

Interorganizational Networks at the Network Level: A Review of the Empirical Literature on Whole Networks[†]

Keith G. Provan*

Amy Fish

*Eller College of Management, University of Arizona, 405nn McClelland Hall,
1130 E. Helen Street, Tucson, AZ 85721-0108*

Joerg Sydow

Institute of Management, Free University of Berlin, Boltzmannstrasse 20, D-14195 Berlin, Germany

This article reviews and discusses the empirical literature on interorganizational networks at the network level of analysis, or what is sometimes referred to as “whole” networks. An overview of the distinction between egocentric and network-level research is first introduced. Then, a review of the modest literature on whole networks is undertaken, along with a summary table outlining the main findings based on a thorough literature search. Finally, the authors offer a discussion concerning what future directions might be taken by researchers hoping to expand this important, but understudied, topic.

Keywords: *interorganizational networks; whole networks; network level of analysis; networks*

The literature on networks is by now quite extensive. From social networks to organizational networks and beyond, networks have been and continue to be an emerging and developing field of study that has spanned many disciplines, including, but not limited to, organizational theory and behavior, strategic management, business studies, health care

[†]The authors would like to thank Joe Galaskiewicz for his insights and comments during the development of this article.

*Corresponding author. Tel: 520-621-1950; fax: 520-626-5549.

E-mail address: kProvan@eller.arizona.edu

Journal of Management, Vol. X No. X, Month XXXX xx-xx

DOI: 10.1177/0149206307302554

© Southern Management Association. All rights reserved.

services, public administration, sociology, communications, computer science, physics, and psychology. In recent years, there have been a number of review articles on social and organizational networks, most recently by Borgatti and Foster (2003) and by Brass, Galaskiewicz, Greve, and Tsai (2004). In general, there has been considerable progress in understanding what networks are, how they are structured, how they operate, and even how they develop.

Despite this progress, there is still a great deal we do not yet know. This article is not an attempt to address these gaps in the literature or to review, once again, what we now know about networks. Instead, our focus is on one particular aspect of network studies that we believe has generally been underresearched. Specifically, we focus on the study of interorganizational networks at the network level rather than at the organizational level of analysis. This is what Kilduff and Tsai (2003), among others, have referred to as focusing on the "whole network." Through our review, we have found this to be a topic that is frequently discussed but seldom empirically studied. Yet it is an important area of research.

Only by examining the whole network can we understand such issues as how networks evolve, how they are governed, and, ultimately, how collective outcomes might be generated. This last point is especially relevant to policy planners and those having a perspective that goes beyond the performance of individual organizations. For instance, an examination of whole networks can facilitate an understanding of how multilateral collaboration can improve the business climate in a region within a particular industry (Saxenian, 1994), how multifirm innovation can be enhanced (Browning, Beyer, & Shetler, 1995; Powell, White, Koput, & Owen-Smith, 2005), how clusters of small firms can more effectively compete (Human & Provan, 2000), and how publicly funded health and human services can be delivered more effectively to clients (Provan & Milward, 1995). Studying whole networks can also have important implications for individual network members, even for firms that, as for-profit organizations, are often assumed to not have an interest in the development of the full network. For instance, the stage of evolution of an interorganizational network may have implications for how the network might best be structured to accomplish the goals of individual members. By focusing only on the members themselves and their interactions with others, however, the importance of individual organizations tends to be exaggerated and the importance of collective behavior underemphasized.

We review the limited empirical literature on whole interorganizational networks (rather than social networks) and offer our suggestions for what we have learned from the modest number of studies that have been conducted and for what directions we might still explore.

Defining Networks

Although interorganizational networks are by now a commonly understood phenomenon of organizational life, it is not always clear exactly what organizational scholars are talking about when they use the term. Even the term *network* is not always used. Many who study business, community, and other organizational networks prefer to talk about partnerships, strategic alliances, interorganizational relationships, coalitions, cooperative arrangements, or collaborative agreements. Many, in particular those tying their work to resource dependence theory (Pfeffer & Salancik, 1978) and transaction cost economics (e.g., Williamson, 1991) or researching interorganizational contracts (e.g., Ariño & Reuer, 2006), also focus only on

dyads (relationships between two organizations). Despite differences, nearly all definitions refer to certain common themes, including social interaction (of individuals acting on behalf of their organizations), relationships, connectedness, collaboration, collective action, trust, and cooperation.

Brass et al. (2004) define a network in a very general way as “a set of nodes and the set of ties representing some relationship, or lack of relationship, between the nodes.” They point out that the content of the relationships between nodes is “limited only by a researcher’s imagination” (p. **PLS PROVIDE PAGE**). Brass et al. provide an overarching look at organizational network research at the interpersonal, interunit, and interorganizational levels of analysis. They take a very broad approach to studying the phenomenon of social networks, focusing in particular on the antecedents and the consequences of networks at each of these levels. Citing Podolny and Page (1998), they include in their definition of interorganizational networks a variety of forms of cooperation, including joint ventures, strategic alliances, collaborations, and consortia.

In contrast, Barringer and Harrison (2000), in their review of the interorganizational literature, provide a different take on interorganizational relationships and networks. In a manner similar to Oliver (1990) in her earlier review of the interorganizational relationship research, Barringer and Harrison provide an overview of the different types of interorganizational relationships and go into considerable detail as to how each is different. For example, they somewhat narrowly define networks as constellations of organizations that come together through the establishment of social contracts or agreements (e.g., the provision of health services through referral systems) rather than legally binding contracts. Legally binding contracts may exist within a network, but the organization of the relationship is primarily based on the social contracts maintained (Alter & Hage, 1993; Jones, Hesterly, & Borgatti, 1997). Barringer and Harrison define joint alliances as an arrangement between two or more firms that establish an exchange relationship but that lacks any joint ownership (Dickson & Weaver, 1997). Thus, alliances bring firms together in a collaborative framework like networks do. However, the term *alliance* is broad and typically refers to dyadic partnerships that are more simple and short term in nature than is seen in networks (Barringer & Harrison, 2000).

These are but two examples of varying definitions of networks and interorganizational relationships. In fact, Borgatti and Foster (2003) question whether we even need to consider networks as a unique organizational form because organizations are already embedded in their broader “network” of economic and social relationships (Granovetter, 1985; Podolny & Page, 1998). Although most would argue that networks are indeed a unique organizational form, even if they are conceived by many as a hybrid form of organization (Williamson, 1991), there has yet to be a common lexicon for studying the construct, leaving those who study networks with multiple definitions and a tangle of meanings. In 1995, Gerald Salancik called for the development of good network theories of organization. Although great strides have been made, a shared language with definite, concrete meanings in the study of networks has not been developed. In particular, it seems indispensable to distinguish between networks as a perspective (often using social network analysis as a methodology and simply capturing any relational embeddedness of organizational action) on one hand and networks as a form of governance on the other (e.g., Grabher & Powell, 2004). This would provide scholars with at least a very basic level of precision that would help to clearly elucidate exactly what is being discussed. Only in a small number of cases are networks studied as a form of governance, regardless of whether

the focus is on interorganizational networks in their broader institutional environment or taking a more managerial approach on “how to design, manage, and control networks in order to reduce uncertainties and improve competitive position” (Grabher & Powell, 2004, p. xiii).

In this article, we make no effort to try to offer an all-encompassing definition of an interorganizational network. Rather, we focus instead on one specific type of network that has been frequently discussed but only infrequently researched, namely, a whole network consisting of multiple organizations linked through multilateral ties. A whole network is viewed here as a group of three or more organizations connected in ways that facilitate achievement of a common goal. That is, the networks we discuss are often formally established and governed and goal directed rather than occurring serendipitously (Kilduff & Tsai, 2003). Relationships among network members are primarily nonhierarchical, and participants often have substantial operating autonomy. Network members can be linked by many types of connections and flows, such as information, materials, financial resources, services, and social support. Connections may be informal and totally trust based or more formalized, as through a contract. Examination and analysis of a whole interorganizational network includes organizations (nodes) and their relationships (ties), the absence of relationships, and the implications of both for achieving outcomes. However, unlike traditional network research, the focus here is on the structures and processes of the entire network rather than on the organizations that compose the network.

As will be discussed later, the boundaries of a whole network may be clear, as when formally specified through a network roster, or fuzzy, as when membership is self-defined. Issues of network bounding are, of course, important for understanding which organizations to include in a network study (Laumann, Marsden, & Prensky, 1983). For the most part, network bounding is a question best answered by individual researchers based on their knowledge of a network and its activities. Broadly speaking, whole networks are bounded by including only those organizations that interact with one another in an effort to achieve a common purpose.

Network Perspectives From Two Levels of Analysis

Most scholars who study the topic would agree that no single grand theory of networks exists (cf. Faulkner & de Rond, 2000; Galaskiewicz, 2007; Kilduff & Tsai, 2003; Monge & Contractor, 2003). However, theorizing about networks can generally be thought of as coming from two different but complementary perspectives: the view from the individual organization (actor level) and the view from the network level of analysis. Galaskiewicz and Wasserman (1994) also make this distinction, referring to a micro-level versus a macro-level network focus. Kilduff and Tsai (2003) refer to the important distinction between a focus on the egocentric network versus the whole network.

Building on these perspectives, the research on networks can be categorized along two dimensions: the independent variable being utilized for the study (organizations or networks) and the dependent variable or outcome focus adopted by the researcher (a focus on organizational outcomes or on the outcomes of collectivities of organizations). Using these dimensions, we have developed a typology, shown as a two-by-two table (see Table 1). This typology demonstrates the possibility of four different types of network research. First, researchers may, and often have, utilized characteristics and attributes of organizations to explain their relationship

Table 1
A Typology of Interorganizational Network Research

Independent Variable or Input Focus	Dependent Variable or Outcome Focus	
	Individual Organizations	Collectivities of Organizations
Organizational variables	Impact of organizations on other organizations through dyadic interactions	Impact of individual organizations on a network
Relational or network variables	Impact of a network on individual organizations	Whole networks or network-level interactions

with other organizations, focusing such issues as organizational trust to explain the nature and extent of an organization's involvement with others, especially through dyadic relationships such as alliances and partnerships (Gulati, 1995). Second, although more rare (cf. Uzzi, 1997, Proposition 5a), researchers may utilize organization-level phenomena to try to explain how individual organizations and their actions might affect outcomes at the network level, such as network structures, stability, and effectiveness. Where this approach is most likely to be found is in studies of interorganizational networks led by a hub firm (Jarillo, 1988; Sydow & Windeler, 1998), where hub firm actions are likely to affect the entire network. Third, researchers focusing at the level of the network have tried to understand the impact of network-level structures and behaviors on individual organizations (e.g., Ahuja, 2000; Bell, 2005; Powell, Koput, & Smith-Doerr, 1996; Walker, Kogut, & Shan, 1997; Westphal, Gulati, & Shortell, 1997). For instance, a common theme has been to examine the impact of network involvement on organizational learning or innovation. Finally, researchers at the network level may choose to study the impact of multilevel actions and structures on network level outcomes. It is this last, whole network perspective on which we focus in this review.

Theories and perspectives that focus on the individual or organizational actor have a long tradition in social research and have guided most of the knowledge about networks. These views, often referred to as egocentric, are concerned with trying to explain how involvement of an individual or organization in a network affects its actions and outcomes. For instance, some egocentric theories focus on an organization and its "embeddedness" in a network. Prominent examples in the organizational literature include work by Burkhardt and Brass (1990), Burt (1992), Uzzi (1997), and Ahuja (2000). The focus of this research is frequently on dyadic relationships between organizations (cf. Gulati, 1995), but it sometimes goes beyond relational embeddedness by including structural and positional measures (Gulati & Gargiulo, 1999). Although dyads are the basic building blocks of networks, dyad-focused research is in most cases limited in that the network is primarily seen as a collection of two-party relationships rather than as a unique, multiorganizational social structure or even a social system in its own right. Researchers often talk of a network of relationships, but it is not the network itself that is being studied, thus ignoring the basic network theoretical insight that actors and actor-to-actor relationships are likely to be influenced by the overall set of relationships (Mitchell, 1969).

