

BUILDING BRIDGES: THE SOCIAL STRUCTURE OF INTERDEPENDENT INNOVATION

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Multidivisional firms often fail to take advantage of innovations that involve combining resources from distinct divisions. This failure of cross-line-of-business innovation is a consequence of design choices employed to execute the firm's strategy: in organizing around its core businesses, the firm renders interdependence between divisions residual to the formal structure. As a result, those innovations which involve cross-line-of-business interdependence are trumped by the firm's articulated strategy and structure. Social structures could, potentially, fill this coordination gap. But social structures associated with the initiation of interdependent innovation are inversely associated with their execution. We build a dynamic, corporate-level, evolutionary model in which individuals autonomously initiate cross-line-of-business projects not through the formal structure of the firm, but using contacts from their own social networks. Some of these projects are selected and actively supported by senior executives; this support sends clear signals about what collaboration is valued by the firm, which gives other actors powerful, albeit informal, incentives to connect with others across the interunit boundary. As a result, the sparse interunit social structure that was conducive to initiation changes, becoming much more cohesive (at least locally) and is able to support execution and retain these interdependent innovations. Thus, where intra-divisional innovations are primarily driven by organizational structure, we suggest that interdivisional innovations are driven primarily by social networks. Copyright © 2007 Strategic Management Society.

'I can't understand how [Time Warner] had Warner Music and AOL and didn't create something like iTunes.'

—Jessica Reif Cohen, Media Analyst,
Merrill Lynch
(quoted in Mehta and Burke, 2005)

INTRODUCTION

In spite of the dismay of industry observers such as Cohen, most large firms fail to take advantage of the

opportunity to create new businesses that combine resources from disparate parts of the firm. Instead, divisions tend to 'stay in their own lanes,' developing new products for their existing customers (Christensen, 1997), adopting technologies that enhance the value of their existing skills (Tushman and Anderson, 1986) and generally paying little attention to one another. Even when firms use collaborative incentives or cross-divisional teams, they rarely succeed in recombining their portfolios of skills, resources and businesses to bring new products to light (Campbell and Goold, 1999). This inability of multidivisional firms to leverage existing assets is an important lost growth opportunity.

Over the past two decades, scholars have identified many reasons why firms are inertial and resist change, even when change bears new growth opportunities (e.g., Barnett and Carroll, 1995; Benner,

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2004; Gavetti and Levinthal, 2000; Henderson, 1993; Leonard-Barton, 1992; Tripsas and Gavetti, 2000). When change requires building bridges across business unit boundaries, the challenge seems to be even greater. We argue that when firms design their internal architecture to minimize coordination costs by organizing around the most strategic interdependencies (Thompson, 1967), they render other possible interdependencies residual to the formal organizational structure. And yet, in firms whose divisions make products that are related, these residual interdependencies offer unique opportunities for growth and strategic renewal; indeed, it has often been argued that the intersection of different disciplines and their respective thought worlds (Dougherty, 1992) is a potential hotbed for innovation (e.g., Johansson, 2004).

Because interdependent innovation—defined as the joint development and implementation of a new product or service by two or more product divisions of a multibusiness firm—is characterized by inconsistency with formal structure, social structure is paramount. We highlight two important roles played by social structure that, absent senior leadership agency, collude to undermine interdependent innovation: emergence and execution. Intraorganizational social networks provide a medium for individuals from disparate parts of the organization to discover and initiate creative new ideas for collaboration across divisional boundaries; they also facilitate the interdivisional coordination necessary to take these ideas and bring them into reality. However, the very network structures that support the discovery and initiation of interdependent innovation undermine their implementation.

Given these self-limiting informal dynamics, we propose an evolutionary approach to interdependent innovation (see Burgelman's, 1991 use of this metaphor for strategic change). In the context of the senior team's overarching aspiration (Bower, 1970; Rotemberg and Saloner, 2000; Siggelkow and Rivkin, 2006), a variety of interdependent innovation initiatives are generated autonomously through the creative initiative of boundary spanning individuals. From this pool of variation, corporate executives proactively select a few innovations as strategic and support their implementation not via formal structural reorganization but rather through hybrid social networks and sustained senior management attention. These hybrid social structures consist of both cross-divisional information brokerage, needed to identify possible collaborations,

and pockets of cross-divisional cohesion, needed to implement them.

Where business unit innovation is driven primarily by formal structural changes, we suggest that interunit innovations are driven primarily via social networks. We argue that interdependent innovation is an important form of corporate-level exploration that takes place in the context of the firm's simultaneously exploiting the stand-alone strategies of its existing lines of business. We conclude with the observation that interdependent innovation is a potentially valuable, but underutilized, source of growth and strategic renewal and with a discussion of the implications of this observation for theory and research on top management teams, organizational design, intraorganizational social networks, and diversification.

INTERDEPENDENT INNOVATION AS CORPORATE-LEVEL EXPLORATION

Sustained organizational performance depends not only on short-term growth, but also on a firm's ability to explore new possibilities (March, 1991). Exploitation involves learning that strengthens and extends the core business by improving efficiency, reinforcing execution, and refining the existing business model. In contrast, exploration of new domains of knowledge is critical to innovation and organizational adaptation, but is inherently more uncertain and the benefits more distant (March, 1991). A firm's ability to balance exploration with exploitation is vital to its long-term survival and growth in the face of changing environments and technologies (Benner and Tushman, 2003; March, 1991; Tushman and Smith, 2002) and is a source of dynamic capabilities (Teece, Pisano, and Shuen, 1997). Collaboration across divisional boundaries to develop new products or services jointly—what we term interdependent innovation—provides multibusiness firms with unique opportunities for exploration.

A range of formal structural solutions has been proposed to attend to the challenges associated with the explore/exploit dilemma (Dunbar and Starbuck, 2006). Scholars have hypothesized (Tushman and O'Reilly, 1996) and found empirical support for (He and Wong, 2004; Tushman *et al.*, 2005) the existence of ambidextrous organizations that successfully manage both exploration and exploitation. Ambidextrous organizations are marked by sharp structural differentiation of exploratory and

