

FRAMING INTERORGANIZATIONAL NETWORK CHANGE: A NETWORK INERTIA PERSPECTIVE

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We introduce the construct of network inertia, referring to a persistent organizational resistance to changing interorganizational network ties or difficulties that an organization faces when it attempts to dissolve old relationships and form new network ties. Previous research has neglected the process of network change in favor of an emphasis on identifying beneficial content effects of networks. We emphasize the constraints on network change and propose a multilevel conceptual model relating key sources of network inertia to changes in network ties. We also discuss the implications of network inertia for the evolution of networks.

In a growing body of research, scholars have focused on changes in (i.e., entry into or exit from) interorganizational relationships as a critical strategic option for organizations attempting to strengthen their capabilities (Hennart, Kim, & Zeng, 1998; Jones, Hesterly, Fladmoe-Lindquist, & Borgatti, 1998). If organizations are dissatisfied with partners that do not provide the desired resources, they attempt to change their partners to gain access to such resources from new partners. However, this assumed flexibility in network change is limited because of the embedded nature of interorganizational ties (Uzzi, 1996). Once relationship-specific routines such as certain technology-based rules or embedded cultures become institutionalized between two parties, it is unlikely the firms will replace their partners with new ones based solely on economic motivations. In this paper we conceptualize the constraints on network change as network inertia—a persistent organizational resistance to changing interorganizational dyadic ties or difficulties that an orga-

nization faces when it attempts to dissolve old relationships and form new network ties.

Research on the formation and dissolution of interorganizational relationships has gained much attention in management and sociology (Gulati, 1998; Gulati & Gargiulo, 1999; Inkpen & Beamish, 1997; Mizruchi & Galaskiewicz, 1994). Despite its success in explaining vital rates of interorganizational network ties, this stream of research has tended to explain the formation or dissolution of interorganizational dyadic ties as discrete events, rather than as a sequence of events that unfold over time. Given that interorganizational networks are formed, dissolved, and reformed on a continuous basis, we view network evolution (i.e., changes) as sequential processes of network dissolution with old partners and reformation with new ones. Several observations follow from such an evolutionary approach to networks.

In previous research on interorganizational networks, scholars have paid insufficient attention to processes that constrain network transformation. Instead, they have implicitly adopted an adaptation perspective on interorganizational networks and have assumed that networks are flexible enough to be created and dissolved easily as a result of comparing returns to organizational performance with current and new partners. Investigating only the “beneficial”

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content of networks, researchers have been tempted to argue that changes in networks are always beneficial as long as new partners provide better resources. Such a perspective, however, overlooks organizations that suffer from unsuccessful network transformation and even fail during the processes of transformation. This approach could be termed the *content-based perspective* on interorganizational networks, because it identifies only the beneficial content of networks.

In contrast, a *process-based perspective* emphasizes the constraints on transitions from old to new partners. The content-based perspective on interorganizational networks is typically subject to sample selection bias, since researchers only examine organizations that form networks with new partners successfully. Concerns about such bias in interorganizational network research have been raised by Podolny and Page, who argue that "researchers must counterbalance the focus on prevalence and functionality (of networks) with an equally strong focus on constraint and dysfunctionality" (1998: 73), but few researchers have addressed these concerns.

Some recent research has started to shift the emphasis from network content to network evolutionary processes. Scholars have examined the developmental processes of specific interorganizational relationships in terms of how organizations negotiate, commit to, and evaluate their relationships (Arino & Torre, 1998; Reuer, Zollo, & Singh, 2002; Ring & Van de Ven, 1994). Ring and Van de Ven (1994) have proposed a process framework that describes the evolution of alliances through repeated negotiations. Arino and Torre (1998) have pointed out the importance of procedural issues and positive feedback loops in maintaining interorganizational ties when two parties renegotiate terms or contracts. Similarly, Reuer, Zollo, and Singh (2002) have explained postformation alliance evolution in terms of changes in such governance structures as contracts, committees, and monitoring mechanisms. However, in research on such developmental processes by participating organizations, scholars have been silent on the processes that constrain network changes.

Further, with a few notable exceptions (Ebers, 1999; Gulati, 1995; Levinthal & Fichman, 1988), previous research has ignored constraints on network change that arise from the properties of existing embedded relationships. Levinthal and

Fichman (1988) have argued that relationship-specific assets between auditors and their clients develop over time as they run their relationships effectively and learn from each other. These researchers show that tie persistence is greater when relationship-specific assets develop or when prior tie duration is long. Gulati (1995) has argued that prior alliances based on trust and relationship-specific routines increase the likelihood that firms will build alliances with the same partners in the future. And Ebers (1999) has developed propositions on impediments to network change showing that interorganizational ties are likely to be stable when they involve a high degree of partner-specific investment, or high setup or fixed costs, and when the adjustment of initial network conditions is costly.

Based on a partial understanding of some constraints on network change from the prior work, we develop an integrated theoretical framework describing causal mechanisms for the action of such constraints, accounting for the roles of internal organizational characteristics, interorganizational dyadic ties, interorganizational network positions, and factors in the external environment. We also show how some internal organizational characteristics and features of dyadic ties interact to influence the likelihood of network change.