Egocentric or organization-level theories and related research can help to answer questions such as (a) the impact of dyadic or network ties on organizational performance, (b) which types

of links are most or least beneficial to individual network members, (c) which network positions might be most or least influential, and (d) how the position of organizations in a network might shift over time in response to changes within and outside the network. Although behavioral and process issues, such as trust and evolution, can be identified that may be unique to a particular level of network analysis, the clearest comparative distinction can be made by focusing on structural issues. Structural issues that are commonly examined and used to explain networks and network outcomes on an organizational, or egocentric, level include the following:

In-degree and out-degree centrality: Does an organization occupy a central or a more peripheral position in the network based on the number of network ties it maintains with other organizations? Degree centrality is based on the number of *direct* links maintained by an organization with others in the network. Calculation of in-degree and out-degree centrality is also possible and is based on the extent to which assets such as resources, information, and clients are coming *into* an organization from others in the network versus those being sent *out* to other organizations.

Closeness centrality: Is an organization in a structural position to spread such assets as information or knowledge that might reside in any organization in the network, even through indirect ties? Central organizations have short “paths” (connections) to all other organizations in the network. Closeness centrality is thus calculated by considering the shortest path connecting a focal organization to any other organization in the network. Direct connections, where A is connected to B, are shorter than indirect ones, where A is connected to B only indirectly through ties to C, which is directly tied to B. Unlike the case with degree centrality, in closeness centrality, *indirect* connections are viewed as valuable mechanisms for exchange of network-based resources.

“Betweenness” centrality: Does an organization serve as a gatekeeper within the network? If so, it must maintain intermediary links between organizations that are not directly connected with one another. Hence, the organization’s betweenness centrality is calculated by considering the extent to which an individual’s position in the network lies between the positions of other individuals.

Multiplexity: What is the strength of the relationship an organization maintains with network partners, based on the number of types of links (e.g., research ties, joint programs, referrals, and shared personnel) connecting them? Multiplex ties are thought to be an indicator of the strength and durability of an organization’s links because they enable the connection between an organization and its linkage partner to be sustained even if one type of link dissolves.

Broker relationships: To what extent does an organization span gaps, or structural holes, in a network, and what are the implications of this for the organization? Organizations that span “structural holes” (Burt, 1992) are considered to be brokers, often occupying positions of considerable influence.

Cliques: Cliques are clusters of three or more organizations connected to one another. At the egocentric level, the extent of an organization’s connectedness to a clique may affect organizational outcomes in ways that are different than when the organization is connected only through a dyad.

Network-level theories draw on and use many of the behavior, process, and structure ideas and measures developed by organization-level researchers. However, the focus is not on the individual organization but on explaining properties and characteristics of the network as a whole. The key consideration is outcomes at the network level rather than for the individual organizations that compose the network. The input may be either the individual organization or the interorganizational network. For instance, instead of examining how organizational centrality might affect the performance or level of influence of individual member organizations, a network-level perspective would focus on overall network structures and processes,

such as centralization or density of the network as a whole. Network-level characteristics would be determined, compared across networks or over time, and then used to answer questions such as how overall sustainability or absorptive capacity of the network could be enhanced or how the multiorganizational services provided to a customer or client group might be strengthened. This perspective presumes that a network involves many organizations collaboratively working toward a more or less common goal and that the success of one network organization may or may not be critical to the success of the entire network and its customer or client group. The preference is for optimization of the whole network even if it comes at the cost of local maximization for any node or group of nodes in the network.

Work at the network level has blossomed during the past decade, but it has primarily been conceptual (cf. Dhanaraj & Parkhe, 2006; Koka, Madhavan, & Prescott, 2006), anecdotal, or based on single, descriptive case studies performed at one point in time. Most prominently, whole networks have been the object of study in research on health (Morrissey et al., 1994; Provan & Milward, 1995; Provan, Nakama, Veazie, Teufel-Shone, & Huddleston, 2003), but comparative empirical work has also been done in other settings (Owen-Smith & Powell, 2004; Safford, 2004). These and other studies utilize many of the structural issues previously discussed in this section for organization-level networks. Typically, these structural issues are aggregated across an entire network and then compared with those of other networks providing similar services. Unique network-level properties may also be considered in these types of studies, including the following:

Density: What is the overall level of connectedness among organizations in the network? Are some networks more fully connected than others? And, more importantly, how much density is beneficial versus detrimental to effectiveness of the network? Higher levels of density are not necessarily advantageous, especially in light of the increased coordination burden placed on network members.

Fragmentation and structural holes: Are all or most network members connected, either directly or indirectly (i.e., through another organization), or is the network broken into fragments of unconnected organizations, dyads, and cliques? Fragmented networks may exhibit connections among organizations that are themselves unconnected or only loosely connected to other clusters of connected organizations. This means that the network has many structural holes.

Governance: What mechanism is used to govern and/or manage the overall network? Even if networks are considered as a distinct form of governance, the mechanism used can considerably vary and range from self-governance, to hub-firm or lead-organization governed, to a network administrative organization (NAO) model.

Centralization: To what extent are one or a few organizations in the network considerably more centrally connected than others? Highly centralized networks may be organized in a manner approximating a hub-and-spoke pattern, recently popularized as “scale free” networks (Barabasi, 2002). Decentralized networks are far more dispersed, with links spread more evenly among members.

Cliques: What is the clique structure of the overall network? (See recent work by Rowley, Greve, Rao, Baum, and Shipilov [2005] on the topic.) How many cliques exist? Which types of organizations are involved? How large are the cliques? Are they connected to other cliques or fragmented? How much overlap is there across cliques, depending on the type of link involved (e.g., shared information or joint programs; cf. Provan & Sebastian, 1998)?

The research reported in what follows is a review of the interorganizational research conducted at this whole, or network, level of analysis and not at the egocentric, or individual,

organizational level of analysis. This literature is far less extensive than the general literature on interorganizational networks, but, as we contended earlier, it is an important topic that we believe has been underaddressed. This review is an attempt to present what work has been done at the whole network level of analysis, pointing out some of the differences and commonalities and then discussing where future research might best be headed.

Method

In an effort to identify recent empirical work done on whole interorganizational networks, we undertook an extensive review of the literature. We first conducted a search for journal articles utilizing both Academic Search Premier (<http://web.ebscohost.com/ehost>) and InfoTrac OneFile (<http://find.galegroup.com>). Consistent with the broad range of definitions of networks in the literature, our search terms included *networks*, *interorganizational networks*, *consortia*, *whole networks*, *clusters*, and *alliances*. Initially, we did not restrict the subject area within which the search was conducted. We also limited the search to the 20-year period from 1985 to 2005 because most empirical work on networks has been done in recent years and because the study of networks is still relatively new. The results were then analyzed for an indication of relevance to the field of organization studies. Because many network studies exist in a variety of fields, we were often able to quickly discard those articles falling outside of studies of networks and organizations. For example, many articles in computer science address computer networks, and many in the health field deal with neural networks.

After the initial analysis, we culled through the abstracts of the articles that remained. Often, the abstracts provided us with ample information about the methods and unit of analysis. Based on a reading of these abstracts, we were able to eliminate the many articles that focused on individuals and their social networks. We also eliminated those articles that focused on single organizations and their ties to others in a network, or what we discussed above as egocentric network studies. We found that egocentric networks make up the vast majority of research on networks in sociology and organization studies. Once relevant articles and potentially relevant articles were identified, we went on to read the complete articles to make sure that each fit the requirements of the search.

Each article that fulfilled the requirement of focusing on interorganizational networks studied at the network level of analysis was then indexed. A summary was produced for each article, which listed the sector in which the network appeared, the type of research conducted (analytic or descriptive), the number of networks involved, the type of data (e.g., cross-sectional or longitudinal), the mode of network governance, the abstract, and the key findings. The article summaries provided us with easily identifiable markers for comparisons of the research being conducted in the field.

In addition to this initial search, we also specifically conducted searches within the fields of administration or management (in public, nonprofit, and business sectors), sociology, and health care. Both Academic Search Premier and InfoTrac OneFile allow researchers to limit results to a specific discipline or area of interest. To specifically search within a discipline, a search can be conducted by choosing keywords and selecting a publication subject. For example, to search within only the sociology literature, one needs to choose sociology as the publication subject in

combination with the keywords of the search to obtain results specifically within sociology journals. These searches were conducted in the same manner as that mentioned above, with limitations placed only in the subject field. The results were much the same, with a few exceptions. We also did searches within specific journals in each of these fields to act as another check on the extensive literature. For example, we did searches solely within *Academy of Management Journal* to ensure that our initial searches were thorough and complete.

Our final list of reviewed articles included 26 empirical network-level studies. All studies included in our review had to involve some type of data collection and analysis. Some studies included egocentric findings but were included if they also showed results at the network level. Studies that heavily focused on a single network organization, such as a hub firm, rather than on the network as a whole were excluded (e.g., Browning et al., 1995). Although our review was thorough, we make no claims that it is exhaustive. Thus, despite our best efforts, we may well have unintentionally omitted a small number of network-level studies from the review.

Recent developments in the field of networks include transnational networks and policy networks. Because of the strict definition of network on which we relied in our exploration of the literature, these studies were eliminated from consideration. Transnational networks include social networks of contacts, as in the cases of migrant networks (Wiley-Hardwick, 2005) and corporate multinational networks. Within organizational transnational networks, those studies we uncovered consisted of a network of many units or nonautonomous organizations owned by the same corporation. The parent company oversees the administration of the network, and, as such, the network is more of a set of intraorganizational ties rather than interorganizational ties (Ghoshal & Bartlett, 1990). Similarly, policy networks (Laumann & Knoke, 1987), or advocacy networks (e.g., Trubek, Mosher, & Rothstein, 2000), were also not included in our study. These networks, such as the Transatlantic Policy Network, consisted not only of multiple businesses, nonprofits, and government agencies but also individual lawmakers and intellectuals, all of whom are working toward a common policy goal or set of goals.

We also excluded from our search those studies that exclusively focused on pieces of whole networks, such as subnetworks or cliques. This includes many studies of small world networks (see Watts, 1999; Watts & Strogatz, 1998), which typically focus on the actions and ties of individuals or subgroups within a broader network of relations (cf. Davis, Yoo, & Baker, 2003; Uzzi & Spiro, 2005). Some of this literature also focuses on strategic alliances between individual organizations (i.e., Madhavan, Gnyawali, & He, 2004; Schilling & Phelps, 2005). This is not to say that small world networks are unimportant; indeed, many advances in network studies are being made using this perspective. For example, in their study of small world networks, Madhavan et al. (2004) tease out what they call a “mesolevel” between dyads and networks, specifically the triads found in small world networks. However, for purposes of this literature review, small world networks largely fall in the grey area between levels of analysis in network studies and were thus excluded, unless they had clear implications for understanding whole network properties (see Baum, Shipilov, & Rowley, 2003).

The extant literature on networks is extremely large. Considering all of the academic journal articles on networks would result in more than 50,000 articles. When one starts placing limits on the networks to only focus on organizational networks, the numbers are considerably smaller. Table 2 provides a listing of the number of “hits” we encountered using each of the two search engines and using each of our search terms.

Table 2
Number of Citations by Search Term and Reference Source

Search Term	Search Engine	
	InfoTrac OneFile	Academic Search Premier
<i>networks</i>	46,088	48,911
<i>interorganizational networks</i>	54	36
<i>whole networks</i>	16	12
<i>consortia</i>	647	692
<i>alliances</i>	5,309	2,535
<i>not joint alliances</i>	5,230	2,535
<i>And organizations</i>	336	481
<i>clusters</i>	14,717	27,659
<i>and organizations</i>	48	780
<i>and firms</i>	89	110
<i>organization networks</i>	115	28

Note: January 1985 to December 2005.