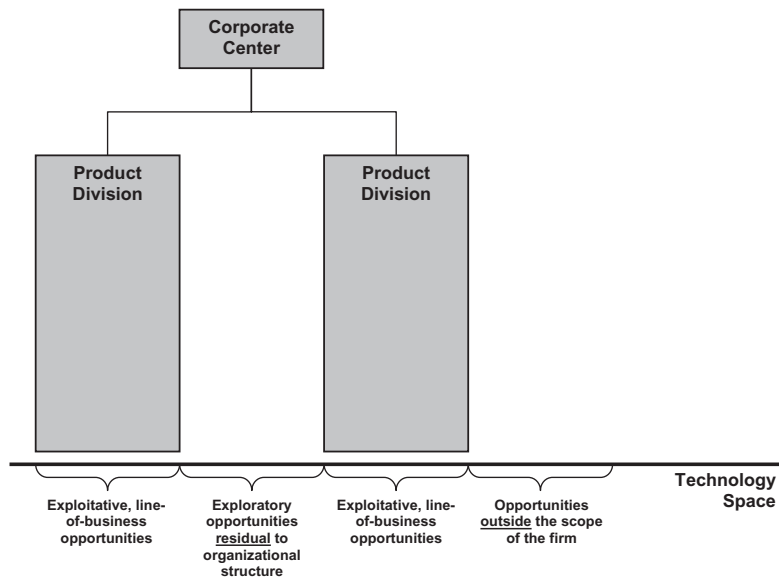


Figure 1. Product divisions are designed to exploit the most important interdependencies; but the divisional structure creates challenges in exploring opportunities that require interdependence between product divisions

exploitative units with targeted integration at the top management level (O'Reilly and Tushman, 2004). Others have argued for organization designs that switch between contrasting designs (e.g., Brown and Eisenhardt, 1997; Duncan, 1976; Siggelkow and Levinthal, 2003), while still others have suggested that matrix designs or other formal structural overlays might enable exploratory innovation (e.g., Clark and Wheelwright, 1992; Miles and Snow, 1978; Nadler and Tushman, 1997).

The literature has resulted in important insights into the dynamics of exploration and exploitation, but there remain important unresolved issues. First, the existing literature has focused primarily on managing the tension between exploration and exploitation at the function, project, or business unit levels of analysis (for a recent review, see Dunbar and Starbuck, 2006). For example, in the ambidextrous organizational form, exploratory and exploitative products are developed within a single business unit, leveraging the existing skills and resources at the disposal of its general manager (Tushman *et al.*, 2005); little research has explored streams of innovation at the corporate level. Although some scholars have argued that a benefit of the multidivision corporation is its recombinant potential (Galunic and Eisenhardt, 2001; Helfat and Eisenhardt, 2004), few have directly examined the dynamics of recombining the corporation's diverse resources for cross-line-

of-business innovation (cf. Martin and Eisenhardt, 2003).

Second, the existing search literature has implicitly focused on search for new technologies (Katila and Ahuja, 2002), strategies (Tripsas and Gavetti, 2000) or organizational configurations (Levinthal, 1997) outside the scope of the current organization (see Figure 1). The tradition dates back to seminal work at the Carnegie school (Cyert and March, 1963; Simon, 1945), which argued that problemistic search, triggered and perpetuated by failure to achieve goals, should begin locally and expand outward. For managers trying to solve the problem of continual growth, this heuristic focuses managerial attention at, or beyond, the boundaries of the firm. Indeed, most of the strategic management research on diversification assumes that new businesses will be outside the scope of the existing businesses (e.g., Montgomery and Wernerfelt, 1988). By contrast, innovation that occurs through recombination of resources already resident in the firm—what we refer to as interdependent innovation—receives scant attention in the extant literature.

Third, the literature on coordination has focused almost exclusively on the roles of formal organizational structure (e.g., Galbraith, 1973, 1994; Nadler and Tushman, 1988) and incentives (e.g., Kaplan and Henderson, 2005; Prendergast, 1999). Scholars of organization theory and organizational econom-

ics have developed a substantial body of theory and empirical evidence about—and firms have become increasingly sophisticated practitioners of—horizontal structures and collaborative incentives. Nevertheless, firms continue to struggle to create new products that recombine knowledge from disparate parts of the firm. Although both formal structure and incentives are indeed important, this literature is undersocialized; it has both underemphasized the role of informal social structure in enabling cross-divisional innovation and underspecified the role of corporate leaders in creating the context for interdependent innovation.

Multidivisional organization design: the inevitability of residual interdependence

Ever since Barnard (1938) distinguished between formal and informal structures, the organization design literature has focused primarily on formal organizational structure. In the pre-Chandlerian world of the early 20th century, firms tended to be formally organized according to function (McCann and Galbraith, 1980), with managers of sales, marketing and R&D departments all reporting to the chief executive. The multidivisional form, by contrast, is characterized by departmentalization according to purpose¹ (McCann and Galbraith, 1980), with the chief executive ceding operational authority to a series of semiautonomous divisional heads, each fully responsible for achieving her own division's purpose, and accordingly, accountable for its profit and loss (Friesen and Mills, 1989). Corporate managers play an important role in monitoring and providing incentives for operating divisions (Jensen and Meckling, 1976); prioritizing resource allocation decisions (Bower, 1970), performing strategic planning (Ansoff, 1965), and managing corporate culture (Schein, 1985) but cannot interfere with divisions' operations without 'thoroughly corrupting' the multidivisional form (Williamson, 1975:148). Thus, in contrast with the interdependence inherent in the functional organization, the multidivisional form explicitly makes divisions conditionally autonomous (Thompson, 1967).

The benefits of the multidivisional form have been well-documented in both the industrial organization economics and organization theory literatures: it

reduces the cognitive load on boundedly rational general managers in complex environments and thus helps to solve the information processing problem in large, complex firms (Chandler, 1962, 1990). Separation of operational authority from strategy-making offers benefits for both divisional managers and the corporate parent. For operating managers, the multidivision form 'favors goal pursuit and least-cost behavior,' (Williamson, 1975) increasing their accountability by measuring profitability at a more disaggregated level (Simons, 2005). For corporate managers, the multidivision form reduces the cognitive load and acts as a 'miniature capital market,' increasing the efficiency with which scarce resources are allocated (Williamson, 1975). But the multidivisional form is hardly a panacea for performance and growth in large firms. While recognizing its benefits, some scholars have also critiqued the M-form, arguing that as a result of decentralization, corporate managers lose their intimate familiarity with the operations of the firm's various businesses (Hill and Hoskisson, 1987). As a result, they measure and evaluate divisional performance based primarily on financial objectives, which promote risk-aversion and a short-term orientation that undermine innovation and long-term performance (Hoskisson and Hitt, 1988).

While the economics and strategic management literatures have focused largely on what benefits and problems the multidivisional form offers, the organization theory literature has asked how managers in multidivision firms should divide the work of a firm, establish roles, and create the firm's formal structure. Decades of organization design research suggest that firms should design their organizational structures to minimize coordination costs between actors whose tasks are interdependent. Task interdependence was implicit in the literature as long ago as Adam Smith's (1776) work on the division of labor in a pin factory; Durkheim (1893) was perhaps the first to study it directly, suggesting that task interdependence resulting from the division of labor in society creates organic solidarity among workers. But March and Simon (1958) were among the earliest scholars to identify task interdependence as a critical challenge of organization design. Building on the notion that task interdependence emerges as actors divide work through specialization, March and Simon argue that interdependence is problematic—and requires costly coordination devices—due to the ubiquitous presence of variability. Thompson deepened our understanding of the nature of task interdependence by

¹ A division's 'purpose' may be defined by the type of product it sells or by its geographic focus.

discerning a spectrum of complexity—from pooled, to sequential and reciprocal—and suggesting that each type requires successively more complex coordination devices (Thompson, 1967).

