army* (pp. 179–194). Amsterdam: Elsevier B.V.
- Brown, J. (2005). *The world café: Shaping our futures through conversations that matter*. San Francisco: Berrett-Koehler Publishers.
- Burt, R. (2004). Structural holes and good ideas. *American Journal of Sociology*, 110(2), 349–399.
- Burt, R. (2005). *Brokerage and closure*. London: Oxford University press.
- Burt, R., & Ronchi, D. (2007). Teaching executives to see social capital: Results from a field experiment. *Social Science Research*, 36(3), 1156–1183.
- Cheshire, C. (2007). Selective incentives and generalized information exchange. *Social Psychology Quarterly*, 70(1), 82–100.
- Church, M., Bitel, M., Armstrong, K., Fernando, P., Gould, H., Joss, S., Marwaha-Diedrich, M., de la Torre, A. L., & Vouhe, C. (2002). Participation, relationships, and dynamic change: New thinking on evaluating the work of international networks Working Paper No. 121. Retrieved on May 25, 2008 from University College of London website: <http://www.ucl.ac.uk/DPU/publications/working%20papers%20pdf/WP121%20final.pdf>
- Cross, R., Baker, W., & Parker, A. (2003). What creates energy in organizations? *Sloan Management Review*, 44(4), 51–56.
- Cross, R., & Thomas, R. (2009). *Driving results through social networks: How top organizations leverage networks for performance and growth*. New York: Jossey-Bass.
- Davies, R., & Dart, J. (2005). The “most significant change” (MSC) technique: A guide to its use Retrieved on November 5, 2007 from Monitoring and Evaluation News website: <http://www.mande.co.uk/docs/MSCGuide.pdf>
- Diani, M. (2003). ‘Leaders’ or brokers? Positions and influence in social movement networks. In M. Diani, & D. McAdam (Eds.), *Social movements and networks: relational approaches to collective action*. Oxford: Oxford University Press.
- Durland, M., & Fredericks, K. (2005) Eds. *Social network analysis in program evaluation, new directions for evaluation*, Number 107.

- Evans, P., & Wolf, B. (2005). Collaboration rules. *Harvard Business Review*, 83(7), 96–104.
- Feller, J., Fitzgerald, B., Hissam, S., & Lakhani, K. R. (Eds.). (2005). *Perspectives on free and open source software*. Cambridge: MIT Press.
- Freeman, L. (1979). Centrality in networks: I. Conceptual clarification. *Social Networks*, 1, 215–239.
- Friedman, M. (2005). *Trying hard is not good enough: How to produce measurable improvements for customers and communities*. Victoria, B.C.: Trafford Publishing.
- Gajda, R., & Koliba, C. (2007). Evaluating the imperative of intra-organizational collaboration: A school improvement perspective. *American Journal of Evaluation*, 28(1), 26–44.
- Gauthier, A. (2006). Developing collective leadership: Partnering in multi-stakeholder contexts. In W. Link, T. Carral, & M. Gerzon (Eds.), *Leadership is Global*.
- Gower, J. C. (1971). A general coefficient of similarity and some of its properties. *Biometrics*, 4(27), 857–871.
- Granovetter, M. S. (1983). The strength of the weak tie: Revisited. *Sociological Theory*, 1, 201–233.
- Grove, J., Kibel, B., & Haas, T. (2007). EvaluLEAD: An open-systems perspective on evaluating leadership development. In K. Hannum, J. Martineau, & C. Reinelt (Eds.), *Handbook of leadership development evaluation*. San Francisco: Jossey-Bass.
- Gutierrez, M., Tasse, T., Gutierrez-Mayka, M., & Hagen, G. (2006). Assessment of the Annie E Casey Foundation's Children and Family Fellowship Program. Unpublished Evaluation.
- Hanneman, R. A., & Riddle, M. (2005). Introduction to social network methods Retrieved March 20, 2008, from the University of California, Riverside Web site: <http://www.faculty.ucr.edu/~hanneman/>
- Kilduff, M., & Tsai, W. (2003). *Social networks and organizations*. London: Sage.
- Krackhardt, D., & Hanson, J. (1993). Informal networks: The company behind the chart. *Harvard Business Review*, 71(4), 104–111.
- Krebs, V., & Holley, J. (2002). Building smart communities through network weaving Retrieved April 30, 2007 from Orgnet.com: <http://www.orgnet.com/BuildingNetworks.pdf>
- Kunkel, P. (2005). Collective leadership—A pathway to collective intelligence. Collective Leadership Institute Retrieved on October 5, 2006 at <http://www.collectiveleadership.com>
- Labianca, G., & Brass, D. J. (2006). Exploring the social ledger: Negative relationships and negative asymmetry in social networks in organizations. *Academy of Management Review*, 31, 569–582.
- LeMay, N., & Ellis, A. (2007). Evaluating leadership development and organizational performance. In K. Hannum, J. Martineau, & C. Reinelt (Eds.), *Handbook of leadership development evaluation*. San Francisco: Jossey-Bass.
- Lorence, D., Monatesti, S., Margenthaler, R., & Hoadley, E. (2005). Toward a patient-centric medical information model: issues and challenges for US adoption. *International Journal of Electronic Healthcare*, 1(4), 349–364.
- Luczakovich, J. J., Borgatti, S. P., Johnson, J. C., & Everett, M. G. (2003). Defining and measuring trophic role similarity in food webs using regular equivalence. *Journal of Theoretical Biology*, 220(3), 303–321.