As noted above, we also searched individual management and organization-oriented journals in a number of fields. Table 3 shows the results of this search, providing the number of network articles that appear in representative journals. These are the specific journals in which we conducted independent searches as a means for cross-checking our previous searches. These numbers include any article that references the word *network*, regardless of what type of network to which it is referring. In addition, the total number of hits does not differentiate between theoretical and empirical research. When multiple articles appeared to have the same or similar authors, with a few exceptions, our criterion for selection was that the research had to be conducted on a unique data base that was not repeated in other articles. When this occurred, we selected the one article from that data base that appeared to best match our search criteria.

Search Findings

A summary of our literature review findings is presented in Table 4. This table outlines the basic characteristics of each study we included and briefly summarizes the key findings.

Several distinct themes emerged in the empirical research we explored. For one thing, most of the network-level studies included in our review were comparative in nature (i.e., they contrasted at least two whole networks). Although the studies by some researchers (e.g., Baum et al., 2003; Krätke, 2002; Lipparani & Lomi, 1999; Soda & Usai, 1999) restricted their analysis to only one network, quite a few others tried to compare the substructures of one complete network with another, often longitudinally (e.g., Owen-Smith & Powell, 2004; Powell et al., 2005; Provan et al., 2003; Provan, Isett, & Milward, 2004).

Another clear finding is that the studies we reviewed often addressed networks within the health and human services sector (14 of 26). We were not sure why this was the case, although we can speculate that it may have to do with the greater prevalence of funding for

Table 3
Select Journals and Number of Network Citations, 1985 to 2005

Journal	Number of Network Hits	Number Selected
<i>Academy of Management Journal</i>	29	4
<i>Administrative Science Quarterly</i>	49	3
<i>Public Administration Review</i>	31	0
<i>Organization Science</i> ^a	14	1
<i>American Sociological Review</i>	69	0
<i>American Journal of Sociology</i>	102	2
<i>Nonprofit and Voluntary Sector Quarterly</i> ^b	12	2
<i>Organization Studies</i>	41	0
<i>International Journal of Management</i>	72	0
<i>Strategic Management Journal</i>	65	0
<i>Journal of Management</i>	7	0

a. Only 1990 to 2005.

b. Only 1999 to 2005.

health services research because multinetwork research is costly and time-consuming. In addition, the network level may be seen by researchers as more relevant in health care because collaboration is significantly less driven by the organizations' self-serving profit interest. Network-level studies within private industry (9) and other sectors (3) did, however, begin appearing more regularly after 1999. In fact, 10 of the 12 articles focusing on the non-health and human services sectors occurred in or after 1999, suggesting increased interest in the topic by business management scholars.

The studies were also evenly divided between cross-sectional and longitudinal data (12 and 13 articles, respectively). Longitudinal studies were also more likely to have more recently occurred, consistent with the more recent evolution of thought and study on whole networks. Nine of the 13 longitudinal studies have appeared since 2000. As one might expect, the exploration of network evolution and development was a theme of all the longitudinal studies we reviewed. Although there has been considerable discussion in the network literature on the evolution of interorganizational relationships in a network context (cf. Gulati & Gargiulo, 1999; Ring & Van de Ven, 1994), there has been scant discussion concerning how full networks evolve (for an exception, see the conceptual article by Koka et al. [2006] and empirical studies by Human and Provan [2000] and Powell et al. [2005]). From the studies we reviewed, it appears that networks have similar patterns of evolution (Human & Provan, 2000) and that their development occurs at multiple levels from the macro network level to the more micro individual organization level (Venkatraman & Lee, 2004). However, we know very little about the process of network development, such as how whole network structures evolve over time and how or if these multilateral relationships are managed.

We also conducted a more substantive review process, focusing on the specific issues addressed in the 26 studies. Although some overlap is inevitable, our observations fall into two broad categories of findings: (a) network properties and processes associated with whole networks, such as structure, development or evolution, and governance and (b) network outcomes.

Table 4
Comparison and Summary of Empirical, Interorganizational, Network-Level Articles, 1985 to 2005

Author	Year	Sector	Type of Analysis	Network Description	Data	Mode of Governance	Key Findings
Morrissey, Tausig and Lindsey	1985	Public and nonprofit in health and human services	Analytic—compared two demonstration projects in New York, using surveys and interviews	Two—one in Schenectady and one in Syracuse, NY	Cross-sectional	Lead organization in both networks	Preconditions at both sites were favorable for the emergence and maintenance of interorganizational resource flows with a high degree of interagency resource dependence, a moderate client overlap, and low duplication of services. In both communities, there was little formalization or centralization. Linkages were more often associated with verbal agreements rather than formal contracts. A majority of relationships in both networks were based primarily on client referrals. Perceived effectiveness of interagency relationships were quite high across both networks.
Morrissey, Calloway, Bartko, Riedgely, Goldman, and Paulson	1994	Public and nonprofit in health and human services	Analytic—key informant and structural data across multiple mental health networks	Six—five demonstration sites and one comparison community	Longitudinal—data collected in 1989 and 1991	Lead organization in all networks, although unclear if some are NAOs	All five demonstration sites exhibited progress toward the integration goals set forth by the project's sponsor organization, although so did the comparison and control site. Regarding governance, the creation of a lead organization was found to be easier to accomplish than reorganization of the entire network. Authors found difficulty in establishing changes in effectiveness, particularly over the brief 2-year period. Network data suggested that density and centralization in service delivery systems cannot be simultaneously maximized.
Provan and Milward	1995	Public and nonprofit in health and human services	Analytic—comparative case research design. Also collected agency-level	Four networks in four cities. Cities chosen were comparable in size, at least one agency acted as	Cross-sectional	Two NAOs (one public, one nonprofit) and two lead organizations	Services integration was not found to be positively related to network effectiveness. Rather, centralization facilitated integration and coordination. Systems in which external fiscal control by the state was direct, and to a lesser

<p>data on involvement in each network.</p> <p>coordinator, and a most-similar and most-different approach regarding funding was used.</p>	<p>extent not fragmented, were more effective than indirectly controlled systems in which allocation and control of state funding was delegated to a local funding authority. Stability was also important for network effectiveness. Networks were most effective when they had centralized integration and direct external control, especially in a stable and well-funded environment.</p>
<p>Araujo and Brito</p> <p>1997</p> <p>Business—port wine industry in Portugal</p> <p>Descriptive—collective action in networks through one case study</p>	<p>Three issue-based networks operating within one major port wine production network</p> <p>Cross-sectional</p> <p>Self-governed</p> <p>Collective action involving shippers, farmers and the Port Wine Institute was mobilized by a small group of shippers. This small group mobilized resources toward the production of a collective good despite the fact that the majority of other actors did nothing. Collective action was embedded in a broader system of interdependent actors where the process of interaction occurred at the economic and political levels of exchange. Collective actions appeared to depend on convergent interests (per Olson, 1965) and provided opportunities for bargaining processes to define shared interests.</p>
<p>Johnsen, Morrissey, and Calloway</p> <p>1996</p> <p>Public and nonprofit in health and human services</p> <p>Analytic—key informant and interorganizational network surveys for two sites</p>	<p>Two—two adjacent North Carolina counties, one urban and one rural, that share some regional services</p> <p>Longitudinal—data collected in 1991 and 1993</p> <p>Unclear—appears to be a lead organization</p> <p>Structural change was more apparent in the rural system. This was in part because of the relative lack of an interorganizational structure in the rural system at the beginning of the demonstration project. The urban system was well organized to begin with, so change was not as apparent, using structural equivalence analysis. The authors expected the rural system to have higher density and centralization scores with lower fragmentation scores at Time 2. However, the rural system became less centralized, more dense, less complex, and, in the information exchange system, more fragmented.</p>

(continued)

Table 4 (continued)

Author	Year	Sector	Type of Analysis	Network Description	Data	Mode of Governance	Key Findings
Fried, Johnsen, Starrett, Calloway, and Morrissey	1998	Public and nonprofit in health and human services	Analytic—key informant surveys and interviews were used to compare seven counties within two catchment areas	Seven distinct networks—one for each of the seven counties within the two area-networks. Constructed by key informants.	Cross-sectional	Varied	All systems varied in the roles assumed by organizations and the extent to which one organization dominated the network. Resource richness and contextual factors affected the structure of a system. Intra-county interactions were far more prevalent than area- or catchmentwide interactions. The authors concluded that coordination of services should not be considered a regional barrier and that integration of services likely requires the centralization of certain tasks to a regional office with a decentralization of service delivery and coordination. Successful network leaders spent much time and energy documenting problems, assessing needs and understanding of stakeholders, educating stakeholders, and creating trust and shared understanding of values. Findings suggested that central players should focus time and energy educating stakeholders. The article provided insights into how organizations are more likely to be motivated to collaborate in situations where they lack control over the allocation of payments across involved organizations.
Bazzoli, Harmata, and Cheeling	1998	Public and nonprofit in health and human services	Descriptive—comparative study of trauma network development in six U.S. cities with a population of over one million	Six developing trauma networks in six U.S. cities	Cross-sectional—used documents and interviews to construct a story	Trauma coordinating councils made up of community members and health care practitioners	Focus was on the effects of interorganizational networks on organizations' responses to environmental threats. Liberal arts colleges in smaller, more homogeneous, and older consortia were more likely to adopt professional degree programs. Network structure had an effect on social learning. The information that comes
Kraatz	1998	Nonprofit liberal arts colleges and intercollegiate associations	Analytic—utilized multiple regression to compare within and across each consortium. Utilized data from Higher	Forty intercollegiate consortia of liberal arts colleges, organized on basis of geographic proximity or institutional similarity	Longitudinal—1971 to 1986, annually	Board composed of member college presidents	interorganizational networks on organizations' responses to environmental threats. Liberal arts colleges in smaller, more homogeneous, and older consortia were more likely to adopt professional degree programs. Network structure had an effect on social learning. The information that comes

from network social learning has substantial influence even when other mechanisms are at work.

Data suggested that the coordination of clients and their needs may be most effective when there are only a small number of closely connected subgroups or cliques of agencies involved in care. Overlaps in clique membership were not as important as overlaps in service link for these networks. In those networks where service link overlaps existed, effectiveness was highest. Findings suggested that network effectiveness can be explained through intensive integration via network cliques or subnetworks. However, integration across a full network was likely to be a poor predictor of effectiveness.

Authors found four-cluster solution for health networks and five-cluster solution for health systems with differentiation and centralization being particularly important in distinguishing unique clusters. High differentiation usually occurred with low centralization, suggesting a broader scope of activity is more difficult to centrally coordinate. Integration was also important, but health networks and systems typically engaged in both ownership-based and contractual-based integration or were not integrated at all.

Proximity and local clustering of firms may be associated with different types of network structures. Here it was associated with hub coordination and commensality-based cooperation. Patterns of cooperation varied considerably across regions, reflecting

Education
General
Survey.

Analytic—
comparative
clique analysis
across three
systems using
a comparative
case research
design. Also
collected
agency-level
data on
involvement in
each network.

1998 Public and
nonprofit in
health and
human
services

Provan and
Sebastian

Three networks in
each of three
different cities.
Cities chosen for
comparable size.

Cross-sectional

Two NAOs (one
public, one
nonprofit) and
two lead
organizations

Analytic—
empirical
measures
aggregate
individual
hospital data to
the network or
system level.
Used cluster
analysis,
converted
differentiation,
integration and
centralization
variables.