Based on the foundation laid by Thompson (1967) and elaborated by Van de Ven, Delbecq and Koenig (1976), organization theorists have argued that managers choose organizational structure to minimize the costs of coordinating across interdependent units. Grouping decisions are based on a logic of maximizing the interdependencies within units and minimizing the interdependence between units, placing the most highly interdependent units, who have the greatest need to coordinate, into common divisions (Nadler and Tushman, 1997).² Residual interdependencies—those left over after the firm has organized around its most strategic interdependencies—are handled through lateral linking mechanisms that overlay the formal hierarchy (Galbraith, 1973).

Such an approach is highly effective at promoting exploitation of core divisional strategies, but squanders combinative innovation opportunities; cross-line-of-business innovations are either not seen or not well-executed. Conversely, organizations that are able to proactively enact interdependence between conditionally autonomous product divisions stand to gain both short-term benefits, in the form of new revenue streams, and long-term benefits, in the form of greater adaptability. By recombining resources from multiple divisions, interdependent innovation takes strategic advantage of residual interdependence that exists between autonomous business units to explore new opportunities, one way of enacting the cooperative M-form organization (Hill, Hitt, and Hoskisson, 1992).

In response to the challenge of coordinating the actions of autonomous product divisions, scholars have emphasized the importance of two primary factors: formal structure and incentives. Organization theorists have argued that when higher-priority coordination requirements prevent the joining of interdependent groups, organizations create either rules to regulate boundary-spanning relations or formal linking structures (Thompson, 1967); numerous formal organizational structures

such as heavyweight teams (Clark and Wheelwright, 1992) or matrix designs (Galbraith, 1994) seek to build bridges across divisional boundaries and enable the management of residual interdependence. Organizational economists, on the other hand, have emphasized the role of incentives. Indeed, theory and empirical evidence show that incentives exert a powerful influence on the behavior of organizational actors. Firms' choice of incentive programs impact organizational outcomes at multiple levels of analysis, including individual productivity and motivation (Alchian and Demsetz, 1972; Roy, 1952), the ability of teams to work together effectively (Wageman, 1995), and the realization of cross-divisional collaboration (Kretschmer and Puranam, 2004). While scholars working within each of these literatures have made important steps toward explaining coordination, organizations are still largely unable to successfully execute innovations that cross business unit boundaries. These domains of inquiry can be complemented and extended with research on the social structure of intraorganizational collaboration (Galbraith, 2006; Kleinbaum and Tushman, 2005).

Indeed, formal structures and incentives are not independent of social structures and recent field research argues for an integration of these formal and informal mechanisms of coordination. In her inductive theory of relational coordination, Gittell (2005) argues that coordination requires not only shared goals, which can be achieved through alignment of formal structures and incentives, but also shared knowledge and mutual respect, achievement of which requires social relations. As we focus our theory on social structure, we nevertheless assume that all three levers—*incentives, formal structures, and social structures*—are important in achieving interdivisional coordination and, indeed, can be mutually reinforcing.

Although the multidivision organizational form offers substantial benefits associated with line of business focus, these benefits also bring unintended consequences associated with cross-line-of-business innovation. As Simon (1962) argued, hierarchical systems are marked by dense interactions within subunits and weaker linkages between subunits. In the context of the multidivision organizational form, we term these linkages that cross divisional boundaries as residual interdependence because, by construction, they take a lower priority in the design of the formal organizational structure. Residual interdependence is, in a very real sense, the residue of organization design.

²This logic is also seen in the literature on product design (Ulrich and Eppinger, 1995) and the link between product design and organizational architecture (Baldwin and Clark, 2000; Henderson and Clark, 1990).

Intraorganizational social networks and strategic interdependence

A central conclusion of the social networks literature is that networks of relationships are an important source of information and power to actors in organizations, as well as in market and interorganizational settings. Most research on intraorganizational networks has focused on the benefits and constraints conferred upon individuals by their position within the network. For example, intraorganizational networks provide individuals with informal sponsorship (Kanter, 1977) and task-based support (Kotter, 1982); social support and instrumental access (Ibarra, 1992); career mobility (Higgins, 2005), and political information about important organizational dynamics (Krackhardt and Porter, 1986). Managers with networks rich in structural holes—which arise when individuals tied to a focal actor are not tied to each other—have been shown to advance in their careers more rapidly (Burt, 1992), to receive better variable compensation (Burt, 2000) due to greater access to the information and control benefits of the intraorganizational social network, and to be more adaptable to changes in their task environments (Gargiulo and Benassi, 2000). Additionally, a ‘behavioral orientation toward connecting people in one’s social network,’ makes individuals more likely to be involved in innovative activity, though it may or may not increase the innovative output of the firm (Obstfeld, 2005). In short, the structural holes perspective emphasizes intraorganizational networks as the ‘pipes’ through which information and control flow in organizations (see Podolny, 2001 for the use of that metaphor to describe the role of networks in markets).

Another school of thought within the social networks literature suggests that the primary benefit of intraorganizational networks lies in their role in enforcement of organizational norms and practices (Coleman, 1988). Developing a notion of social capital, Coleman argues that network closure—the degree to which a group of people is densely interconnected by a web of strong ties—provides a mechanism for the monitoring and control of individual behavior by the network, thereby enforcing expectations and norms and reducing variability and uncertainty. In theorizing about social capital, Coleman’s school of thought aims to bridge the gap between economists’ under-socialized view and sociologists’ over-socialized view of individual choice. And indeed, empirical research confirms

that under some conditions, network closure contributes to the productivity of teams (Reagans and Zuckerman, 2001).

The network closure perspective is rooted in sociometric work on the social dynamics among triads of actors. This research begins with the observation that when two people share a common contact, they are likely, through that mutual contact, to come into contact with one another. From the perspective of the focal actor, our contacts tend to become increasingly interconnected (Homans, 1951; Simmel, 1902). Theory (Davis and Leinhardt, 1972) and evidence (Khurana, 2002; Obstfeld, 2005) suggest that social structures tend to become increasingly connected over time (Figure 3).

The network closure perspective on social capital offers a different view from the structural holes perspective and recent scholarship has tried to reconcile these divergent views to determine which network structure optimizes individual performance. Burt argues that structural holes are the source of network benefits while network closure can help to ‘[realize] the value buried in the holes’ (Burt, 2000:410). Podolny and Baron (1997) argue that the network structure that will be most advantageous is contingent on the content of network ties; when ties convey resources, brokerage is advantageous, but when ties convey normative expectations or social identity, closure is advantageous. Gargiulo and Benassi (2000) suggest that cohesive networks may be more useful when the task structure is constant, but that brokerage structure may be more adaptable to changes in task structure. All of these researchers take some measure of individual performance as their dependent variable, so whatever their differences, adherents to both perspectives share a common focus on the network advantages conferred upon individuals by their positions in the social structure.