We explore these constraints under a concept of "network inertia," drawing on the structural inertia theory of organizational ecology (Hannan & Freeman, 1984, 1989; Hannan, Pólos, & Carroll, 2002a,b,c). According to structural inertia theory, inertia is not a symptom of "bad management"; rather, it is the natural result of creating a well-tuned organizational architecture that exploits strategic advantage and synergy (Barnett & Carroll, 1995; Hannan & Freeman, 1984). Similarly, network inertia can be regarded not as a symptom of poorly managed interorganizational networks but as a by-product of the previously successful management of networks that generate synergies for the participating organizations.¹

¹ Inertia is conceptually different from escalation of commitment, a situation where a decision maker commits additional resources to a failing course of action (Staw, 1981). Escalation of commitment is often used as an example of bad management.

THEORETICAL BACKGROUND

Why has previous research paid insufficient attention to constraints on network change? We believe it is because the organizational theories that have been used to support network-related arguments have neglected such processes. These organizational theories include transaction cost theory, resource dependence theory, and neoinstitutionalism. All share an adaptation perspective on organizations, which implies that an organization can deal with emerging environmental problems by building optimal structures and employing various strategies, including cooperative interorganizational networks. From this perspective, interorganizational networks are assumed to be flexible enough to be created and manipulated at little cost. Thus, interorganizational networks can be used when transactions cannot easily be conducted through market contracts but the transaction costs involved are not so high as to mandate internal organization within a hierarchy (Williamson, 1975), when there is a resource gap between the focal organization and its partners (Baker, 1990; Miner, Amburgey, & Stearns, 1990; Pfeffer & Salancik, 1978), or when the quality of actors is hard to evaluate and others make inferences about their quality by examining their interorganizational networks so as to reduce the uncertainty about those actors (Baum & Oliver, 1992; Human & Provan, 2000; Podolny, 1993; Stuart, Hoang, & Hybels, 1999).

By considering primarily the beneficial effects of networks, organizational theories based on the adaptation perspective have neglected the obstacles organizations face when attempting to modify the structure of their network ties. Consider instead the perspective proposed by Barnett and Carroll (1995). They argue that, to understand the differences between adaptation and selection, the content effects pertaining to the destination state in an organizational transformation need to be separated from the costs of undergoing the transformation (process effects). Organizational change results in improved performance only when the organization moves to a more attractive destination state and is able to absorb the costs of undertaking the change. Thus, if change in network ties is treated as a type of organizational change, then not only do beneficial network ties need to be identified but the disruptions caused by network transforma-

tion also need to be overcome. Such a process-based analysis should help to increase our understanding of the evolutionary dynamics of interorganizational ties.

Research on interorganizational network ties often applies a rational cost-benefit calculus to retaining and changing such ties. These rational models assume that if the costs of maintaining existing network ties are greater than their benefits, an organization with a great need for network change will dissolve its current ties and form new ties without much difficulty. Although such rational calculation may dictate that an organization should change its ties, the organization will still experience difficulty in doing so to the extent that it is constrained by what we defined above as network inertia. In that respect, the propositions developed below have a *ceteris paribus* nature—the constraints will operate even if the need for network change is recognized. Furthermore, these arguments are based on the assumption that organizations seek to catch up with constantly changing environments, and network change is one way of aligning organizations with such environments.

For the purposes of this paper, we define network change as the dissolution or replacement of an interorganizational network tie, and we consider only completely broken dyadic ties between two partners (e.g., Baker, Faulkner, & Fisher, 1998) without a planned fixed duration (Inkpen & Beamish, 1997; Park & Ungson, 1997). Sometimes, network ties are dissolved merely because they were designed to last for a specific duration. We do not consider network inertia as influencing the dissolution of such ties.

INERTIAL CONSTRAINTS ON CHANGES IN INTERORGANIZATIONAL TIES

When an organization attempts to change its network partner, the change is greatly influenced by four types of constraints derived from network relationships among relevant social actors at four different levels: internal constraints (intraorganizational networks), network tie-specific constraints (interorganizational dyadic ties), network position-specific constraints (interorganizational network position), and external constraints (the interorganizational field).

We can define an organization as a structure in which intraorganizational interactions form "a centralized network in which the vast major-

ity of ties flow to or from one particular node" (Podolny & Page, 1998: 59). Intraorganizational networks refer to relationships among people, subunits, teams, and departments (Krackhardt & Brass, 1994), which often represent different interests and ideologies in an organization (Cyert & March, 1963). Accordingly, decisions about organizational structures and strategies, including changes in interorganizational ties, are the context for competition among groups that represent different interests or ideologies within the organization, and changes in interorganizational ties are therefore constrained by the internal dynamics of the organization.

Network tie-specific constraints coming from an organization's dyadic relationships with its partners also affect the organization during network transformation, because the very benefits that the organization has received through its network ties lead to network inertia. From a structural inertia perspective (Hannan & Freeman, 1984), network inertia is not a negative symptom of poor networks but, rather, a by-product of successfully managed networks. The unique relational characteristics in a particular network tie between two parties represent the level of attachment reflecting their entire history of relations (Cook, 1977; Levinthal & Fichman, 1988). In building an interorganizational tie, participating organizations develop relation-specific assets, such as institutionalized routines and human assets, over time. These specialized assets have been suggested as a mechanism through which the interorganizational tie leads to competitive advantage for those organizations (Blau, 1964; Dyer & Singh, 1998; Williamson, 1985). When an organization attempts to change its current tie, it risks losing the value of such relation-specific assets, perceives the change as being too costly, and thus is less likely to change its network partner (Ebers, 1999; Levinthal & Fichman, 1988). Even the recognition of the need for network tie change becomes more difficult for the organization because of its existing attachment with the current partner (Galaskiewicz & Zaheer, 1999).