1999 Private, public,
nonprofit,
health and
human
services

Bazzoli, Shortell,
Dubbs, Chan,
and Kralovec

295 health systems
(networks in
which all
providers are
owned by same
entity) and 274
health networks

Primarily cross-
sectional but
technically
longitudinal—
two years of
data with
some look at
change

Varied

Descriptive—
used public
documents,
in-depth
interviews of
100 firms, and
case studies

1999 Business,
nonprofit,
public—
looked at
optics—
electronics
industry

Hendry, Brown,
Defillippi, and
Hassink

Six networks—
compared
network types
and networks in
general across six
regions

Cross-sectional

Unclear

Table 4 (continued)

Author	Year	Sector	Type of Analysis	Network Description	Data	Mode of Governance	Key Findings
Lipparini and Lomi	1999	Private biomedical firms in Italy	clusters by examining universities, businesses, government agencies and Germany Analytic—analyzed the effects of network relationships on performance of the system. Used survey data.	One network made up of 96 firms in the province of Modena	Cross-sectional	Self-governed	local historical experiences of each region. Industry clusters within countries function as localized nodes of national and international network of technology development, production, and distribution. The structure of interfirm relationships mattered for performance of the system. The key factor affecting industry growth was the formation of different types of organizations, with new organizations playing an important role in helping larger and older organizations reduce their weaknesses. Information conveyed through the network was influenced by network structure and positioning of each organization in the industry structure. Large firms played a central role. Results suggested there was a need for appropriate governance mechanisms to integrate into the overall system of relationships. When relevant knowledge is widely distributed and not easily produced within firm boundaries, relational activity increases. Authors used “relational capital” to explore the effects of network embeddedness, both for dyads of firms and for the network as a whole. Relational capital for dyads was a good predictor of integration and simplification processes occurring in the industry after a crisis. High amounts of relational capital pushed companies through horizontal integration processes (i.e., mergers and acquisitions). Relational capital within the whole network decreased. The findings suggest how, under certain
Soda and Usai	1999	Private, public—the Italian construction industry	Analytic—utilized UCINET	One network made up of the 49 largest Italian, private, state-controlled, and cooperative public works contractors	Longitudinal—1992 to 1996	Self-governed	

Human and Provan	2000	Business—U.S. wood products manufacturing	Analytic—compared the evolution of two networks from inception utilizing qualitative interview and survey data	Two formally constructed networks. Firms selected based on membership and activity within the network.	Longitudinal—data collected in 1994-1995 and again in 1997-1998	NAO	<p>conditions, a cooperative network can cause negative effects or externalities on the whole economic system, representing a structural source of unstable competitive advantage for the individual firms in the network.</p> <p>Comparison of two networks—one that succeeded and one that failed. The two networks had similar patterns of evolution and developed similar legitimacy requirements. Network sustenance depended on adopting both an inside-out and an outside-in strategic orientation for legitimacy building in response to demands or expectations of stakeholders. Findings suggested that when networks are formally constructed and organized “from scratch,” dynamics of evolution are likely to be different from those in joint alliances and ventures—they will not be based on previous business ties.</p>
Van Raak and Paulus	2001	Private, public—provision of health and human services in the Netherlands	Descriptive—used 12 case studies of network formation for the provision of care for psychogeriatric patients	Twelve networks, each consisting of multiple providers, including insurance companies, doctors, social workers, and home care workers	Longitudinal—data collected during a 3-year period, from 1990 to 1993	Self-governing, but the insurance company had central control over funding so acted as lead organization by proxy	<p>This study was largely descriptive, building theory around network development or lack thereof. Key findings included evidence that the smaller the power difference between actors, the greater the chance negotiations will occur; one actor cannot impose system development on others. Findings suggested that negotiations take much time and energy and that negotiators must be skillful for development to occur, and, even then, it is not ensured. Network development was the result of use of rules produced during steering interactions that drive the development of the system and are dependent on the meanings that actors attach to them.</p>

(continued)

Table 4 (continued)

Author	Year	Sector	Type of Analysis	Network Description	Data	Mode of Governance	Key Findings
Krätkle	2002	Production firms and regional institutions in the film industry	Analytical—structural analysis of one network comprising 55 players. Also collected agency-level data on firms inside and outside the region that stayed in contact with the network.	One network in a regional cluster in East Germany.	Cross-sectional	Mostly self-governed, but some lead firms	The network exhibited not only a very marked functional differentiation but also a high degree of density, centralization, and cohesion (no subclusters despite the size of the network). Both especially large companies in the cluster (e.g., studio providers, production and postproduction firms) had a high level of centrality and seem—as lead firms—to play a coordinating role in the network. Centrality of the firms is interpreted as integration in the network. Surprisingly, television channels—the main clients of this industry—do not occupy a central position leading the author to the conclusion that the transaction relations of the cluster need to be seen in the supralocal and regional context. Some of the regional institutions (a college, a media initiative, and a bank) were densely connected to the firms in the cluster. Data suggested that external environment, especially resources in that environment, have a substantial influence over initiative implementation. Grant support was particularly helpful. CCN partnerships used availability of grant support to gain legitimacy for efforts and to motivate others to join. Study revealed that the scope of tasks associated with an initiative greatly influenced its implementation. Focused, diverse partnership leadership was also important to implementation. A good balance of responsibility between partners and paid staff was related to initiative success.
Bazzoli, Casey, Alexander, Conrad, Shortell, Sofaer, Hasnain-Wynia, and Zukoski	2003	Nonprofit, business, and public community organizations in health and human services (CCNs)	Analytic—compared implementation of four initiatives in 25 voluntary public-private partnerships	25 partnerships or CCNs in health care industry. Partnerships used final milestone report for quantitative data and in-depth interviews, with 8 of 25 partnerships for qualitative data.	Cross-sectional—data collected at the end of the of the CCN demonstration period	Mixed	

Hasnain-Wynia, Sofaer, Bazzoli, Alexander, Shortell, Conrad, Chan, Zukoski, and Sweney	2003	Nonprofit, business, and public community organizations in health and human services	Analytic—compared perceptions of network effectiveness among participating members across 25 CCNs	25 partnerships or CCNs in health care industry	Cross-sectional—used data from survey collected in 1997, site visits and reports from 1997-1998, and phone interviews in 1998	Self-governed	Findings suggested that networks with more diverse partnerships are perceived as less effective. The diversity that comes with the size and heterogeneity needed for legitimacy brought management challenges with it, especially regarding coordination, communication, and conflict management. Findings disconfirmed the assumption that breadth of membership will help a partnership be more effective. Perceptions of leadership effectiveness played a role in perceptions of network effectiveness. If leader was seen as effective in keeping partnership focused on tasks and objectives, the network was seen as being more effective. Also if the leaders were seen as ethical and not solely self-interested, the network was perceived as more effective. Focus was on how small world networks emerge within a network and how that effects network level interactions. The authors discovered that cliques were initially formed based on past partners, but over time cliques were more likely to form based on clique-spanning ties and learning. The impact on the network as a whole was found to rest mainly in stability, which depends in part on the role of core and periphery players in the network. If core members are partnered in a clique, network stability is higher. If periphery members are partnered and outnumber the core organizations, the network is characterized by more instability, but may also be more open to change.
Baum, Shipilov, and Rowley	2003	Investment banking syndicates in Canada	Analytic—documented the evolution of small world networks and their effects on the whole network	One network with several subnetworks	Longitudinal—used data from underwriting syndicates and their links from 1952 to 1990	Self-governed	Findings suggested that efforts to build community capacity through the development of a broad-based collaborative network of organizations
Provan, Nakama, Veazie, Teufel-Shone, Huddleston	2003	Public and nonprofit in health and	Analytic—used organizational surveys,	One network providing chronic disease health prevention and	Longitudinal—data collected after the network was	Self-governed	

(continued)

Table 4 (continued)

Author	Year	Sector	Type of Analysis	Network Description	Data	Mode of Governance	Key Findings
Provan, Isett, and Milward	2004	Public and nonprofit in health and human services	Analytic—used key informant surveys, interorganizational surveys, and in-depth personal interviews	One network providing services to adults with serious mental illness with four subnetworks of ARPs and their networks of providers	Longitudinal—compares network immediately after managed care funding mechanism was implemented and again 3 years later—1996 and 1999	NAO for full network; lead organization for each subnetwork	can be a successful way to address complex health problems. Also, external initiatives can aid in the creation of a collaborative network through the funding creation of an infrastructure, which facilitates collaboration between organizations. Collaboration was most often built on shared information. Although attitudes toward collaboration were positive, overall levels of trust decreased despite increased collaboration, suggesting that trust takes longer to establish than many types of network ties. With pressures to control costs in a new system, there was an overall pattern of increased network involvement by all the agencies in the network, but especially for the ARPs. Formal contract ties did not increase as much as the more informal referral ties, especially across subnetworks. The increase of ties and cross-network involvement suggested that the ARPs were becoming increasingly embedded in the system, suggesting less fragmentation in the delivery of services to clients and increased local support of the NAO governance model. Performance data revealed enhanced system quality and less variance in quality among ARPs over time. Findings suggested that a community-based system of health and human services like the one studied can adapt to conflicting pressures from both the state and the profession.
Owen-Smith and Powell	2004	Business—biotechnology firms	Analytic—examined relationship	Two networks—one consisting of organizations	Longitudinal—data collected 1988 and 1999	Self-governed	Two attributes—geographic proximity and the institutional characteristics of key members in a network—transformed the

<p>between local and nonlocal network positions and patent volume</p>	<p>located within the Boston region and the other consisting of organizations outside the area having ties to a Boston-based organization</p>	<p>ways in which an organization's position within a larger network configuration translated into advantage. The accessibility of information transmitted through formal linkages was a function of the extent to which ties were embedded in a dense regional web of both formal and informal affiliations and whether the nodes that anchor a network pursued private goals. The main analysis was at the firm level, but key comparisons were made regarding density and reachability in the Boston versus regional network and comparing the networks at two points in time.</p>	<p>different network patterns age differently—some past structures may exert stronger effects on performance than current ones. An important aspect of this study was the focus on the outcomes of past and current ties instead of just examining the durability of the ties. The payback from bridge ties would have to be large and fast to justify investing in them, as they are more expensive to create and maintain. Authors found that there was a U-shaped relationship between past network closure and performance, confirming that closure has long-lasting benefits. This relationship relies on structural properties of the network rather than on tie strength. Findings suggested that rather than viewing structural holes and closure as conflicting alternative forms of social structure, they can be viewed as complementary. Because this study focused on temporary networks, tacit knowledge and intellectual capital were critical.</p>
<p>Soda, Usai, and Zaheer</p>	<p>2004</p>	<p>Business—Italian television production industry</p>	<p>Self-governed</p>
<p>Analytic—developed unique data set of television productions from archival public sources.</p>	<p>249 small temporary project production networks embedded in the larger historical production network</p>	<p>Longitudinal— all television productions produced and broadcast by any of the six national television channels in Italy from 1988 to 1999</p>	<p>Self-governed</p>

(continued)

Table 4 (continued)

Author	Year	Sector	Type of Analysis	Network Description	Data	Mode of Governance	Key Findings
Venkatraman and Lee	2004	Business—U.S. video game sector	Analytic—utilized multiple data sets to look at the organizational-level decision making and the evolution of the network	Multiple networks overlapping—highlighted the links between platform and producer	Longitudinal—study of product launches in the industry during an 8-year period, broken up into three snapshots of the networks	Self-governed	Results showed that video game networks evolve, with the formation of links reflecting macro network characteristics (density overlap and embeddedness) and platform characteristics (dominance and newness) when developer characteristics (age, share, coupling, and prior ties) are used as controls. Findings pointed to the need to understand competition—cooperation dynamics in a network. Authors treated the games as complementary resources for platforms—as conduits and prisms—while recognizing situations may call for treatment as either conduit or prism. The study went beyond looking at structure to look at how structure changes over time.
Knight and Pye	2005	Private and public—English health sector, prosthetic services	Analytic—network learning concept was explored using qualitative methods, including participant observation and interviews. Documentary sources also provided data.	One primary network made up of organizations providing prosthetic (artificial limbs) services. Study was also informed by comparisons with data from previous research done by authors on two other related health networks.	Longitudinal—participant observation and 34 interviews—1997 to 2001	Initially self-governed with an informal board, then a more formal NAO was created (PSSG)	The authors found that changes in network practices, structures, and interpretations must be widespread and enduring to be seen as network learning outcomes, but they need not be universal or uniform. A key finding suggested that network learning outcomes occur at the network level but that the process of learning actually occurs “slightly below” the network at a more localized level. The authors explored the link between learning and improved performance and found that where changes occurred that delivered (perceived) improvements in performance, it was because there was a new alignment among network interpretations, structures, and practices.