Relatively few scholars have directly studied the benefits that intraorganizational social networks bring to the organization itself. Nohria and Ghoshal suggest that underlying the literature’s focus on individual-level outcomes, there may be an assumption that ‘the social capital of its members aggregates to the social capital of the entire organization’ (Nohria and Ghoshal, 1997:154). Early work on the organizational benefits of intraorganizational networks developed within the research and development management literature. Allen (1977) studied the role of intraorganizational communication networks in a research and development department, showing

that increased communication between R&D groups increases R&D effectiveness. In a series of follow-on studies, Tushman and colleagues (Tushman, 1977, 1979; Tushman and Katz, 1980; Tushman and Scanlan, 1981) developed a more fine-grained understanding of the network structure needed to increase R&D effectiveness, finding that individuals tend to specialize in spanning particular organizational boundaries (i.e., boundaries between labs within the R&D division; between the R&D division and the rest of the organization; or between the organization and its environment) and that the degree of interunit communication needed and the structure of the communication network are contingent on the nature of the laboratory's tasks. More recent research has shown that intraorganizational social networks benefit organizations by moderating inter-group conflict (Labianca, Brass, and Gray, 1998; Nelson, 1989); by promoting positive relations and task coordination between groups (Ancona and Caldwell, 1992); by providing timely access to information about prospective exchange partners (Mizruchi and Stearns, 2001); and by increasing the quality of ideas (Burt, 2004).

Since the early research in the R&D management literature, relatively few scholars have studied the ability of social networks to coordinate interdependence between formally defined organizational sub-units. Even Galbraith, who cites direct communication as the simplest and most effective form of lateral relation, generally focuses on more formal approaches, such as designated liaison positions or cross-divisional teams, only recently recognizing the importance of informal structure (Galbraith, 1973, 1994, 2006). The focus on formal structure is not without reason: the social network often emerges to correspond closely with the formal structure of the organization. Particularly in large organizations, individuals tend to develop network ties with those others with whom they have work-related contact. Formal organizational structure has been shown to both seed and constrain the formation of social ties by organizational members (Han, 1996; Henderson and Clark, 1990; Ibarra, 1995). Burt argues that 'opinion and behavior are more homogeneous within than between groups' (Burt, 2004:349). Nelson puts it more forcefully: 'strong ties between groups do not occur naturally,' (Nelson, 1989:397–398); the social networks in many organizations tend to be strongly correlated with the formal organizational structure (Krackhardt and Stern, 1988). Burt referred to this phenomenon as 'institutional holes' and argued that

individuals can broker relations across institutional holes: 'The manager's network is a social construction laid on top of the firm's bureaucratic structure, and there are holes in the bureaucratic structure that can be advantageous' (Burt, 1992:148–9).

A few researchers have explicitly studied the ability of informal structure to manage residual interdependence by examining the consequences of cross-divisional social networks for various organizational outcomes. The work on R&D labs (Tushman, 1977; Tushman and Scanlan, 1981) highlighted the importance of boundary-spanning individuals in gathering information from outside the group, division or organization for innovation. Gould and Fernandez (1989) identified and formally measured several distinct boundary-spanning roles, including the gatekeeper (who collects information from outside and transmits it throughout her unit), the representative (who collects information from her unit and transmits it to the outside) and the liaison (who gathers information from one unit and transmits it to another without being a member of either). In a study of product development in an electronics firm, Hansen (1999) found that network ties serve as conduits for knowledge and, contingent on the degree of fit between tie strength and the type of knowledge being transferred, can speed the product development process.

Joining the organizational literature with the strategic management literature, Tsai (2000) suggests that interunit ties seem to be particularly valuable when units are strategically related and have the potential for fruitful collaboration—consistent with research on the collaborative M-form (Hill *et al.*, 1992). Further research suggests that as managers search their organizations for valuable information, such as information about potential collaborations, they tend to rely first on networks of informal relations, even more than relatedness of competences (Casciaro and Lobo, 2006; Hansen and Løvås, 2004). Tsai and Ghoshal (1998) showed that network ties across divisional boundaries in a large, multinational electronics company were positively associated with interdivisional resource exchange and product innovation by the participating division. Similarly, in the context of multinational corporations, Nohria and Ghoshal (1997) suggest that firms perform better when the various national subsidiaries are tightly integrated by a network of boundary-spanning individuals. As managers strive for growth, social networks that span divisional boundaries can provide timely information about potentially beneficial inter-

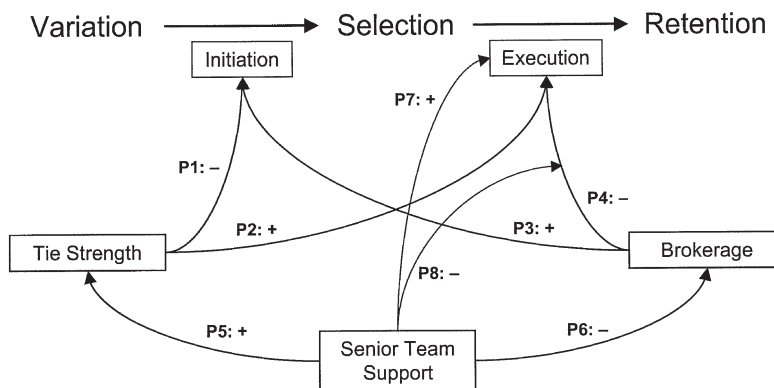


Figure 2. Overall evolutionary model of interdependent innovation

unit collaborations; can provide referrals for actors to access that information; and can promote interunit coordination and cooperation to better implement those collaborations.

SHAPING RESIDUAL INTERDEPENDENCE: AN EVOLUTIONARY MODEL OF INTERDEPENDENT INNOVATION

Strategy scholars have distinguished between planned and emergent strategy, suggesting that strategy formulation is conceptually distinct from its implementation. They suggest that planned strategies are those that are developed analytically and realized as intended (Mintzberg and Waters, 1985) and argue that organizational structure is a tool for the implementation of strategy (Chandler, 1962). Indeed, differentiated multidivisional firms often decentralize strategy formulation, with each major product division responsible for developing and implementing its own strategy. As such, coordinated strategic actions are difficult for multidivisional firms to achieve (Eisenmann and Bower, 2000; Quinn, 1978). In the context of decentralized strategies, the exploratory, collaborative opportunities of interdependent innovation are trumped by exploitative actions in autonomous business units.

We suggest that the lost opportunity of interdependent innovation can be captured by activist corporate executives. Far from acting single-handedly (cf. Eisenmann and Bower, 2000), these senior leaders create the context for autonomous interdependent innovation and, in turn, proactively select a few as strategic. Their action reduces the set of possible

residual interdependencies into a subset of strategic interdependencies. These senior leaders then proactively shape interdivisional social networks and structural overlays in order to give those selected interdependent innovations a chance to survive. We suggest, then, an evolutionary approach to interdependent innovation where variation, selection, and retention processes are shaped by senior leaders in the context of strong line of business designs (for a summary of the model, see Figure 2).