In social network research, the distinction between the properties of dyadic ties and the global properties of the entire network is important (Scott, 2000). Although the entire network is derived from the configuration of dyadic ties, its characteristics cannot be reduced simply to the sum of the characteristics of the dyadic ties (Lin-

coln, 1982). The social structure of the entire network influences an actor's actions by constraining the set of available actions and shaping the actor's dispositions (Marsden, 1981) through its position in the structure. The actor's position in the network also constrains other actors' cooperative behaviors embedded in the closed structure (Coleman, 1988; Granovetter, 1985; Shan, Walker, & Kogut, 1994). These arguments suggest that an organization's position in the context of the entire network is an important constraint on changing its dyadic ties (Gulati, 1998).

Finally, scholars generally agree that an organization's environment plays a significant role in shaping its activities and performance. Proponents of a network perspective argue that the most significant elements of an organization's environment are represented by the other organizations with which it must interact, including key suppliers, customers, regulatory agencies, and organizations with similar services and products (Nohria, 1992). This environment of connections between an organization and other social actors is often referred to as an *interorganizational field*—"a field of relationships that bind organizations together" (Nohria, 1992: 5). Changing organizational structures and strategies—specifically, changing interorganizational ties—depends on how an organization interacts with other organizations in its interorganizational field.

After proposing a multilevel conceptual model of how these four different sources of network inertia influence network change, we also examine how the first two sources of constraint (internal and network-specific constraints) generate joint inertia effects on network change.

Intraorganizational Networks As Internal Constraints

Internal constraints on network change can be viewed in terms of the stability and complexity of intraorganizational networks. Intraorganizational networks tend to become stable and even rigid, with established structures, routines, and cultures, over time (network stability), or to become complicated, with different interest groups representing certain practices or ideologies with increasing organizational size (network complexity). Stable and complex networks within an organization exert great influence on any changes in interorganizational ties.

Organizational age and size. New organizations tend to have lower levels of reliability and accountability than older ones (Hannan & Freeman, 1984). Developing trust and working relationships and acquiring a range of skills and knowledge take time (Stinchcombe, 1965). Structural inertia increases with age as structures, operating procedures, and roles become institutionalized over time. From a network perspective, this means that the ways people and units interact with one another become stable or even rigid. Previous research has shown that organizations are less likely to change as they age (e.g., Amburgey, Kelly, & Barnett, 1993; Delacroix & Swaminathan, 1991; Miller & Chen, 1994).

Structural inertia also increases with organizational size (Hannan & Freeman, 1984). As size increases, the number of units grows and the complexity of hierarchical linkages and relationships among people and units also increases. A larger number of units and longer chains of hierarchical relationships reduce the speed with which an organization can reorganize in response to environmental changes (Hannan & Freeman, 1984; Hannan et al., 2002b). Several studies have shown that larger organizations are less likely to change (e.g., Delacroix & Swaminathan, 1991), while other studies have shown that midsize organizations are the most likely to change (e.g., Haveman, 1993). Taken together, these studies suggest that organizational inertia makes organizations less likely to undertake architectural change that results in long cascades of change, and such architectural change damages organizational performance, at least for a short period of time (Hannan et al., 2002b,c).

Changes in interorganizational ties can be considered a type of organizational change, and, thus, structural inertia in older and larger organizations may reduce the speed of dissolving old ties and establishing new ones in a changing environment. An older organization with a history of established employment relations, experiences, and routines may find it hard to replace current partners with new ones, because such changes often require high levels of commitment and significant resources. As size increases, an organization may experience complexity arising from coordinating a large number of units and managing hierarchical sets of linkages and relationships among people and units. This increased complexity leads to diffi-

culty in reconciling different interests among individuals and groups when attempting to find new partners for core activities. The networks of older and larger organizations therefore are expected to exhibit a greater degree of network inertia.

Proposition 1: The older an organization, the less likely it is to change its network ties.

Proposition 2: The larger an organization, the less likely it is to change its network ties.

Organization's past history of network change. A complete understanding of organizational change requires consideration of an organization's history of changes. Organizations learn from what they have done in the past and become better at it with experience (Argyris, 1999; Hannan & Freeman, 1989; March, 1991). As they accumulate knowledge and experience in a set of activities, their propensity to repeat these activities increases accordingly (Amburgey et al., 1993; Dobrev, Kim, & Hannan, 2001).

The propensity to maintain consistency in organizational action by modeling current behaviors on past actions also applies to changes in networks. Gulati (1995) reports that, as the number of past alliances increases, the likelihood an organization will form a new alliance with the same partner also increases. Similarly, an organization's prior experiences with network change are expected to increase the likelihood of change in its network ties in the future. Once an organization knows how to change its networks and manage the processes during network transformation, it becomes more experienced at that particular kind of organizational change. This know-how concerning interorganizational network change has been conceptualized as "alliance capability," which refers to an organization's ability to identify partners, initiate alliances, and engage in the ongoing management, possible restructuring, and termination of these alliances (Khanna, 1998). This alliance (or network) capability allows the organization to better absorb the collective knowledge generated in networks, allows it to reach its network goals quickly, and frees it to pursue new goals that require network changes (Larsson, Bengtsson, Henriksson, & Sparks, 1998).

Furthermore, an organization with prior experience in implementing network change may draw on this cumulative experience to deal with various problems arising from internal and external factors. An organization that succeeds in solving problems based on knowledge gained from past network changes tends to have a higher propensity to change network ties whenever it needs to solve new problems. Based on this reasoning, we expect repetitive momentum to increase the likelihood of future network changes.