Powell, White, Koput, and Owen-Smith	2005	Private businesses (DBFs) in the biotechnology industry	Analytic—utilized Pajek for network data analysis and multiple measures to test hypotheses	One main network of 482 organizations. In 1988, there were 253. During the course of 11 years, 229 more entered the field, whereas 91 exited.	Longitudinal—data collected from 1988 to 1999	Self-governed	Multiconnectivity expanded as the cast of participants increased and diversity became more important over time. In this field, reputation was very important and “casts a long shadow.” Collaborations were often cross-cutting, meaning that one’s collaborator at Time 1 may very well be a competitor at Time 2. The density of the network called for the careful consideration of exit strategies. A very small core of organizations dominated the network over time. Multiconnectivity and “rich-get-richer” relationships dominated, and those few organizations were most likely to set the pace for the network. The main point was how the institutional features promoted very dense webs of connection that influenced both subsequent decisions and the trajectory of the field. Longitudinal data showed how the network evolved over time and how homophily may not be the best measure of attachment for all networks.
--------------------------------------	------	---	--	---	---	---------------	---

Note: NAO = network administrative organization; CCN = community care network; ARP = at-risk provider; PSSG = prosthetic strategic supply group; DBF = dedicated biotechnology firm.

Network Properties and Processes

Network structure. Many of the studies reviewed specifically addressed the structure of whole networks, focusing in particular on density, centralization, and the existence of sub-networks or cliques. Findings suggested that both general network structure and the positioning of each organization within the network influence the information that is conveyed through the network (Lipparini & Lomi, 1999). The density of ties in a network, particularly density overlap, tends to increase over time (Venkatraman & Lee, 2004). Although centralization facilitates integration and coordination in a network (Provan & Milward, 1995), density and centralization cannot simultaneously be maximized (Morrissey et al., 1994). Some tradeoff between the two must occur, and the existence of a large number of ties does not necessarily mean that the network is centralized. Different network patterns also differently age, with some past structures exerting stronger effects on performance than current ones. Time may modify the flow through the network as density and centralization change and one form of network structure benefits over another (Soda, Usai, & Zaheer, 2004). In the same way, two structurally similar networks originally at different levels of system development will develop in relatively the same way over time (Johnsen, Morrissey, & Calloway, 1996).

In addition, there is some trade-off between centralization and differentiation. High differentiation occurs with low centralization, suggesting that attempting a broad scope of activity is difficult to centrally coordinate (Bazzoli, Hramata, & Chan, 1998). High differentiation in networks proves to be important for the identification of unique clusters of organizations within networks (Bazzoli et al., 1998). Clusters can be created out of convenience, as in cases of geographic clustering (cf. Hendry, Brown, Defillippi, & Hassink, 1999; Owen-Smith & Powell, 2004). But they also can be created based on the provision of a certain set of services (Fried, Johnsen, Starrett, Calloway, & Morrissey, 1998; Morrissey et al., 1994; Provan & Sebastian, 1998). Cliques, subnetworks, or clusters within networks are prevalent and can play important roles in the creation of positive outcomes. For example, Provan and Sebastian (1998) discovered that network effectiveness can be explained through the intensive integration (where service links overlap) via network cliques.

Network development. With half the studies being longitudinal, network development, or evolution, was a major theme of the studies reviewed. Network development may be seen as the result of the use not only of resources but also of rules and norms produced as steering mechanisms to drive development of the network (Sydow & Windeler, 1998). These rules are dependent on the meanings the individual actors attach to them, so the development of the network is dependent on the knowledge of those mechanisms and the meanings, goals, and values of all organizations within the network (Lipparini & Lomi, 1999; Van Raak & Paulus, 2001). A key group of nodes (organizations) within the network and their leaders often play a central role as the main carriers of those rules and practices, often reflecting the environment in which they are situated (Hendry et al., 1999). The practices and commitments of those key nodes may result in the development of dominant logics at the network and community levels (Bazzoli et al., 1998; Owen-Smith & Powell, 2004). In other words, a dominant core within the network may drive how the network develops and/or evolves. These few organizations, marked by multiple connections and "rich get richer" relationships,

set the pace for the entire network, at least under certain conditions (Bazzoli et al., 2003; Knight & Pye, 2005; Powell et al., 2005).

Networks and subnetworks are often formed based on a firms' preoccupations with past partners and their partners' partners as a means of creating embedded relationships that foster cooperation (Gulati & Gargiulo, 1999). As Baum et al. (2003) found in their study of subnetworks in Canadian banking, past relationships work to shape future relationships between organizations and the way the network operates as a whole. These relationships are not, however, necessarily stable over time. For instance, Powell et al. (2005) found that collaborations are often cross-cutting, suggesting that a collaborator at time one may be a competitor at a later time. This suggests that a more in-depth analysis of the outcomes of ties, rather than a focus purely on the durability of ties, may be more useful for understanding the evolution of a network. It also suggests that certain network properties, such as structural holes and closures, should not be seen as conflicting concepts, but, rather, they should be viewed as complementary and shifting, which is what Soda et al. (2004) found. In general, interorganizational networks can thus be characterized by the evolution of a rich variety of relationships or ties (Araujo & Brito, 1997).

Resource availability also strongly influences the ability to gain legitimacy and facilitate network development. As seen in Bazzoli et al. (2003), the availability of grant funding greatly influenced partnership formation and the perceived legitimacy of both organizations and the network. Legitimacy and reputation are generally very important in collaborations, particularly in networks where collaborations among organizations within a network vary over time. Powell et al. (2005) discovered that a few densely connected organizations dominated the network and were found to be key actors in collaborations within those networks. Although network multiconnectivity as a whole increased during the 11-year period of their study, those few key actors seen as the most reputable maintained control over the network over time. This is true also of key organizations even when there is no control over the allocation of available resources in the network, as shown by Bazzoli et al. (1998). Key organizations can shape the evolution of the network by focusing time and energy on educating stakeholders and other organizations within the network.

Network governance. As previously mentioned, the mode of governance is also a critical aspect of whole network research, although as found in our review, the explicit study of governance has not been common. Governance may have definite impacts on network outcomes, as evidenced by the Provan and Milward (1995) study comparing four mental health service delivery networks. However, a gap appears to exist in the literature in understanding how interorganizational networks govern themselves. Although networks are seen as mechanisms not only of social embeddedness but also of coordination and governance (Grabher & Powell, 2004; Jones et al., 1997), few empirical examinations exist exploring how activities occurring within a network are managed and coordinated. Relationships between organizations in a network are understood to be either informally maintained, through the structure of the network (Coleman, 1990) and norms of reciprocity and trust (Alter & Hage, 1993), or formally maintained, through the existence of contracts, rules, and regulations (Coleman, 1990; Kogut, 2000; Ostrom, 1990). However, these formal and informal control mechanisms protect organizations in their relationships to each other (as dyads) and not the network's

activities as a whole. In addition, there has, until recently, been an implicit but incorrect assumption that networks do not significantly differ. The assumption is that they are an answer to market failure (Williamson, 1991), and, as such, they are all essentially similar in form, being primarily different from markets and hierarchies (cf. Powell, 1990). We are thus left with an understanding of why networks may be a superior mode of governance but not of how they are themselves governed.

We utilized the typology recently proposed by Provan and Kenis (2006) to identify the governance mechanisms within the networks in each article we reviewed. This typology identifies three distinct types of governance within networks: shared governance, lead organization governed, and NAO governed. Shared governance networks occur when the organizations composing the network collectively work to make both strategic and operational decisions about how the network operates. There is no unique, formal governance structure other than through the collaborative interactions among members themselves. Control over activities may be formally conducted through meetings of network members or more informally conducted through ongoing interactions and collaboration.

Lead-organization or hub-firm (Dhanaraj & Parkhe, 2006; Jarillo, 1988; Sydow & Windeler, 1998) governance occurs in networks in which all organizations may share a common purpose but where there is a more powerful, perhaps larger, organization that has sufficient resources and legitimacy to play a lead role. Although the organizations within the network may regularly interact with one another, activities and decision making are coordinated through a single organization, as in the case of Japanese *keiretsu*, or a small group of organizations that is responsive to network members. A lead organization provides products and services and conducts business much like the other members of the network but is, in addition, responsible for the maintenance of existing internal relationships and the development of external relationships.

NAO governance is similar in nature to the lead organization model in that all activities and decisions are coordinated through one organization (cf. Human & Provan, 2000). The difference is that the NAO is an organization (or even an individual) specifically created to oversee the network. Unlike the lead organization, the NAO is not involved in the manufacturing of goods or provision of services, as is the case with network members. The task of the NAO may be primarily to support (rather than execute) network leadership so that this type of governance may sometimes coexist with one of the other two.

Although we did not, of course, expect this new typology to appear in the existing literature, we did expect to find some indication of how each of the networks we reviewed is maintained and governed. In fact, very few articles specifically identified the governance model (e.g., Bazzoli et al., 1998; Johnsen et al., 1996; Provan & Milward, 1996). Several articles neglected to address governance at all (e.g., Hendry et al., 1999), and most others only implicitly did so. As with effectiveness, the articles were distinctly divided, with more attention paid to governance by those researchers who explored networks within the health and human services sector. Even so, a clear identification of governance within those studies in health and human services was far from universal. Of the articles reporting findings in the health and human services, 7 of the 14, or half, explicitly defined the network governance structure. For those articles lacking a specific explication of the governance structure, we attempted to identify the type of governance from the descriptions of the samples from which the data were gathered and were able to confidently do so in most cases. However, in

some of the larger samples, it was unclear or varied across networks. For example, in their 2003 article on community care networks, Bazzoli et al. studied 25 networks with varied governance structures. Some of these networks are known to have NAO models of governance; however, it was unclear if all 25 networks followed the same pattern.

The beginnings of a pattern of studying the modes of governance can be seen in the literature on whole networks. Mainly, networks in business or private industry were more likely to have a self-governance model than were those networks in the health and human services, which were more likely to have either a lead organization or, more often, a NAO model. In some European countries (e.g., Germany), the NAO model is also quite common because it is expected to stimulate public sector–private sector interactions in networks or clusters. Though not necessarily mandated by the government, some national or regional development programs may specifically recommend the NAO model (<http://www.kompetenznetze.de>).

Network Outcomes

Another theme that emerged in at least some of the studies was network outcomes, especially network effectiveness and learning. Although few studies explicitly measured effectiveness, it was an underlying theme in much of the research. Provan and Milward's (1995) study of four mental health networks was a first attempt to directly study effectiveness. Others have since addressed the topic, though only for studies focusing on health and human services. This may be because of the nature of what networks in the health and human services sector do. They generally provide services, sometimes to vulnerable populations such as the elderly or mentally ill, and are often funded in part via third parties or the government. As a result, organizations in this sector may need to be responsive to collective indicators of effectiveness. In business, more attention may be paid to matters of efficiency rather than effectiveness and to organizational rather than network-level outcomes. Ultimately, effectiveness will mean different things to each network and to each sector in which a network exists.