In the evolution of interdependent innovation, variation occurs through decentralized agency, as actors throughout the organization use their social networks to explore possible collaborations. This exploration requires search processes that identify capabilities or resources in another division that could fruitfully be combined with capabilities or resources resident in the focal division. Exploration may take the form of problemistic search (Hansen, 1999; March and Simon, 1958); may arise serendipitously through normal work or casual interactions (Perry-Smith and Shalley, 2003); may be the result of timely referrals by third party information brokers (Burt, 1992, 2000); or may arise in response to the senior team's strategic aspirations (Rotemberg and Saloner, 2000). Whatever the form, this variation phase is marked by autonomous strategic activity by decentralized actors working together with individuals from other divisions of the organization to develop new products or to better serve customer needs (Burgelman, 1991). This period of variation is influenced by actors' perceptions about what kinds of projects are most likely to appeal to corporate managers (Bower, 1970). This autonomous search, if left unchecked, is also associated with partisan actors, self-serving political behaviors, conflicting

agendas, and political deadlocks (Hargrave and Van de Ven, 2006; Siggelkow and Rivkin, 2006).

Once particular ideas emerge, agency shifts from a decentralized mode, in which autonomous actors use their social networks as means to pursue ends of their choosing, to a more centralized mode, as corporate management actively decides which opportunities are most promising and are most consistent with the firm's overall corporate strategy. It is through this selection process that some opportunities that were residual to the organization's design are enacted as strategic. In making these selection decisions, corporate management must consider not only the market potential and technical feasibility of the opportunity, but also the degree to which the potential collaborators are likely to work together effectively, given their respective structures as well as the possibility and potential costs associated with the interdependent innovation becoming a distraction from the core exploitative business (Smith and Tushman, 2007).

Implementation of interdependent innovation involves jointly developing and marketing the innovation based on the resources of multiple divisions with a minimum of disruptive interdivisional conflict. A variety of mechanisms may be used to promote retention. Formal structures and incentives are often used; but because implementation of these innovations is, by construction, residual to the organization's design, social structures are critical in assuring the continued collaboration and sharing of information across divisional boundaries. We develop a set of ideas on the social network conditions under which interdependent innovation can be shaped for the development of new products or services that combine knowledge, skills or resources from multiple divisions of a large firm, allowing firms to explore at the corporate level in the context of business unit exploitation.

Effects of social networks on initiating and executing interdependent innovation

Consistent with the literature on brokerage and closure, our theory focuses on two attributes of social structure that bridges formal structural gaps between business units: the strength of interunit ties and the amount of interunit brokerage. Interunit tie strength refers to the average strength of the interpersonal relations that link actors in one unit with actors in another. Strong ties offer the benefits of fine-grained information transfer (Uzzi, 1997) and enforcement

of organizational norms and practices, thus reducing the uncertainty that inheres in exchange (Coleman, 1988; Hansen, Podolny, and Pfeffer, 2001). But strong ties can also lead to problems of over-embeddedness because they are associated with excessive trust and reliance on local partners (Gulati, 1995); over-embeddedness reduces the scope of search and 'insulate[s] actors from information that exists beyond their network' (Uzzi, 1997). Additionally, because maintaining ties is costly (Burt, 1992) and strong ties are more costly to maintain than weak ties (Hansen, 1999; Hansen *et al.*, 2001), weak ties are a more efficient means of search.

In predicting the emergence of interdependent innovation, the benefits of tacit and fine-grained information transfer are relatively unimportant. Conversely, as divisions search for opportunities for interdependent innovation, efficiency of search and broad access to information will be of substantial benefit in discovering novel and useful ideas (Burt, 2004). For this reason, we propose that strong interunit ties will be detrimental to the search process.

Strong ties between two units reduce the efficiency of search for interdependent innovation; but conditioning on the decision to engage in interdependent innovation, strong interunit ties offer substantial benefits for implementation. First, when implementing interdependent innovation, the benefits of fine-grained and tacit information transfer more than compensate for the additional cost of maintaining strong ties (Hansen, 1999; Uzzi, 1997). Strong ties are particularly helpful as organizational actors struggle to navigate the unfamiliar formal structure of their partner division and identify the people whose cooperation is necessary for the interdependent innovation; that knowledge of organizational structure and politics is more likely to traverse the interdivisional boundary through a strong tie than through a weak one. Second, high interunit tie strength is associated with pockets of cohesion in the interunit social networks. This cohesion enables the behavior of individuals to be monitored by the social structure, reinforcing expectations and norms and increasing trust that others will honor their obligations (Coleman, 1988). To the extent that high interunit tie strength increases interunit trust, the uncertainty inherent in interdependent innovation is reduced and the probability of effective execution is increased. Finally, strong ties help to reduce intergroup rivalries (Nelson, 1989) that could lead to conflict and undermine implementation.

Proposition 1: The greater the tie strength between two organizational units, the less likely they will be to initiate interdependent innovation.

Proposition 2: The greater the tie strength between two organizational units, the more likely an interdependent innovation will be successfully implemented.

Interunit brokerage is the degree to which interpersonal ties that cross divisional boundaries connect otherwise disconnected actors, providing the focal unit with access to non-redundant information that originates in the other unit.³ The network literature on brokerage traces its roots to the work of Burt (1992), who defines brokerage as the degree to which an individual's contacts are disconnected from one another in the social structure, conferring upon the broker both information and control. In the context of the initiation of interdependent innovation, interunit brokers are particularly important for conveying information across the firm's formal boundaries (Tushman, 1977); indeed, access to novel information is almost definitional of brokerage relations. Just as individuals obtain information that is more diverse and less redundant when they engage in brokerage relationships (Burt, 1992), divisions also obtain more diverse, less redundant information about another division when brokerage relations span the interdivisional boundary. When a high degree of interunit brokerage exists, each unit will have access to a broad range of information about what capabilities reside in the other division; the greater the awareness of what capabilities reside in another division, the more likely it is that opportunities for collaboration will be discovered. In contrast, when interunit brokerage is low, ties will tend to offer access to redundant information; even if there are many ties that provide extensive search, multiple searchers will discover the same capabilities in the other division and, therefore, will discover

fewer of the collaborative opportunities that may exist.

While brokerage relations increase each division's ability to access information from another division, and thereby increase the likelihood that the divisions will discover opportunities to collaborate, a social structure of extensive interunit brokerage also accentuates intraorganizational politics as multiple innovation champions, cliques and coalitions vie for scarce human and financial resources even as they compete for limited executive attention (Pfeffer, 1992; Siggelkow and Rivkin, 2006). Such information brokers may enact that brokerage divisively, by seeking to divide actors for one's own benefit, or by playing a more cooperative, linking role (Burt, 1992; Obstfeld, 2005). Whether the actions of brokers are duplicitous or integrative, numerous actors each championing their own project are associated with coalitional behaviors that stunt innovation (Hargrave and Van de Ven, 2006). Such brokerage behaviors may be effective ways to enhance individual careers, but they generate coalitional behaviors that erode the interpersonal trust needed to achieve effective interunit collaboration (Gulati, 1995).