Proposition 3: The greater the number of network changes that an organization has previously experienced, the more likely it is to change its network ties.

Interorganizational Dyadic Ties As Network Tie-Specific Constraints

The characteristics of dyadic ties that reflect relation-specific assets and previous attachment between partners make tie changes harder to achieve. Previous research on interorganizational attachment (Dyer & Singh, 1998; Levinthal & Fichman, 1988) has shown that, in the development of interorganizational ties, dyadic tie characteristics emerge, lead to benefits, and become constraints on network changes in terms of four key dimensions: relational, knowledge-sharing, institutionalized, and cognitive.

The relational dimension of interorganizational ties involves relationship-specific interpersonal ties between the agents of participating organizations developed through long-term personal interactions (Doz, 1996; Luo, 2001; Madhok, 1995; Ring & Van de Ven, 1994). Although these personal relationships play a critical role in maintaining interorganizational ties by preventing the occurrence of cheating, such strong personal relationships may lock an organization into unproductive relations with its partners, and they possibly may lead to network inertia (Galaskiewicz & Zaheer, 1999).

The knowledge-sharing dimension involves collective learning (Dyer & Singh, 1998; Powell, Koput, & Smith-Doerr, 1996), in which participating organizations tend to develop expertise peculiar to their partners' needs (Levinthal & Fichman, 1988). However, this partner-specific learning can constrain the organization's further

innovation and network change strategies (Levinthal & March, 1993).

The institutionalized dimension involves institutionalized routines, such as certain rules, norms, taken-for-granted behaviors among participating organizations, and the bureaucratic and technical structures that emerge within an interorganizational tie. Once these network-specific routines and structures are institutionalized, they are less subject to change and, thus, become constraints because of the high setup or fixed costs involved (Ebers, 1999).

The cognitive dimension involves cultural values and goals that are shared by the partners in an interorganizational tie. Successful collaboration often requires cognitive integration of employees in the participating organizations, as well as the creation of a shared identity, cultural values, and ideology (Nahapiet & Ghoshal, 1998; Parkhe, 1991), thereby reducing the possibility of opportunistic behavior (Ouchi, 1980). However, these shared identity and cultural values within the tie lead to organizational members' strong attachment to the current tie and, thus, their resistance to network tie change.

Using these four dimensions of interorganizational network ties as an analytical framework, we explore the question of how dyadic tie characteristics influence the likelihood an organization will change its network partners. Consistent with recent research (Dyer & Singh, 1998), the strategic behavior of an organization in a network tie may be mainly influenced by the previous history, the total volume (scale), and the breadth (scope) of its dyadic tie with its partner. Thus, we examine how network tie duration, size, and multiplexity influence the likelihood the focal organization will change its network tie.

Network tie duration. From a structural inertia perspective, network inertia represents the past success of network ties. The duration of network ties between partners has been suggested as one indicator of the successful performance of interorganizational ties (Geringer & Hebert, 1991; Kogut, 1988). Parkhe (1993) has argued that longer tie duration results in a reduction in each partner's perception of opportunistic behavior by the other, an increase in trust, and a greater possibility of resolving conflict among the partners in a dyadic tie. Persistent network ties indicate past success and, thus, possible inertia,

and an organization may find it difficult to change such long-lived ties.

What specific mechanisms then increase the degree of network inertia and make network partner change harder? The relational dimension of a dyadic tie involves personal bonds between agents of the participating organizations established through repetitive interactions in the network tie development process (Arino & Torre, 1998; Ring & Van de Ven, 1994). Personal relationships based on trust restrain each actor from taking advantage of its partner organization (Seabright, Levinthal, & Fichman, 1992). Because of the affective nature of personal relationships and the enormous costs of building trust, however, these long-lasting personal relationships can also become a source of network inertia resistant to network partner change (cf. Krackhardt, 1994).

A long-lasting dyadic tie also facilitates the development of greater relation-specific expertise and generates knowledge useful only in the context of the current network tie. Organizations are often myopic in their learning, relying too much on exploiting existing knowledge instead of exploring new directions (Levinthal & March, 1993). As a result of successful learning experience in a long-lasting relationship, an organization becomes specialized in niches in which its previous experience with the current partner yields advantages. However, the organization also becomes increasingly removed from other bases of experience and knowledge that it could potentially explore (David, 1985). Thus, the organization becomes both more reluctant to change its network tie and vulnerable to environmental change.

In network ties of longer duration, an understanding of the normative and technical characteristics—and of the specific styles of partners—becomes institutionalized through informal and formal routines (Doz, Olk, & Ring, 2000). These highly partner-specific routines and structures in a long-lived network tie can result in network inertia because of the high setup or fixed costs of specialized systems and relevant equipment and technology (Ebers, 1999). In the context of auditor-client relationships, Levinthal and Fichman (1988) have shown that the dissolution of a longer-term auditor relationship with a specific client is more difficult, because the auditing firm has built the accounting system and has

accumulated know-how peculiar to the specific client over a long period of time.

Attachment and commitment in a relationship affect the members' attitudes, beliefs, goals, and values (Salancik, 1977). As a result of long tie duration, the partners influence each other's organizational culture and assimilate elements of the other culture. Employees in each organization increasingly feel familiar with employees in the partner organization, and they identify themselves as members of an interorganizational tie rather than as members of separate organizations. These shared values and identity may influence the likelihood an organization will change its network partner. Based on these arguments, network inertia is expected to increase with the duration of network ties, and the organization will find it increasingly difficult to change its network partners.