- McCauley, C., & Van Velsor, E. (Eds.). (2004). *The center for creative leadership handbook of leadership development*. San Francisco: John Wiley and Sons.
- McDowell, C., Nagel, A., Williams, S. M., & Canepa, C. (2005). Building knowledge from the practice of local communities. *Knowledge Management for Development Journal*, 1(3), 30–40.
- McGrath, C., & Blythe, J. (2004). Do you see what i want you to see? *The effects of motion and spatial layout on viewers' perceptions of graph structure*. Retrieved September 10, 2004 from the Journal of Social Structure Web site: <http://www.cmu.edu/joss/content/articles/volume5/McGrathBlythe/>
- Militello, M., & Benham, M. K. P. (2010). "Sorting Out" collective leadership: How Q-methodology can be used to evaluate leadership development. *Leadership Quarterly*, 21, 600–619 (this issue).
- Milward, H., & Provan, K. (2006). *A Manager's Guide to Choosing and Using Collaborative Networks*. IBM Center for the Business of Government.
- Nunez, M., & Wilson-Grau, R. (2003). *Toward a conceptual framework for evaluating international social change networks*. <http://www.people.bath.ac.uk/edsajw/madpdf/app3.htm>
- Ospina, S., Schall, E., Godsoe, B., & Dodge, J. (2002). Co-producing knowledge: Practitioners and scholars working together to understand leadership. *Building Leadership Bridges* (pp. 59–67).
- Owen, H. (1998). *Expanding our now: The story of open space technology*. San Francisco: Berrett-Koehler Publishers.
- Perer, A. (2008). Integrating statistics and visualization to improve exploratory social network analysis. PhD Dissertation University of Maryland Department of Computer Science. Retrieved September 15, 2008 from the Digital Repository at the University of Maryland: <http://www.hdl.handle.net/1903/8502>
- Plastrik, P., & Taylor, M. (2004). Lawrence community works: Using the power of networks to restore a city. Retrieved September 30, 2007, from The Barr Foundation Web site: [http://www.barrfoundation.org/resources/resources\\_show.htm?doc\\_id=239289](http://www.barrfoundation.org/resources/resources_show.htm?doc_id=239289)
- Plastrik, P., & Taylor, M. (2006). Net gains: A handbook for network builders seeking social change. Retrieved December 6, 2006, from The Innovation Network for Communities Web site: [http://www.in4c.net/index.asp?lt=net\\_gains\\_download](http://www.in4c.net/index.asp?lt=net_gains_download)
- Provan, K. G., & Milward, H. B. (2001). Do networks really work? A framework for evaluating public-sector organizational networks. *Public Administration Review*, 61, 414–423.
- Putnam, R. (2001). *Bowling alone: The collapse and revival of American community*. New York: Simon & Schuster.
- Reinelt, C., Kubo, M., & Hoppe, B. (2006). Sierra Health Leadership Program: Evaluation findings and outcomes (unpublished PowerPoint).
- Rizova, P. (2006). Are you networked for successful innovation? *MIT Sloan Management Review*, 47(3), 49–55.
- Salganik, M. J., Dodds, P. S., & Watts, D. J. (2006). Experimental study of inequality and unpredictability in an artificial cultural market. *Science*, 311(5672), 854–856.
- Shipilov, A., Labianca, G., Kalnysh, V., & Kalnysh, Y. (2007). "Career-related network building behaviors, range social capital and career outcomes." Best Papers Proceedings, 67th annual conference of the Academy of Management, Philadelphia, PA.
- Shirky, C. (2003). A group is its own worst enemy. Retrieved December 3, 2008 from the Clay Shirky's Writings Web site: [http://www.shirky.com/writings/group\\_enemy.html](http://www.shirky.com/writings/group_enemy.html)
- Tener, B., Nierenberg, A., & Hoppe, B. (2007). *Boston green & healthy building network: A case study*. Retrieved March 1, 2008, from the Barr Foundation Web site: [http://www.barrfoundation.org/usr\\_doc/Boston\\_GHBN\\_Case\\_Study\\_2008.pdf](http://www.barrfoundation.org/usr_doc/Boston_GHBN_Case_Study_2008.pdf)
- Tyler, J.R., Wilkinson, D.M., & Huberman, B.A. (2003). Email as Spectroscopy: Automated Discovery of Community Structure within Organizations. Communities and technologies: Proceedings of the First International Conference on Communities and Technologies. M. Huysman, E. Wenger, and V. Wulf, Eds. New York: Springer.
- Umble, K. S., Diehl, A., Gunn, & Haws, S. (2007). Developing leaders, building networks: An evaluation of the National Public Health Leadership Institute—1991–2006. Retrieved December 20, 2007 from Public Health Leadership Institute website: <http://www.phli.org/evalreports/index.htm>
- Wang, C. C. (2006). Youth participation in photovoice as a strategy for community change. *Journal of Community Practice*, 14(1/2), 147–161.
- Wasserman, S., & Faust, K. (1994). *Social network analysis: Methods and applications*. Cambridge, UK: Cambridge University Press.
- Wenger, E., McDermott, R., & Snyder, W. M. (2002). *Cultivating communities of practice*. Cambridge, MA: Harvard Business School Press.
- Watts, D. (2004). *Six degrees: The science of a connected age*. New York: W.W. Norton & Company.