Proposition 3: The greater the degree of brokerage between two organizational units, the more likely they will be to initiate interdependent innovation.

Proposition 4: The greater the degree of brokerage between two organizational units, the less likely an interdependent innovation will be successfully implemented.

These propositions suggest that high interunit tie strength will be detrimental to the emergence of varied interdependent innovations, but that once an innovation gets selected, high interunit tie strength becomes a substantial asset. Conversely, interunit brokerage is beneficial to search processes that lead to variation, but become a liability following selection. Taken together, these hypotheses suggest an explanation for the dilemma about why firms are generally so unsuccessful at developing interdependent innovation: the social structure needed to generate innovation variants is different from the social structure needed to implement them. The paradox is evident: even when cross-divisional initiatives are supported by appropriate formal organizational structures and collaborative incentives, the initiatives that emerge may lack the informal social structure they need to succeed.

³Note that our definition of interunit brokerage does not refer to the ability of one unit to act as intermediary in the relations between other units. Rather, it refers to the ability of individuals within the units to maintain non-redundant contacts across the divisional boundary, acting as information brokers that provide their own units with novel information. A focal unit with substantial interunit brokerage with respect to an alter unit will have many such information brokers. Thus, the benefits of brokerage that occurs at the individual level accrue to the unit. This subtle difference in unit of analysis dramatically affects the interpretation of the theory.

The role of corporate leadership: selection and support of interdependent innovation

The existence of multiple interdependent innovation attempts is associated with heightened potential for cross-unit coalitions, cliques, and interunit politics. In this political context, corporate executives can exert strategic choice (Child, 1972), selecting from the varied interdependent innovation options those opportunities that deserve strategic attention. Once the focus of senior management attention and oversight, those selected innovations—and their associated residual interdependencies—are more sharply attended to and become more sensible (Dutton and Ashford, 1993; Gilbert, 2005; Weick, Sutcliffe, and Obstfeld, 2005). Senior leadership support and attention focuses social activity around boundary spanning individuals, reshaping the firm’s social structure to provide the information and political support to implement interdependent innovation. It is through this reshaping that an organization whose social structure previously enabled the initiation of interdependent innovations can come to enable their execution as well.

In particular, once an interdependent innovation receives the backing of senior managers—a clear signal that they consider the interdependence between those divisions to be important—actors in each participating division will feel a strong, albeit informal, incentive to connect with actors in partner divisions (Pfeffer and Salancik, 1978). This motivation may stem from innate curiosity or loyalty to the organization, but is also rooted in career concerns and hopes for future advancement (Gibbons and Murphy, 1992). This incentive may lead to the creation of new ties spanning the boundary between divisions. But more likely, it will lead actors to seek to expand contact with the partner division by taking advantage of already-existing ties. Those actors who play boundary-spanning roles will become increasingly important, as their colleagues will turn to them for help in connecting with actors in the partner division. This demand for cross-unit contact will result in triadic closure (Davis and Leinhardt, 1972; Homans, 1951; Simmel, 1902), as information brokers introduce their local contacts to their primary contacts in the partner division and, conversely, as they meet the contacts of their primary contacts (Figure 3). In

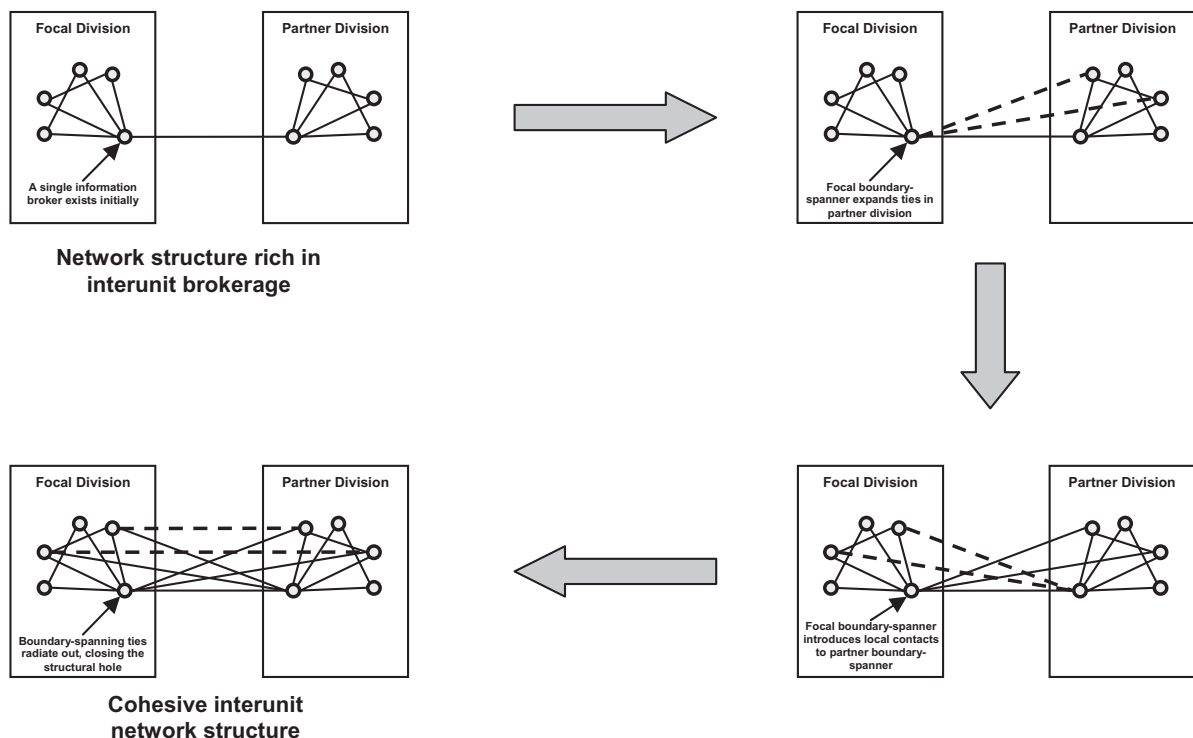


Figure 3. Triadic closure makes brokerage networks more cohesive

this way, the support and attention of senior managers leads to an iterative process of triadic closures that enables direct interunit contact to radiate outward from the original boundary-spanning relation, creating a more cohesive social structure across the divisional boundary. This more cohesive social structure, in contrast to the social structure marked by weak brokerage relations, enables the successful implementation of interdependent innovation.