Proposition 4: The longer the duration of an organization's network ties, the less likely it is to change them.

Network tie size. The size of a network tie represents the total volume—the scale aspect—of the participating organizations' involvement in a specific network tie, and it can be measured by such indicators as the total capital invested in the tie or the total sales or profits related to the dyadic tie. Because a larger network tie may lead to more frequent transactions, possibly greater tie benefits, and a higher level of interdependence and commitment (Dyer & Singh, 1998), the partners become subject to a common fate, thus impeding network tie change.

Individuals in boundary-spanning positions may acquire more power within their organization as the organization's business activities become more dependent on the network tie and the success of the network tie becomes more critical for the survival of the participating organizations (cf. Gulati, 1998). Furthermore, more frequent interactions from greater involvement in a tie may result in closer personal relationships between interacting agents in the participating organizations. These individuals may develop shared political interests in favor of the continuity of the network tie. Boundary spanners responsible for network tie maintenance therefore resist network tie change.

Collective knowledge generation or collective learning is one of the important outcomes of

alliances (Powell et al., 1996). A large-scale dyadic tie makes the partners recognize their strong interdependence. This recognition of a common fate encourages the partners to pursue common rather than private benefits from the dyadic tie by achieving collective learning through joint efforts (Khanna, 1998). However, collective learning also requires greater relation-specific expertise and investment in procedures for knowledge sharing, potentially leading to greater network inertia.

Larger organizations require more formalized and bureaucratic structures. Similarly, a large-scale network tie requires effective structures and technical routines to coordinate the different interests of the participating organizations, an effective communication system for a smooth flow of information (Monge et al., 1998), and an effective governance system to control the collaboration process associated with a highly interdependent large-scale tie (cf. Gulati & Singh, 1998). This greater investment in specific structures and institutionalized routines makes changes in the large-scale tie particularly unlikely.

In a large-scale network tie, employees in participating organizations often develop a shared identity and shared norms and values that affect network tie stability (Borys & Jemison, 1989). Through this process, people in the participating organizations start to identify themselves with the network tie as a separate entity. Because of organizational members' cognitive attachment to the current tie and their resistance to changes in this tie, the organization becomes locked into the existing network relation rather than pursues new network opportunities. Thus, a larger network tie, representing the scale of tie involvement, tends to increase network inertia and to make network change more difficult.

Proposition 5: The larger the size of an organization's network ties, the less likely it is to change them.

Network tie multiplexity. In social network research, multiplexity refers to the extent to which two actors are linked together by more than one relationship in a network (Verbrugge, 1979). In the context of an interorganizational network, network tie multiplexity represents the breadth—the scope aspect—of the involvement of participating organizations, possibly measured by the number of business functions the network tie en-

compasses (e.g., R&D and manufacturing), the number of products produced in the network tie, or the number of markets the network tie serves (cf. Killing, 1988).

Individual actors involved in multiplex relationships are less able to withdraw from their existing ties, because withdrawal in one context may jeopardize existing relationships in other contexts (Mitchell, 1969). Previous research has suggested that network multiplexity constrains individual actors' behaviors, decreases the permeability of actors' networks to new relations, and draws those actors into existing networks (Jackson, Fischer, & Jones, 1977; Minor, 1983). Similarly, network multiplexity in an interorganizational tie indicates how much the network tie between partners is imbued with obligations to and expectations about each other (cf. Feld, 1997; White, Boorman, & Breiger, 1976). Therefore, network multiplexity may lead to stronger network inertia and may constrain the likelihood an organization will change network partners.

If a dyadic tie involves different business functions, the set of employees who are involved in the network tie from diverse functional areas on each side and who share a personal interest in the success of the tie is thus larger and leads to greater resistance to network change. Furthermore, the greater level of embeddedness associated with multiplex ties (Feld, 1997) may lead to closer relationships, and to greater solidarity and trust, among boundary spanners. Thus, the personal relationships of the large number of people involved on each side of the existing tie lock the organization into the existing relationship.

In a multiplex network context, participating organizations rely on synergy across various functional areas to pursue collective learning. An organization with a multiplex tie needs to integrate the expertise and knowledge gained in various functional areas, because innovation and learning in one area influence learning in other areas. As this partner-specific knowledge sharing spreads through more diverse functional areas, the organization is subject to greater network inertia.

A multiplex tie also requires more complex mechanisms to coordinate the network interactions of the participating organizations across multiple functions. Formal management structures, such as the governance system and tech-

nical and other institutionalized routines, need to be consistent, integrated, and specific to the partner across various functional areas. For instance, changing the partner in a multiplex tie involves simultaneously changing manufacturing technology, institutionalized marketing know-how, and the corresponding accounting system. The change of the multiplex tie is therefore harder to implement.

Through greater interaction among a larger number of employees involved in various functional areas, and through the use of integrated mechanisms, the partners can better understand each other. The enforceable trust and solidarity that emerge from the embedded nature of network multiplexity lead to stronger identification of employees in the participating organizations with the current network tie (cf. Portes & Sensenbrenner, 1993). Thus, we expect tie multiplexity, representing the scope of tie involvement, to increase network inertia.

Proposition 6: The more multiplex an organization's network ties, the less likely it is to change them.