Although most of the studies reviewed indicated, at least implicitly, the performance enhancing effects of networks, interorganizational networks do not always result in positive outcomes. Indeed, under certain conditions a cooperative network can have negative effects on the whole economy (e.g., as in the case of cartels) and may prove to be a structural source of unstable competitive advantage between organizations (Soda & Usai, 1999) or even between regions (Grabher, 1993). Networks can also fail. For instance, Human and Provan (2000) found that the sustainability of networks was largely dependent on both internal and external legitimacy and support in the early stages of evolution. They concluded that networks that are formally constructed and do not emerge out of previous relationships are more likely to fail. Along similar lines, Baum et al. (2003) found that the stability of the whole network is in part dependent on the types of relationships occurring within subnetworks, based on their small world properties. As subnetworks evolve, the stability of the network will be determined by the nature of the organizations' status within the network. Core organizations and their subnetworks will tend to stabilize the entire network, whereas actors that are more peripheral will destabilize it. Indeed, the social and informational influences created by networks can also result in undesirable adaptation and evolution (Kraatz, 1998).

Effectiveness is also related to the concept of network learning. For instance, Kraatz (1998) found that network ties influence the way organizations evolve from an institutional isomorphism perspective (DiMaggio & Powell, 1983). Organizations are more likely to imitate a particular professional program if they are tied to a successful early adopter of innovation. Without those network ties, or with ties to less successful organizations, both the network and the individual organization members may not be successful. In other words, the organization learns from those organizations around them, and as they evolve, the network is more likely to evolve in ways that lead to network effectiveness. Without learning and evolution, the network may fail. Outcomes at the network level occur where a new alignment among network interpretations, structures, and practice occurs (Knight & Pye, 2005). The practices, structures, and interpretations within a network must be both widespread and enduring, yet it need not be universal, to result in network outcomes. Network learning occurs, but at a somewhat different pace and in a different order than is found in the traditional conceptions of learning. The traditional conception of learning consists of three ordered steps: defining meaning, developing commitment, and developing method. Knight and Pye (2005) found that although all three stages are also required in network learning, they need not and often do not occur in that order.

Network learning and successful evolution are often dependent on distinct role-players within the network. The outcomes of network learning appear at the network level of analysis, but the actual learning often occurs at a level slightly below the network level (Knight & Pye, 2005). Owen-Smith and Powell (2004) found that key organizations acted as the keepers of the rules and practices of the network, resulting in the development of dominant logics that set the pace within the network. Similarly, in their comparison of a rural and an urban network, Fried et al. (1998) found that certain organizations dominated the networks, thereby influencing the way in which the networks evolved. These organizations were not necessarily the official lead organizations within the network; rather, they were organizations that were dominant because of resource richness or contextual factors such as geographic proximity (see also, Hendry et al., 1999; Lipparini & Lomi, 1999).

Future Directions for Whole Network Research

The broadest conclusion that can be drawn from the empirical literature on whole networks, or interorganizational networks studied at the network level, is that there is simply not very much of it. There is, especially, very little work on business networks, which is somewhat surprising in light of the large number of organizational network studies that have been published in business sectors during the past 20 years. Because there have been so few empirical studies on whole networks, it seems premature at this point to review and analyze the extant literature beyond what we have already done. Rather, it seems more useful to build on what we know and do not know to discuss those areas where future researchers might most productively focus their efforts. Consistent with the themes of our review, we focus on the two broad areas of network properties and processes (structure, development, and governance) and network outcomes, primarily effectiveness. Our ideas for what is needed in each area are discussed below. These recommendations will then be followed by a discussion of what we

see as the primary methodological issues that must be overcome if significant progress is to be made on the topic.

Network Properties and Processes

Network structure. The structure of relationships among members has probably been the most frequently studied aspect of networks. This is certainly true for social networks, and it has been a common theme that has emerged from the literature on whole networks. One reason for this is the frequent collection of relational data and the availability of network analytical software, such as UCINET (Borgatti, Everett, & Freeman, 2002). Despite all we know at this point regarding certain aspects of network structure, there are many questions that have not been adequately addressed, especially at the whole network level.

- Are certain network structures more effective than others? For instance, do networks with small world properties (Watts, 1999) more effectively operate than do networks that are more densely and directly connected? Provan and Milward (1995) found that integrated health and human services networks were more effective only if integration occurred through a central coordinating entity. Do these findings hold for business networks? Are there other structural properties that are critical for overall network effectiveness, such as the presence of structural holes (Burt, 1992) or overlapping cliques (Provan & Sebastian, 1998)?
- Are the structural properties that are most predictive of network behaviors, processes, and outcomes when studying interpersonal social networks also likely to explain the behavior, processes, and outcomes of whole interorganizational networks?
- What is the role that policy entities, especially government, play in shaping and constraining the structure of relationships within interorganizational networks, especially those that are formed through mandate?
- In general, what are the critical factors that affect the emergence of different network structural forms? For instance, do structures differ across whole networks in different sectors, across networks having different functions, or across evolutionary stages?

Network governance. We have already discussed the fact that network governance has only implicitly been considered in many of the network-level studies we reviewed. However, it is important to explicitly consider network governance. Unlike dyadic relationships, which are managed by the organizations themselves, and unlike serendipitous networks, which have no formal governance structures at all, the activities of whole, goal-directed networks must generally be managed and governed if they are to be effective. We have already outlined three “pure” forms of governance that may be utilized: shared governance, lead organization governance, and NAO governance. Whether these three forms will stand up to the scrutiny of in-depth empirical analysis remains to be seen. But regardless of the specific form that governance may take, there are a number of important questions that must be addressed.

- What are the basic forms of network governance, and how do they operate? Do the governance forms discussed by Provan and Kenis (2006) fit all networks, or are there other forms that exist? What are their key characteristics? Are there really pure forms in practice, or are hybrid models common? And how do each of these forms operate in practice?

- Are certain forms of governance more effective for whole networks than others, and, if so, under what specific conditions will one form be best? And how is network performance affected when a particular governance form is mandated?
- How do governance forms emerge, and how do they become institutionalized? It may be, for instance, that nonmandated governance forms typically change as the network grows and matures, or it may instead be that, once established, a particular governance form becomes reinforced despite changing external conditions.
- When, how, and under which circumstances will the governance form of a particular interorganizational network change? Will this change be deliberate or be path dependent and proceed on any specific “organizational track” (Hinings & Greenwood, 1988) or interorganizational track?

Network development. One of the main ways in which all forms of network research have changed during recent years is that longitudinal research has become much more prevalent, opening the way to in-depth consideration of network development. This is a welcome change because there is only a limited amount we can know about networks when focusing on their static properties. Nonetheless, there is still very little we know about network dynamics (Bell, den Ouden, & Ziggers, 2006), especially when focusing on whole interorganizational networks. One reason for this is the difficulty in obtaining data during an extended period, even when relying on secondary data. In addition, although changes in social networks may be observable during a relatively short period, it may take years for whole networks to change in significant ways. There have been few studies of whole network evolution (cf. Human & Provan, 2000; Lerch, Sydow, & Provan, 2006; Owen-Smith & Powell, 2004; Powell et al., 2005), and these have suggested a number of directions that the study of network evolution might proceed.

- How do networks evolve from early birth to maturity and beyond? Does evolution occur in predictable ways, either in specific evolutionary stages or based on environmental conditions and internal pressures and changes? Human and Provan (2000) found that small-firm manufacturing networks do go through predictable stages, although it is unclear when these stages begin and end and what specific network characteristics explain each stage.
- Are there critical prenetwork activities and structures that predict successful network evolution? Prior work on dyadic relations has suggested the importance of preexisting ties (Gulati, 1995; Gulati & Gargiulo, 1999) and the establishment of trust. However, these findings are at the dyadic level, and many whole network relationships are newly established, not being built on preexisting ties. It may be, however, that prior network experience with other organizations not in the new network may be predictive of the successful emergence of a new network of relationships.
- Do networks continually shift and evolve in significant ways, or does network stability emerge at some point as an important factor for explaining network success? Networks have traditionally been discussed as highly flexible entities (Powell, 1990), but work by Provan and Milward (1995) has found that overall system change can be detrimental and that stability is an important factor for explaining network effectiveness. Other networks have even been found to be quite inert or persistent. Can this persistence, as suggested by Walker et al. (1997) regarding the impact of networks on organizations, be described in terms of path dependencies?
- To what extent can a whole network be stable (dynamic) despite significant changes at the subsystem or organizational level (cf. Kilduff, Tsai, & Hanke, 2006)? What, then, is the impact of network structural characteristics on its development? For instance, how does network homophily

(i.e., similarity of members) or its clique structure (Rowley et al., 2005) enhance or constrain the ways in which the network can grow?

- How does network-level trust evolve? There has been quite a bit of work done on trust in networks (cf. Gulati, 1995; Zaheer, McEvily, & Perrone, 1998), but it has focused on dyadic relationships. However, it is unclear whether network-level trust is the same thing and how it emerges. For instance, in their study of the evolution of chronic disease prevention networks, Provan et al. (2003) found that despite the increase in density of ties as the network evolved, measures of trust across the network actually declined. Provan and colleagues attributed this finding to the fact that the new relationships were untested and not deep. Organizations were willing to connect to new partners, but trust would take longer to develop.

Network Outcomes

Network outcomes in general, and effectiveness in particular, are critical issues when studying whole networks. If organizations are involved in networks solely for their own benefit, then one may question the viability of even studying whole networks. It is only when the interorganizational network itself has value that network members have an incentive to consider relationships beyond the ones they maintain on their own. This, perhaps, is the primary reason why such a large number of the network-level studies we reviewed focused on the health and human services sector. Organizations in this sector are traditionally more mission driven (Moore, 2000), and thus their strategies may be far more focused on broad client-based outcomes that go beyond the success of individual organizations. Community needs and interests play an important role in guiding organizational behaviors. In contrast, in business sectors, organizations tend to be far more bottom-line oriented, interested in responding to the self-interested goals of key organization-level stakeholders. Thus, the effectiveness of the network as a whole may appear to some to be less important than the performance of individual firms. That said, network-level effectiveness can be and is important in business. For instance, effective business networks can promote economic development in a region (Safford, 2004), act as a catalyst for innovation (Powell et al., 2005), stimulate new product development (Browning et al., 1995), and foster networkwide learning (Kraatz, 1998).

The relative lack of studies examining network effectiveness was somewhat surprising. If we are to understand about networks and network performance, then it is essential that network effectiveness be addressed. In part, the problem may be that few have studied network evolution during a sufficiently long period to understand why interorganizational networks might succeed or fail at their mission. In part, it may also be that, like organizational effectiveness, network effectiveness is not readily measured or understood. In fact, what may be a positive outcome for the network as a whole (e.g., improving innovation, economic activity, or community well-being) may prove detrimental to one or more individual network members, as when innovations are implemented by some firms but not others, making the innovators more competitive relative to others in the network.

What are the key issues concerning network effectiveness that need to be addressed if progress in the area of effectiveness on whole networks is to be made? Our review of the literature has suggested several.

- What do we mean by network effectiveness, and how should it be operationalized? We have already discussed that the focus must be at the network level rather than at the level of individual organization members. However, it is not clear who should benefit. Provan and Milward (2001) discussed measurement of effectiveness in the public and nonprofit sectors, suggesting that stakeholders at three levels must be considered: community, network, and organization or participant. These levels may not be appropriate for all business networks, but their work suggests the importance of considering multiple stakeholders having potentially conflicting, or at least different, goals. In addition, what is considered an effective network by some may not be viewed as having positive societal outcomes, as seen in work on illegal or “dark” networks (Baker & Faulkner, 1993; Raab & Milward, 2003).
- Consistent with the above point, are there certain network outcomes that can be viable alternatives to direct measurement of effectiveness? For instance, to what extent are proximate outcomes such as network learning (Knight & Pye, 2005) or network innovation (Powell et al., 2005) ultimately related to effectiveness?
- What is the impact of mandate on network effectiveness? Although many networks are formed from the bottom up by the members themselves, others have structures and composition that are imposed by an external entity, especially government. This is especially true in the public and nonprofit sectors, but it may also be true in business, particularly when a government entity provides funding and structure for economic development or innovation (cf. Lerch et al., 2006; Lutz, 1997).
- What is the relationship between effective dyadic ties and effectiveness at the network level? Is it simply cumulative (i.e., more effective dyads lead to more effective networks), or do conflicting goals and effectiveness measures at the organization level (based on dyadic connections) constrain network-level effectiveness?
- What effect, if any, does network effectiveness and/or its measurement have on the development of a network (Sydow, 2004) and, especially, on the choice of the actual form of network governance?