Proposition 5: Senior team selection of and support for an interdependent innovation will strengthen the weak ties that join partner units, increasing the likelihood of successful implementation (see Proposition 2).

Proposition 6: Senior team selection of and support for an interdependent innovation will decrease the degree of brokerage between partner units, increasing the likelihood of successful implementation (see Proposition 4).

In addition to their informal influence on the search and interaction decisions of actors throughout the organization, senior management holds one important formal responsibility: appointment of actors to linking roles. Which actors get appointed to key linking roles is important in both a symbolic and a practical sense (Pfeffer, 1981). Research on product development focuses on the importance of selecting 'heavyweight' actors to occupy formal linking roles across interdependent units (Clark and Wheelwright, 1992; Galbraith, 1973).

The product innovation literature emphasizes structure and process in determining whether a given actor provides sufficient gravity for a role. We suggest that the 'weight' of an actor must be considered in the context of the particular task; actors who are well-connected in the focal divisions—rather than actors who have the most authority in a more global sense—may be best-suited to occupy formal boundary-spanning roles because they are best able to promote effective contact between actors in both divisions. Thus, by deliberately choosing actors based, in part, on their network structures, the senior team can explicitly 'seed' the closure of the interunit social structure for successful implementation.

Proposition 7: Senior team appointment of actors who are well-connected in both collaborating divisions to formal linking roles will increase the likelihood of successful implementation.

The senior leadership team's support for particular interdependent innovations also moderates the relationship between social structure and execution. Whereas the uncertainty that marks the preselection period tends to result in unadjudicated political behavior, as various actors promote their own interdependent innovations, senior team selection of particular innovations eliminates this uncertainty, resulting in dramatically reduced politics and greater cooperation. Senior management's attention to these selected interdependent innovations and to their associated interdependencies creates the strategic focus and political context where boundary-spanning activities take on a collective, integrative character (Allen, 1969; Obstfeld, 2005) as opposed to a careerist, self-interested character (Burt, 1992).

Proposition 8: In the context of strong senior team support, the negative effect of interunit brokerage on the likelihood of successful implementation of interdependent innovation will be attenuated.

Corporate executives play a pivotal role in creating contexts that balance induced, exploitative, line of business behaviors with emergent, exploratory behaviors of autonomous internal product champions (Burgelman, 2002; Gilbert, 2005). Where multiple champions trigger political stalemates, the selection by senior leaders of a few interdependent innovations reduces uncertainty and associated political behaviors. These actions by senior leaders reduce the number of interdependent innovation options through selection, sending clear signals to the organization about which initiatives are strategically important and which are not. This more strategically and politically clear context creates the conditions for social networks to reshape in favor of the execution of targeted interdependent innovations.

Finally, whereas these social dynamics are complex among members of two product divisions, as our theory has implicitly assumed, large, multidivisional firms often have many product divisions. When interdependent innovation requires collaboration from multiple product divisions, or when divisions are particularly dissimilar in their core technologies, these dynamics will be exacerbated.

CONCLUSION

Growth is a central challenge for firms (e.g., Gulati, 2004), one that only gets accentuated as firms get

larger (Christensen, 1997) and older (Hannan and Freeman, 1984; Sørensen and Stuart, 2000). Exploitation crowds out exploration (Benner and Tushman, 2003; March, 1991) such that further growth is often achieved through crisis, strategic renewal, alliances, and/or acquisition (e.g., Gulati, 1995; Hurst, 1995; Tushman and Romanelli, 1985). We argue that large, established firms need not necessarily look outside their boundaries for new opportunities to grow and explore. In related diversified firms, an alternate source of growth and exploration exists in interdependent innovation that relies on the recombination of disparate technologies, skills and resources already resident inside the firm in service of new products. However, interdependent innovation is extremely difficult to manage precisely because the structure of the multidivisional organization—both formal and informal—is designed to manage the primary interdependence within divisions, not the residual interdependence between divisions. Although collaborative incentives and formal organizational structures are useful and well-studied ways to manage interdependent innovation, they can be complemented by corporate leadership actions to shape and leverage interdivisional social networks.

We suggest that among the central roles of corporate executives is to shape the firm's context to facilitate the emergence of autonomous interdependent innovations and to then select from these a few strategic interdependent innovations. Once these residual interdependencies are transformed into strategic interdependencies, the leadership team can, in turn, reshape the social structure to build bridges across divisional boundaries. In this fashion, a crucial role of corporate executives is to balance line of business exploitative behaviors with exploratory cross-line-of-business experimentation. Ironically, then, the context most antithetical to extant theories of organization design—managing strategic interdependence across divisional boundaries—appears to be the most tenable approach to shaping interdependent innovation in service of proactive corporate growth and strategic renewal.

The corporate leadership team's role is particularly central in shaping interdependent innovation. The corporate team both shapes and drives business unit exploitative action even as it creates the conditions to advance exploratory interdependent innovation. Our evolutionary approach to growth through interdependent innovation involves several domains of executive action. Corporate executives stimulate variation by setting an emotionally

engaging, broad strategic aspiration that stimulates autonomous, entrepreneurial actions of independent boundary spanning individuals. This source of innovative variation is not induced by corporate fiat, but rather it is generated through autonomous action of individual information brokers across independent business units.

But effective variation is also associated with power, politics, cliques, and coalitional behavior. Thus a critical role of the corporate team is to select from these interdependent innovation variants those few strategic opportunities. This selection action by senior leaders takes multiple instances of residual interdependence and enacts a few instances of strategic interdependence. Once a few strategic interdependent innovations are selected, the senior management team then shapes a fundamentally different set of social networks—cross-line-of-business networks exhibiting elements of both brokerage and cohesion—to execute the selected cross-line-of-business opportunities. In the absence of senior management selection, by contrast, the self-defeating dynamics of brokerage-based search, followed by coalitional behavior without the benefits of pockets of trust that result from cohesion in the social network, are allowed to undermine interdependent innovation. Thus, this evolutionary model of interdependent innovation puts a premium on the senior team's ability to create the conditions for interdependent innovation variants to arise, to be able to exert strategic choice from these variants, and to, in turn, shape social networks to execute the selected interdependent innovations.

These actions to shape interdependent innovation take place in the context of simultaneously managing the business units to execute their existing line of business strategies. These dual and inconsistent roles of business unit exploitation as well as cross-unit exploration put a premium on the corporate team's ability to attend to and deal with fundamentally inconsistent strategic agendas. These contrasting strategic agendas require that the team have sufficiently complex cognitive models that they are able to attend to and deal with contradictory strategic objectives (Hambrick, 1994; Smith and Tushman, 2005). To the extent that informal interactions between organizationally disparate actors become a distraction that undermines performance in core businesses, interdependent innovations will succeed only at tremendous cost for the firm as a whole.