Interorganizational Network Positions As Network Position-Specific Constraints

Beyond the dyadic tie between two partners, an organization's actions, such as network change, are also constrained by its position in the entire network, which is not reducible to aggregates of the characteristics of dyadic ties (Lincoln, 1982). Whereas a network position with structural holes involves an actor's active network positioning to reduce the uncertainty it faces, a position of high status is related to other actors' perceptions of the ability of the actor to reduce the uncertainty they face (Podolny, 2001). We examine how an organization's network position in terms of structural holes and status in the entire network influences the organization's likelihood of network partner change.

Structural holes as network position. Structural holes are the gaps between disconnected social actors, and structural hole theory emphasizes the importance of bridging ties connecting different social actors (Burt, 1992; see Fernandez & Gould, 1994, and Marsden, 1982, for further discussion of the concept of brokerage). Social actors who act as brokers, connecting otherwise disconnected groups, receive the best and most

timely information, because brokers have contacts on each side of a hole and have access to nonredundant information flows from disconnected groups (Burt, 1992, 1997). Social actors who span structural holes are also able to control the flow of information, because the disconnected groups communicate only through these brokers (Burt, 1992; Fernandez & Gould, 1994; Gould, 1989). Thus, a structural hole-rich position provides an organization with access to diverse and timely information in the network and confers it with structural autonomy.

These benefits from a structural hole-rich position enable an organization to be less subject to network inertia by increasing its networking capabilities. The occupation of a structural hole-rich network position can reduce an organization's uncertainty about its market decisions, including exchange partner choices. An organization in a hole-rich position tends to have more diverse information about market opportunities and risks, the ways to realize these opportunities and to deal with the risks, and the availability of potential new partners (Burt, 2000; Podolny, 2001). The structural autonomy and, thus, control over resource flows derived from a structural hole-rich position facilitate initiatives in strategic actions, such as changing network partners, instead of merely responding to the actions of other actors in the network (Gnyawali & Madhavan, 2001). Therefore, organizations that span structural holes tend to be more active and to take the initiative in changing their network partners; organizations with fewer structural holes are expected to exhibit greater network inertia and to be less likely to change their network partners.

Proposition 7: The more structural hole-rich position an organization occupies, the more likely it is to change its network ties.

Status as network position. Status has been suggested as an important structural and positional characteristic of an organization (Gulati, 1998; Podolny, 1993). Status in a network typically has been indicated by central positioning (Wasserman & Faust, 1994), by affiliation with high-status partners (Stuart et al., 1999), or by recognition from high-status peers (Podolny, 1994). The high status of an organization provides signals about the quality of the organization to other social actors in the network and

reduces the uncertainty faced by other social actors in choosing exchange partners (Podolny, 1993, 2001).

High status facilitates an organization's prominence in the network, and its prominence and visibility enable the high-status organization to have greater access to critical resources, such as information, financial capital, human capital, and better potential network partners (Fombrun, 1996; Knoke & Burt, 1983). Low-status organizations lack access to critical resources and face greater difficulties in dissolving existing ties, identifying potential partners, and successfully implementing network partner change. Furthermore, because potential exchange partners prefer building ties with high-status organizations, high-status organizations tend to have more options and greater discretion in their choice of partners (Podolny, 2001). In contrast, low-status organizations tend to have fewer options and face greater constraints derived from network inertia (cf. Jones et al., 1998). Consistent with this argument, Baker et al. (1998) have shown that an organization's status is positively related to its rate of dissolution of ties with clients.

Proposition 8: The higher an organization's status, the more likely it is to change its network ties.

Interorganizational Fields As External Constraints

An organization's external environment can be viewed as the interorganizational field in which it is embedded. The interorganizational field consists of both technical and institutional environments, each of which plays a pivotal role in shaping organizational behavior (Scott & Meyer, 1991). Theories of technical environments tend to emphasize competitive relationships among organizations; those of institutional environments tend to focus on patterns of conforming to rules or beliefs to gain legitimacy from other social actors. Competitive and institutional forces are destabilizing and stabilizing forces on market exchanges and interorganizational networks, respectively (Baker et al., 1998; DiMaggio & Powell, 1983; Scott & Meyer, 1991).

Technical environment. Among the most salient aspects of the technical environment are the competitive relationships among organizations. Previous research has shown that competi-

tive intensity increases the rate of organizational change. For instance, greater competitive pressure results in higher R&D expenditures and innovation rates (Stuart, 1999), and it encourages changes in organizational market positions (Dobrev et al., 2001).

Similarly, more intense competition is expected to lead to changes in interorganizational networks. Baker et al. (1998) found that competition increases the rate of dissolution of the ties between advertising agencies and their clients. Stuart (1998) showed that crowding in technological space promotes the likelihood of alliance formation among semiconductor companies. An increasing number of firms with competing designs increase market uncertainty (Hannan & Freeman, 1989), especially in industries featuring rapid technological innovation (Tushman & Anderson, 1986).

When an organization faces high market uncertainty and needs to catch up with new technologies, forming new interorganizational network ties with new partners who have marketing and technological capabilities helps it improve its performance (Nohria & Garcia-Pont, 1991). A greater expectation of learning from new partners makes new tie formation an attractive option for firms, thus lowering the degree of network inertia. Conversely, in a less competitive environment, an organization has less need to gain competitive advantage by forming alliances with others because of the relative stability and low uncertainty.

Proposition 9: The more competitive the environment, the more likely an organization is to change its network ties.