Methodological Issues

One of the main explanations for the relative lack of work on whole networks is because of problems with the research methods required for meaningful analysis. Ideally, a network-level study would require researchers to study multiple networks during a period of years. Such work is generally very time-consuming and costly. It is certainly true that traditional network research, focusing on dyads or on the antecedents or consequences of network involvement for individual organizations, may also be complicated and costly. However, the problem is one of unit of analysis. That is, when studying the organization–network interface, the unit of analysis is the organization, and researchers can collect data on many organizations, both within a single network or across many different networks. When studying whole networks, however, it may take studying interactions among 30, 50, or more organizations to research a single network. Trying to generalize would mean collecting data on perhaps 30 to 40 different networks, a daunting task. Although no such study has yet to be undertaken, larger-scale network studies have been conducted in the health services sector. As noted earlier, one of the reasons for this may be that there are more sources of research funding in health care than in business, allowing larger-scale studies to be attempted (cf. Bazzoli et al., 1998; Fried et al., 1998; Morrissey et al., 1994; Provan & Milward, 1995).

Another methodological problem is the issue of network bounding. When studying ego-centric networks, what constitutes the network is typically defined as the network of relationships maintained by the focal organization. With serendipitous networks, the network is defined in terms of whatever relationships exist. For research on whole networks, however, network boundaries generally must be more carefully defined and delineated so that it is clear which nodes and ties are included in the network and which are not. This can be a difficult issue. Should only those organizations that are listed on the formal network roster be included? What if there is no such list? Should a reputational sampling approach be used? What happens when there is a formal list of network participants but many of them are involved in name only? Which ones should be included and which ones dropped? Should the network be delineated in terms of who is interacting with so-called core network members whose activities are central to the mission and goal of the network? If so, does this not constitute sampling on the dependent variable? These and other questions are critical if research on whole networks is to be successfully done in ways that can be replicated by others.

Finally, there is a clear need to study interorganizational networks not only during a longer period at different levels of analysis but also using quantitative and qualitative methods of inquiry. So far, most networks have been studied using either qualitative and secondary data or standardized questionnaires and structural network analysis (Borgatti et al., 2002), but not both. Although there is hardly any serious alternative to these quantitative methods for studying large-scale networks, additional insights into the structure and content of relationships, their development over time, the initial conditions at founding, and changing contexts could be gained by the additional use of qualitative methodologies such as narrative interviews and participant observation. These methods would prove to be especially useful for understanding the functioning of networks as a unique form of governance and why different modes of governance might be appropriate for different types of networks and at different stages of network development.

Conclusion

This article has provided a comprehensive overview of studies of whole networks, reviewing empirical studies carried out during the past 20 years at the interorganizational network level of analysis. In sharp contrast to the abundant network research at the individual organization level, especially with a focus on dyadic relationships, network-level research is still of a manageable size for a review article like this. On the more critical side, research on whole networks has, so far, left many important questions unanswered. Apart from giving an overview of empirical studies of whole networks, another aim of this article has been to raise such important questions, especially in regard to network structure, network governance, network development, network outcomes or effectiveness, and network-level methodology.

Rather than trying to independently address these questions, network-level researchers can and should draw on many of the theoretical and methodological insights gained from more micro-level analyses. For instance, the insights gained regarding trust building from research at the organizational level, in both dyadic relations and more complex networks of relationships (Bachmann & Zaheer, 2006), may be used to study this process in whole networks. At

the same time, it is clear that at a more micro level, organizations should be brought back into network-level research to investigate, for example, how, on one hand, organizations are affected by their engagement in different types of networks and how, on the other hand, organizations get ready for networking. On a more macro level, the more or less recursive interplay between whole networks and regional clusters, organizational fields, or complete societies should also be put on the agenda of network researchers.

Although our review has focused on theoretical and empirical issues relevant to network researchers, there are important practical considerations as well. In particular, when governments, communities, foundations, or regional industry groups think about how they can improve their economy, disaster preparedness, competitiveness, health and well-being of citizens, and so on, collaboration through an interorganizational network is an approach that is increasingly utilized. The focus of these government and private groups is on large-scale outcomes that can be accomplished through the collective efforts of multiple organizations. In other words, emphasis is on the whole network and not on the specific relationships that any one or pair of organizations maintains. As a result, it is imperative that network researchers understand how whole networks operate, how they might best be structured and managed, and what outcomes might result. At present, network researchers in business, public management, and health care services have only a marginal understanding of whole networks, despite their importance as a macro-level social issue. Enhancing this knowledge is clearly a challenge that researchers in all sectors must take seriously.

Despite all the efforts we have made to present a complete review of network-level research, the study has clear limitations. Admittedly, the search procedure we used was somewhat subjective, so that some studies that might be considered to be at the network level of analysis may not have been included. Our search process was narrowly focused but serves to point out the relative dearth of empirical literature on the topic, despite a considerable amount of conceptual discussion. Nevertheless, we are convinced that we have compiled the vast majority of the studies carried out on this level of analysis. We have investigated this research in a way that should provide useful insights for future researchers choosing either to focus on whole networks or to include this important level of analysis in even more complex multilevel analyses of interorganizational networks.

References

- Ahuja, G. 2000. Collaborative networks, structural holes, and innovation: A longitudinal study. *Administrative Science Quarterly*, 45: 425-455.
- Alter, C., & Hage, J. 1993. *Organizations working together*. Newbury Park, CA: Sage.
- Araujo, L., & Brito, C. 1997. Agency and constitutional ordering in networks: A case study of the port wine industry. *International Studies of Management & Organization*, 27: 22-46.
- Ariño, A., & Reuer, J. J. (Eds.). 2006. *Strategic alliances: Governance and contracts*. New York: Palgrave Macmillan.
- Bachman, R., & Zaheer, A. (Eds.). 2006. *Handbook of trust research*. Cheltenham, UK: Elgar.
- Baker, W. E., & Faulkner, R. R. 1993. The social organization of conspiracy: Illegal networks in the heavy electrical equipment industry. *American Sociological Review*, 58: 837-860.
- Barabasi, A. L. 2002. *Linked: The new science of networks*. New York: Perseus.
- Barringer, B. R., & Harrison, J. S. 2000. Walking a tightrope: Creating value through interorganizational relationships. *Journal of Management*, 26(3): 367-403.

- Baum, J. A. C., Shipilov, A. V., & Rowley, T. J. 2003. Where do small worlds come from? *Industrial and Corporate Change*, 12(4): 697-725.
- Bazzoli, G. J., Casey, E., Alexander, J. A., Conrad, D., Shortell, S., Sofaer, S., Hasnain-Wynia, R., & Zukoski, A. 2003. Collaborative initiatives: Where the rubber meets the road in community partnerships. *Medical Care Research and Review*, 60(4): 63S-94S.
- Bazzoli, G. J., Hramata, R., & Chan, C. 1998. Community-based trauma systems in the United States: An examination of structural development. *Social Science and Medicine*, 46(9): 1137-1149.
- Bazzoli, G. J., Shortell, S. M., Dubbs, N., Chan, C., & Kralovec, P. 1999. A taxonomy of health networks and systems: Bringing order out of chaos. *Health Services Research*, 33(6): 1683-1717.
- Bell, G. G. 2005. Clusters, networks, and firm innovativeness. *Strategic Management Journal*, 26: 287-295.
- Bell, J., den Ouden, B., & Ziggers, G. W. 2006. Dynamics of cooperation: At the brink of irrelevance. *Journal of Management Studies*, 43(7): 1607-1619.
- Borgatti, S. P., Everett, M. G., & Freeman, L. C. 2002. *UCINET for Windows: Software for social network analysis*. Needham, MA: Analytic Technologies.
- Borgatti, S. P., & Foster, P. C. 2003. The network paradigm in organizational research: A review and typology. *Journal of Management*, 29(6): 991-1013.
- Brass, D. J., Galaskiewicz, J., Greve, H. R., & Tsai, W. 2004. Taking stock of networks and organizations: A multi-level perspective. *Academy of Management Journal*, 47: 795-817.
- Browning, L. D., Beyer, J. M., & Shetler, J. C. 1995. Building cooperation in a competitive industry: SEMATECH and the semiconductor industry. *Academy of Management Journal*, 38: 113-151.
- Burkhardt, M. E., & Brass, D. J. 1990. Changing patterns or patterns of change: The effect of a change in technology on social network structure and power. *Administrative Science Quarterly*, 42: 339-365.
- Burt, R. S. 1992. *Structural holes: The social structure of competition*. Cambridge, MA: Harvard University Press.
- Coleman, J. 1990. *Foundations of social theory*. Cambridge, MA: Belknap.
- Davis, G. F., Yoo, M., & Baker, W. E. 2003. The small world of the American corporate elite, 1982-2001. *Strategic Organization*, 1: 301-326.
- Dhanaraj, C., & Parkhe, A. 2006. Orchestrating innovation networks. *Academy of Management Review*, 31(3): 659-669.
- Dickson, P. H., & Weaver, K. M. 1997. Environmental determinants and individual-level moderators of alliance use. *Academy of Management Journal*, 40(2): 404-425.
- DiMaggio, P. J., & W. W. Powell. 1983. The iron cage revisited: Institutional isomorphism and collective rationality in organizational fields. *American Sociological Review*, 48: 147-167.
- Faulkner, D. O., & de Rond, M. 2000. Perspectives on cooperative strategy. In D. O. Faulkner & M. de Rond (Eds.), *Cooperative strategy*: 3-39. Oxford, UK: Oxford University Press.
- Fried, B. J., Johnsen, M. C., Starrett, B. E., Calloway, M. O., & Morrissey, J. P. 1998. An empirical assessment of rural community support networks for individuals with severe mental disorders. *Community Mental Health Journal*, 34(1): 39-56.
- Galaskiewicz, J. 2007. Has a network theory of organizational behaviour lived up to its promises? *Management and Organization Review*, 3: 1-18.
- Galaskiewicz, J., & Wasserman, S. 1994. Introduction: Advances in the social and behavioral sciences from social network analysis. In S. Wasserman & J. Galaskiewicz (Eds.), *Advances in social network analysis*: xi-xvii. Thousand Oaks, CA: Sage.
- Ghoshal, S., & Bartlett, C. A. 1990. The multinational corporation as an interorganizational network. *Academy of Management Review*, 15: 603-625.
- Grabher, G. 1993. The weakness of strong ties: The lock-in of regional development in the Ruhr area. In G. Grabher (Ed.): *The embedded firm*: 265-277. London: Routledge.
- Grabher, G., & Powell, W. W. 2004. Introduction. In G. Grabher & W. W. Powell (Eds.), *Networks*, vol. 1: xi-xxxi. Cheltenham, UK: Elgar.
- Granovetter, M. 1985. Economic action and social structure: The problem of embeddedness. *American Journal of Sociology*, 91(3): 481-510.
- Gulati, R. 1995. Does familiarity breed trust? The implications of repeated ties for contractual choice in alliances. *Academy of Management Journal*, 38: 85-112.
- Gulati, R., & Gargiulo, M. 1999. Where do interorganizational networks come from? *American Journal of Sociology*, 104(5): 1439-1493.