Further, this point of view puts a premium on conceptualizing several distinct types of strategic inter-

dependencies and organizational designs to execute those interdependencies. Senior teams must be able to attend to strategic interdependencies associated with exploiting line of business outcomes as well as exploratory interdependencies associated with cross-line-of-business innovation. In the context of these distinct types of strategic interdependencies, senior teams link strategic interdependencies to the fundamental form of their organization (Henderson and Clark, 1990) even as they influence social networks to execute strategic interdependencies across autonomous business units. Although Thompson focused on task interdependence among organizational units—such as the branch offices of a firm or the operations and maintenance units of an airline (Thompson, 1967:54–55)—in the last decade, few scholars have studied task interdependence at such a macro level (cf. Casciaro, 2003). Research has focused almost exclusively on interpersonal task interdependence or interdependence within teams, across functions, or with alliance partners outside the firm (e.g., Stewart and Barrick, 2000; Wageman, 1995; Wageman and Gordon, 2005). This review suggests a return of the notion of task interdependence at the corporate level of analysis.

This review also suggests that more attention could be fruitfully paid to cross-line-of-business design and the role of senior leaders in creating growth opportunities through cross-line-of-business innovation. We suggest that this source of exploratory growth takes place in the context of line of business exploitation and as such is shaped by senior leaders shaping those contrasting social networks and informal bridge building associated with creating versus executing interdependent innovations. Most fundamentally, it is the primary role of senior leaders to not get caught in what Burgelman (2002) calls strategic vectors rooted in line of business blinders, but rather, to maintain a balance between line of business exploitation and cross-line-of-business exploration. Maintaining such a balance cannot be done by senior executives alone; rather, this theory implies an important role for organizational culture in encouraging managers at all levels to value the dual agendas of exploitation within existing lines of business and cross-line-of-business exploration. Such a culture can help line of business managers to balance these sometimes conflicting agendas by situating them in the context of the long-term performance of the organization and the long-term interests of their own careers (Holmstrom, 1999).

If this evolutionary model of interdependent innovation has merit, then it has implications for at least four areas of theory and research. First, it suggests that the current design work on structures and incentives be complemented with research that explores the role of senior teams in shaping social contexts for interdivisional exploration. These contexts involve shaping contrasting social networks to both explore and, in turn, exploit strategic interdependent innovations. Our evolutionary model of interdependent innovation suggests that senior teams must both select those innovations that are strategic but also proactively reshape social networks as firms move from generating innovation variants to executing a given set of interdependent innovations. But reshaping the social networks to implement an interdependent innovation requires a delicate touch; our theory suggests that wholesale commitment to cohesive networks across divisional boundaries is not only impractical, but potentially perilous to an organization. Cross-divisional ties, when not targeted toward specific interdependent innovations, risk becoming a distraction from core divisional activities. Furthermore, cohesive interunit ties can undermine the information brokerage needed to develop a variety of interdependent innovations to choose from in the future. Rather, the critical task of senior leadership in reshaping the social network is to be highly targeted, involving all those—and only those—people whose formal roles or informal, social structures make them essential to the success of the interdependent innovation. Doing so requires an attention to social dynamics (Krackhardt, 1990) that is seldom demanded of managers, but that is critical to promote the successful implementation of the interdependent innovation, while also maintaining the organization's focus on exploiting core divisional resources and enabling the initiation of new interdependent innovations in the future.

Second, and more generally, our approach suggests that the larger issue of organizational design could be better informed by research on social networks at the corporate level of analysis. This research might focus on the selection and shaping of boundary spanning individuals and the structures that link these key individuals. Who are these individuals, how do they evolve, and do they create networks of gatekeepers in service of interdependent innovation? Are these social networks different for interdependent innovations that differ in terms of the boundaries spanned (i.e., divisional boundaries versus firm

boundaries), the number of boundaries spanned, or the complexity of task interdependence?

Third, these ideas on interdependent innovation might also inform the work on diversification (e.g., Ansoff, 1957; Hill and Hoskisson, 1987; Montgomery and Wernerfelt, 1988; Rumelt, 1974; Villalonga, 2004). Scholars have rarely drawn an explicit link between the challenge of successful diversification and the structure of the multidivisional form itself. The multidivisional form requires the strategic prioritization of some interdependencies over others, with the high-priority interdependencies contained within divisions; interdependent innovation between divisions is, by construction, the lowest priority. In intensely competitive, highly dynamic environments, these lowest-priority residual interdependencies can be a source of great diversification opportunities. These diversification attempts are extremely difficult to manage precisely because they are the residue of organizational design. The notion of residual interdependence and associated social structures helps inform this diversification work.

The diversification literature examines the sources of benefit that inhere in different types of diversification. Theory suggests that unrelated diversification offers financial benefits (if any benefits at all; see Villalonga, 2004) and should be implemented with a structure of high decentralization and accountability. Related diversification, by contrast, offers benefits of economies of scope, and should be implemented with a structure that is more centralized, allowing corporate managers to play some role in coordinating the actions of autonomous divisions (Hill and Hoskisson, 1987). We suggest that this perspective can be complemented with greater attention to social structure: in addition to a certain amount of formal centralization, related diversified firms can achieve economies of scope through interdivisional social networks. These networks will, to a limited extent, occur naturally, but must also be proactively managed by corporate leadership.

This theory also contributes to research on the relationship between diversification and innovation. Critics of the multidivisional form have demonstrated a negative relationship between diversification and innovation, with functional form firms and dominant-diversified firms investing substantially more in R&D than related and unrelated diversifiers (Hoskisson and Hitt, 1988). The mechanism they posit for this relationship is based on financial controls and incentives, which promote risk-aversion and short-term orientation in divisional

managers (Stonich, 1981). Our theory suggests another possible explanation: as firms become increasingly diversified into a broader range of less-related businesses, divisions have less commonality and, as a result, the number of boundary-spanning social relations lessens, reducing the potential for interdependent innovation.

And fourth, an important direction for research involves the interaction between formal structure and informal structure. The traditional organization design perspective on interdependent innovation involves the creation of formal lateral linking structures, such as cross-divisional teams or liaison roles or the use of matrix structures (Galbraith, 1973). This paper has highlighted the important role of network structure, but, as Barnard (1938) pointed out so long ago, formal structure and network structure are not independent. Future research should empirically examine the endogeneity of formal and social structure, looking at the network structures of individuals involved in such formal lateral structures to determine what kinds of structural positions are most suitable for playing boundary-spanning roles. Additionally, future research should examine the degree to which, and the contingencies under which, formal structure and social structure may be mutually supportive. Theory suggests that formal work relations tend to expand in multiplexity, evolving to incorporate elements of trust, advice, support, or even friendship (McPherson, Smith-Lovin, and Cook, 2001), and furthermore that formal lateral structures, such as task forces, will coalesce into well-functioning teams more quickly and more completely in the context of social relations high in trust (Hackman, 1987). This might be the mechanism to explain why team effectiveness tends to increase over time, at least initially (Allen, 1977). Yet these ideas haven't yet been explored empirically in the context of interdependent innovation.

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