Institutional environment. The central idea of neoinstitutionalism (Meyer & Rowan, 1977) is that an organization tends to conform to norms and cultural codes in a community or society to gain legitimacy and, thus, to improve its performance or survival chances (DiMaggio & Powell, 1983; Meyer & Rowan, 1977). Zuckerman (1999) has demonstrated that the failure to acquire social legitimacy imposes an economic penalty on organizations in a financial market.

The dissolution and formation of interorganizational ties are among the many aspects of organizational behavior constrained by external legitimacy or norms. Changes in interorganizational networks might be difficult when there

are strong norms constraining such changes in an industry or a community. For example, when a firm changes its auditor, the firm's stock price drops, because investors suspect that the firm is shopping for more favorable interpretations of its accounting practices (Fried & Schiff, 1981; Levinthal & Fichman, 1988). In the investment banking industry, the relational norm of corporations having loyal sole-source ties with banks was prevalent in the 1970s (Eccles & Crane, 1988). This relational norm shifted to transactional norms of multiple-source ties with banks in the 1980s. Likewise, advertising, law, and other professional services also experienced such shifts in the 1980s (Baker et al., 1998).

When an industry has a relational norm of loyal sole-source ties with clients, firms have a propensity to conform to the norm to gain external legitimacy. In a similar fashion, in a community where bounded solidarity and enforceable trust are salient (Portes & Sensenbrenner, 1993), selecting a new partner that is not seen as a member of the community or that does not conform to community norms might meet with disapproval from other network members, although forging relations with the new partner may be economically rewarding (e.g., in a foreign direct investment setting).

Proposition 10: The stronger the pressure on an organization to conform to an institutional environment, the less likely it is to change its network ties in ways that violate the institutional environment.

Interactions Between Internal and Network Tie-Specific Constraints

We further develop propositions based on the interactions between internal and network tie-specific constraints associated with a focal organization to illustrate the dynamic relationship between the two types of constraints. In particular, we examine the interactive effects of organizational age and organizational size (i.e., internal constraints) and network tie duration and network tie size (i.e., network tie-specific constraints) on the likelihood of network change, respectively.

Interaction between organizational age and network tie duration. Are the negative effects of network tie duration on network change greater

for older organizations with rigid intraorganizational networks among different interest groups, or for younger organizations with more dynamic intraorganizational networks? Relation-specific assets derived from interorganizational ties are more valuable for younger organizations compared to older organizations because of the vulnerability of young organizations. The liability of newness argument (Stinchcombe, 1965) suggests that newly founded organizations suffer from a lack of stable relationships and sufficient resources, are highly vulnerable to environmental change, and have a high propensity to fail (Hannan & Freeman, 1984). Thus, researchers have shown that interorganizational network ties are particularly beneficial for young organizations in mitigating the risks of newness and yielding better performance (Baum, Calabrese, & Silverman, 2000; Shan et al., 1994). However, younger organizations face greater difficulty in finding and establishing successful network ties (Aldrich, 1999; Stinchcombe, 1965). Developing trust and external legitimacy takes time, and younger organizations tend to suffer from a lack of legitimacy and resources. Under these difficult conditions, once young organizations establish a few relatively long-lived network relationships with specific network partners, they may find it more difficult to change those partners and may be less likely to change their network ties because of the potential loss of accumulated investment in relationship-specific assets.

Recent research on the network characteristics of entrepreneurial organizations has shown that, during the emergence stage of its life cycle, an organization relies on relationships with family (Bhappu, 2000) and close friends to gain the key resources needed to establish organizational viability (Larson & Starr, 1993). The proportion of embedded ties within the organization's network and the cohesiveness of the network decrease as the new organization moves from emergence to early growth (Hite & Hesterly, 2001). An embedded and cohesive network tends to constrain an organization's network expansion beyond the boundaries of the current network (Portes & Sensenbrenner, 1993). Thus, the tendency of younger organizations to have more embedded and cohesive networks makes it more difficult for them to change their network ties.

Proposition 11: The effect of network tie duration on network change is likely to be greater for younger organizations than for older organizations.

Interaction between organizational size and network tie size. How does the scale of network involvement differentially influence larger organizations with complex intraorganizational networks among different interest groups, compared to smaller organizations with simple intraorganizational networks, in terms of their network change activities? Having relatively large-scale involvement with a specific partner makes a smaller organization more vulnerable to network change. Large-scale network involvement represents a high level of interdependence and commitment between partners. Because of this high interdependence, changing a large-scale network partner is more critical for a smaller organization compared to a larger organization. Although small organizations tend to attempt structural change more often, they are also more likely to fail and die in the process, because any change in core activities takes time and entails costs (Hannan & Freeman, 1984; Stinchcombe, 1965).

Further, because of their weak market positions and lack of legitimacy, smaller organizations find it relatively more difficult to build beneficial network relationships with other organizations. Cases of successful large-scale network involvement between small organizations and their partners are rare. The dependence of small organizations on their network partners, where network involvement is large in scale, is proportionally more important relative to that of large organizations. Thus, smaller organizations find it relatively more difficult to change their large-scale network ties (Larsson et al., 1998).

Proposition 12: The effect of network tie size on network change is likely to be greater for smaller organizations than for larger organizations.

DISCUSSION AND IMPLICATIONS

The concept of network inertia has been defined as a persistent organizational resistance to changing interorganizational network ties, or the difficulties an organization faces during net-

work transformation. The specific mechanisms behind network inertia can be explained at multiple levels: how an organization's internal context (intraorganizational networks), network tie-specific context (interorganizational dyadic ties), network position (interorganizational network position), and external environment (interorganizational field) constrain network change, and how internal and network tie-specific constraints jointly affect network change.