- Hasnain-Wynia, R., Sofaer, S., Bazzoli, G., Alexander, J., Shortell, S., Conrad, D., Chan, B., Zukoski, A., & Sweeney, J. 2003. Members' perceptions of community care network partnerships' effectiveness. *Medical Care Research and Review*, 60(4): 40S-62S.
- Hendry, C., Brown, J., Defillippi, R., & Hassink, R. 1999. Industry clusters: Opto-electronics in 6 regions in UK, USA and Germany. In A. Grandori (Ed.), *Interfirm networks: Organization and industrial competitiveness*: 151-184. London: Routledge.
- Hinings, C. R., & Greenwood, R. 1988. *The dynamics of strategic change*. Oxford, UK: Basil Blackwell.
- Human, S. E., & Provan, K. G. 2000. Legitimacy building in the evolution of small-firm networks: A comparative study of success and demise. *Administrative Science Quarterly*, 45: 327-365.
- Jarillo, J. C. 1988. On strategic networks. *Strategic Management Journal*, 9: 31-41.
- Johnsen, M., Morrissey, J. P., & Calloway, M. 1996. Structure and change in child mental health service delivery networks. *Journal of Community Psychology*, 24(3): 275-289.
- Jones, C., Hesterly, W. S., & Borgatti, S. P. 1997. A general theory of network governance: Exchange conditions and social mechanisms. *Academy of Management Review*, 22: 911-945.
- Kilduff, M., & Tsai, W. 2003. *Social networks and organizations*. Thousand Oaks, CA: Sage.
- Kilduff, M., Tsai, W., & Hanke, R. 2006. A paradigm too far? A dynamic stability reconsideration of the social network research program. *Academy of Management Journal*, 31(4): 1031-1048.
- Knight, L., & Pye, A. 2005. Network learning: An empirically derived model of learning by groups of organizations. *Human Relations*, 58(3): 369-392.
- Kogut, B. 2000. The network as knowledge: Generative rules and the emergence of structure. *Strategic Management Journal*, 21(3): 405-425.
- Koka, B. R., Madhavan, R., & Prescott, J. E. 2006. The evolution of interfirm networks: Environmental effects on patterns of network change. *Academy of Management Review*, 31(3): 721-737.
- Kraatz, M. S. 1998. Learning by association? Interorganizational networks and adaptation to environmental change. *Academy of Management Journal*, 41(6): 621-643.
- Krätke, S. 2002. Network analysis of production clusters: The Potsdam/Babelsberg film industry as an example. *European Planning Studies*, 10(1): 27-54.
- Laumann, E. O., & Knoke, D. 1987. *The organizational state. Social choice in national policy domains*. Madison: University of Wisconsin Press.
- Laumann, E. O., Marsden, P. V., & Prensky, D. 1983. The boundary specification problem in network analysis. In R. Burt & M. J. Minor (Eds.), *Applied network analysis: Structural methodology for empirical social research*, 18-34. Beverly Hills, CA: Sage.
- Leirich, F., Sydow, J., & Provan, K. G. 2006. *Cliques within clusters—Multi-dimensional network integration and innovation activities*. Paper presented at the annual colloquium of the European Group for Organizational Studies, Bergen, Norway.
- Lipparini, A., & Lomi, A. 1999. Interorganizational relations in the Modena biomedical industry: A case study in local economic development. In A. Grandori (Ed.), *Interfirm networks: Organization and industrial competitiveness*: 120-150. London: Routledge.
- Lutz, S. 1997. Learning through intermediaries: The case of interfirm research collaborations. In M. Ebers (Ed.), *The formation of interorganizational networks*: 220-237. New York: Oxford University Press.
- Madhavan, R., Gnyawali, D. R., & He, J. 2004. Two's company, three's a crowd? Triads in cooperative-competitive networks. *Academy of Management Journal*, 47: 918-927.
- Mitchell, J. C. (Ed.) 1969. *Social networks in urban settings*. Manchester, UK: Manchester University Press.
- Monge, P. R., & Contractor, N. S. 2003. *Theories of communication networks*. New York: Oxford University Press.
- Moore, M. H. 2000. Managing for value: Organizational strategy in for-profit, nonprofit, and governmental organizations. *Nonprofit and Voluntary Sector Quarterly*, 29: 183-204.
- Morrissey, J. P., Calloway, M., Bartko, W. T., Ridgley, S., Goldman, H., & Paulson, R. I. 1994. Local mental health authorities and service system change: Evidence from the Robert Wood Johnson Foundation Program on Chronic Mental Illness. *Milbank Quarterly*, 72(1): 49-80.
- Morrissey, J. P., Tausig, M., & Lindsey, M. 1985. Community mental health delivery systems: A network perspective. *American Behavioral Scientist*, 28: 704-720.
- Oliver, C. 1990. Determinants of interorganizational relationships: Integration and future directions. *Academy of Management Review*, 15: 241-265.

- Olson, M. 1965. *The logic of collective action*. Cambridge, MA: Harvard University Press.
- Ostrom, E. 1990. *Governing the commons: The evolution of institutions for collective action*. New York: Cambridge University Press.
- Owen-Smith, J., & Powell, W. W. 2004. Knowledge networks as channels and conduits: The effects of spillovers in the Boston biotechnology community. *Organization Science*, 15: 5-21.
- Pfeffer, J., & Salancik, G. R. 1978. *The external control of organizations: A resource dependence perspective*. New York: Harper & Row
- Podolny, J. M., & Page, K. L. 1998. Network forms of organization. *Annual Review of Sociology*, 24: 57-76.
- Powell, W. W. 1990. Neither market nor hierarchy: Network forms of organization. In B. M. Staw & L. L. Cummings (Eds.), *Research in organizational behavior*, vol. 12: 295-336. Greenwich, CT: JAI.
- Powell, W. W., Koput, K. W., & Smith-Doerr, L. 1996. Interorganizational collaboration and the locus of innovation: Networks of learning in biotechnology. *Administrative Science Quarterly*, 41(1): 116-145.
- Powell, W. W., White, D. R., Koput, K. W., & Owen-Smith, J. 2005. Network dynamics and field evolution: The growth of interorganizational collaboration in the life sciences. *American Journal of Sociology*, 110(4): 1132-1206.
- Provan, K. G., Isett, K. R., & Milward, H. B. 2004. Cooperation and compromise: A network response to conflicting institutional pressures in community mental health. *Nonprofit and Voluntary Sector Quarterly*, 33(3): 489-514.
- Provan, K. G., & Kenis, P. 2006. *Modes of network governance: Structure, management and effectiveness*. Working paper, Eller College of Management, University of Arizona, Tucson.
- Provan, K. G., & Milward, H. B. 1995. A preliminary theory of network effectiveness: A comparative study of four community mental health systems. *Administrative Science Quarterly*, 40: 1-33.
- 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.
- Provan, K. G., Nakama, L., Veazie, M. A., Teufel-Shone, N. I., & Huddleston, C. 2003. Building community capacity around chronic disease services through a collaborative network. *Health Education and Behavior*, 30(6): 646-662.
- Provan, K. G., & Sebastian, J. 1998. Networks within networks: service link overlap, organizational cliques, and network effectiveness. *Academy of Management Journal*, 41(4): 453-462.
- Raab, J., & Milward, H. B. 2003. Dark networks as problems. *Journal of Public Administration Research and Theory*, 13(4): 413-439.
- Ring, P. S., & Van de Ven, A. H. 1994. Developmental processes of cooperative interorganizational relationships. *Academy of Management Review*, 19(1): 90-118.
- Rowley, T. J., Greve, H. R., Rao, H., Baum, J. A. C., & Shipilov, A. V. 2005. Time to break up: Social and instrumental antecedents of firm exits from exchange cliques. *Academy of Management Journal*, 48(3): 499-520.
- Safford, S. 2004. Why the garden club couldn't save Youngstown: Civic infrastructure and mobilization in economic crises. Working paper, MIT Industrial Performance Center, Cambridge, MA.
- Salancik, G. R. 1995. Wanted: A good network theory of organization. *Administrative Science Quarterly*, 45: 1-24.
- Saxenian, A. 1994. *Regional advantage: Culture and competition in Silicon Valley and Route 128*. Cambridge, MA: Harvard University Press.
- Schilling, M. A., & Phelps, C. C. 2005. *Interfirm collaboration networks: The impact of small world connectivity on firm innovation*. Academy of Management Best Paper Proceedings, Honolulu, HI.
- Soda, G., & Usai, A. 1999. The dark side of dense networks: From embeddedness to indebtedness. In A. Grandori (Ed.), *Interfirm networks: Organization and industrial competitiveness*: 276-302. London: Routledge.
- Soda, G., Usai, A., & Zaheer, A. 2004. Network memory: The influence of past and current networks on performance. *Academy of Management Journal*, 47(6): 893-906.
- Sydow, J. 2004. Network development by means of network evaluation? Explorative insights from a case in the financial services industry. *Human Relations*, 57(2): 201-220.
- Sydow, J., & Windeler, A. 1998. Organizing and evaluating interfirm networks: A structurationist perspective on network processes and network effectiveness. *Organization Science*, 9(3): 265-284.
- Trubek, D. M., Mosher, J., & Rothstein, J. S. 2000. Transnationalism in the regulation of labor relations: International regimes and transnational advocacy networks. *Law and Social Inquiry*, 25(4): 1187-1214.
- Uzzi, B. 1997. Social structure and competition in interfirm networks: The paradox of embeddedness. *Administrative Science Quarterly*, 42: 35-67.
- Uzzi, B., & Spiro, J. 2005. Collaboration and creativity: The small world problem. *American Journal of Sociology*, 111: 447-504.

- Van Raak, A., & Paulus, A. 2001. A sociological systems theory of interorganizational network development in health and social care. *Systems Research and Behavioral Science*, 18: 207-224.
- Venkatraman, N., & Lee, C. 2004. Preferential linkage and network evolution: A conceptual model and empirical test in the US video game sector. *Academy of Management Journal*, 47(6): 876-888.
- Walker, G., Kogut, B., & Shan, W. 1997. Social capital, structural holes and the formation of an industry network. *Organization Science*, 8: 109-125.
- Watts, D. 1999. Networks, dynamic, and the small world phenomenon. *American Journal of Sociology*, 105: 493-527.
- Watts, D., & Strogatz, S. H. 1998. Collective dynamics of "small-world" networks. *Nature*, 393: 440-442.
- Westphal, J. D., Gulati, R., & Shortell, S. 1997. Customization or conformity? An institutional and network perspective on the content and consequences of TQM adoption. *Administrative Science Quarterly*, 42(2): 366-394.
- Wiley-Hardwick, S. 2005. The ties that bind: Transnational migrant networks at the Canadian-U.S. borderland. *American Review of Canadian Studies*, 35(4): 667-682.
- Williamson, O. E. 1991. Comparative economic organization: the analysis of discrete structural alternatives. *Administrative Science Quarterly*, 36(2): 269-96.
- Zaheer, A., McEvily, B., & Perrone, V. 1998. Does trust matter? Exploring the effects of inter-organizational and interpersonal trust on performance. *Organization Science*, 9: 141-159.

Biographical Notes

Keith G. Provan earned his PhD at the State University of New York, Buffalo. He is McClelland Professor, School of Public Administration and Policy, and Department of Management and Organizations, both of which are in the Eller College of Management, University of Arizona. His research focuses on organizational networks.

Amy Fish earned an MA degree in sociology and is a PhD student in the School of Public Administration and Policy, Eller College of Management. Her research interests focus on the delivery of health services, especially through organizational networks.

Joerg Sydow earned his doctorate and habilitation in business administration at the Free University of Berlin, Germany, where he is professor of management, School of Business and Economics, and doctoral program director. He is currently an international visiting fellow of the Advanced Institute of Management Research in London.