Thus, formulating the constraints on network change provides fresh insights into a vibrant stream of research on interorganizational relationships: network evolution. Researchers have previously drawn attention to the need to study the longitudinal dynamics of networks (Emirbayer & Goodwin, 1994). Studies of network evolution, however, have been undertheorized, because in previous research on interorganizational networks, scholars have adopted an adaptation perspective—framing network effects in terms of searching for beneficial networks while ignoring difficulties in implementing network change. Conceptualizing network evolution from a network inertia perspective facilitates focusing on the constraints an organization faces in the network transformation process.

Another reason previous network research focused on identifying network ties that improve performance is that the theoretical arguments of this stream of research have been derived mainly from organizational theories with an adaptation perspective, such as transaction cost economics, resource dependence theory, and neoinstitutionalism. Drawing instead on organizational ecology allows researchers to explain the mechanisms through which network inertia arises at the aforementioned four levels. Combining organizational ecology and network analysis is not novel (see Burt, 1992; DiMaggio, 1986; Hannan & Freeman, 1989; Podolny, Stuart, & Hannan, 1996). However, efforts to integrate the two perspectives revolve around basic concepts such as niche or structural equivalence to find significant effects of covariates in statistical models. This new perspective may facilitate shifting the theoretical foundations of network evolution research from an adaptation-oriented perspective to a selection-oriented perspective. Drawing on structural inertia theory highlights the importance of transformation processes in

network evolution, focusing on the possible difficulties and impediments in network change processes.

This network inertia concept is an attempt to fill a gap in the development of interorganizational network theory. The focus of previous interorganizational network and strategic alliance research has progressed from network formation and network dissolution to network development. Previous network research has shown how initial conditions of organizations affect network tie formation (Oliver, 1990) and dissolution (Park & Ungson, 1997), and it has described the process through which the network itself develops (Ring & Van de Ven, 1994), while leaving unanswered questions about network evolution. The network inertia perspective in this paper should thus provide a more integrated understanding of network evolution through the initial conditions of organizations and environments, network formation, network benefits, network development processes, network change, and network dissolution. For example, this approach should facilitate exploring how initial conditions in the organizations in a network (e.g., similarity of partners) affect network inertia during network change, and thereby network dissolution (cf. Doz et al., 2000).

The propositions formulated above also have implications for the effects of network change on organizational performance. An organization that changes its network ties, when network inertia is high, may experience lower performance than other organizations with lower network inertia, at least for a short period of time. Changing network ties disrupts structures, routines, and cultures developed from relationships with previous partners. An organization's absorptive capacity to learn from its partners might shrink (Cohen & Levinthal, 1990), and a "learning race" between former collaborators might begin again (Khanna, Gulati, & Nohria, 1998).

Often, it takes a substantial amount of time and effort to develop good relationships with new partners. Therefore, changes in network ties may set back the liability of newness clock and, thus, reduce organizational performance and elevate organizational mortality rates (cf. Amburgey et al., 1993; Dobrev et al., 2001; Hannan & Freeman, 1984). However, once the organization overcomes the obstacles and impediments it faces during network transformation and makes the right choice of partners, the or-

ganization should achieve superior performance. Future research may use longitudinal research designs to explore the question of how changes in network ties affect organizational performance.

Because this framework has broad applicability to different units of analysis, the propositions can be extended to interpersonal networks, interunit networks in a corporation, or intercountry networks, such as treaties or alliances. For example, they might help one understand why some interpersonal networks (e.g., friendships, marriages, information networks, working relationships in academic and business areas, affiliation networks with voluntary associations) are stable over time, although individuals may pursue ties based on self-interest. Our argument implies that individuals' propensity to change interpersonal networks are constrained by the four different sources of network inertia in the paper. Although we think that some propositions should be modified when applied to interpersonal, interunit, or intercountry networks, we expect that the network inertia perspective is useful for explaining the evolution of those types of networks. Just as interorganizational networks are subject to inertial forces, so are friendship, interunit, or country-level networks.

This paper also suggests the need for more research on the role of changes in external environments, along with the evolution of network ties. Theories of the industry or product life cycle (Abernathy & Utterback, 1978; Klepper, 1996) and evolutionary theories (Nelson & Winter, 1982), including organizational ecology (Carroll & Hannan, 2000; Dobrev, Kim, & Carroll, 2002; Hannan & Freeman, 1989), share a common view that different phases of industry evolution matter for organizational action and performance. Different phases of industry evolution could be systematically related to changes in technology, in the availability of network partners, in the asymmetric bargaining power between buyers and sellers, in political environments including government regulations, and in the industry network structure. For example, the effects of the constraints in our propositions might vary, depending on the network structure in which the focal organization resides. The organization might be embedded in tightly dense networks with relatively few structural holes and a high level of mutual dependency or, conversely, in loosely connected open networks. Although we

believe that our arguments are still valid, holding other factors constant, future research should address these issues of dealing with different aspects of external environments as important factors in explaining changes in interorganizational networks.

In conclusion, network ties can contribute to successful adaptation, but it is important to recognize that an organization also faces difficulties and obstacles when it attempts to change its network ties, and these constraints are derived from the organization's internal, network-specific, network position-based, and external characteristics. The multilevel model from a network inertia perspective allows a better understanding of network evolution by focusing on the process of network transformation, while emphasizing the effects of constraints on network change.

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