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Common Third Parties and Coordination Disruptions in New Product Development Organizations

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This conceptual article builds on existing research on network analysis to examine the possibility that the self-organizing tendencies of communication networks may endogenously affect the likelihood of informal communication between interdependent teams in new product development organizations. Although informal communication between teams emerges out of those teams' effort to coordinate their task interdependencies, the presence of common third parties in the communication network may shape the behavior of teams in ways that makes this communication network depart from the underlying network of technical interdependencies between the teams. In some cases, the presence of a common third party may reinforce the predisposition of interdependent teams to exchange information. In others, it may drive teams to enter exchanges without an apparent technical need to do so. Finally, and more importantly, the presence of a common third party may induce interdependent teams to neglect exchanging information on their technical interdependencies. This possibility is more likely when coordination between two interdependent teams and a common third party can result in cyclic exchanges that can trigger design oscillations affecting the work of the common third party. While these oscillations may be undesirable, efforts to prevent them can result in coordination disruptions that are also undesirable, because they can affect the performance or durability of the affected components and subsystems.

Practitioner Points

- Informal communication networks can have an independent effect on the propensity of design teams to exchange technical information.
- Dense clusters in the informal communication network can induce teams to communicate without a technical reason to do so.
- Task interdependencies that can trigger cyclic communication patterns among teams are more likely to experience coordination disruptions.

Introduction

Research on new product development has highlighted the role of informal communication between design teams as an effective means to help those teams coordinate interdependent tasks. While the role of informal networks in facilitating coordination in engineering organizations has been acknowledged at least since the pioneering work by Allen (1977) and Tushman (1977), organizational scholars have not considered the possibility that the informal communication network that emerges out of the efforts of teams to coordinate their task interdependencies might, on some occasions, hinder coordination. Yet, this possibility is fully consistent with advances in the understanding of the self-organizing principles operating in informal communication networks.

This conceptual article builds on research in network theory to explore how the self-organizing tendencies of informal communication networks can induce teams to exchange and, more importantly, to neglect exchanging information about task interdependencies. To this end, the article examines the various mechanisms used to cope with the coordination challenge associated with developing complex products. The article then addresses the role of informal communication between teams as an important coordination mechanism. Finally, it focuses on the role of common third parties in the communication network as a factor that might help or hinder coordination between interdependent teams.

The Challenge of Coordination in New Product Development

The development of complex industrial products poses substantial operational and organizational challenges for managers. Organizations have developed two

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complementary approaches to deal with such challenges. The operational approach decomposes complex products into subsystems, which may be further decomposed into smaller components if they are still deemed too complex (Alexander, 1964; Simon, 1996). The organizational approach assigns each component to a team responsible for its design and for its integration with other components to ensure product functionality (e.g., Clark and Fujimoto, 1991). In general, the breakdown of the product into subsystems and components and the interfaces between components define the architecture of the product and create technical interdependencies between design teams (Eppinger and Browning, 2012; Ulrich, 1995). Effective coordination between interdependent teams is therefore one of the most critical challenges for successful complex product development (Galbraith, 1973; Mihm, Loch, and Huchzermeier, 2003; Smith and Eppinger, 1997; Thompson, 1967).

The challenges of effective coordination between interdependent teams prompt organizations to structure tasks in ways that minimize coordination requirements (Daft and Lengel, 1980; Thompson, 1967). This entails minimizing the number and complexity of the interdependencies between product components without compromising product functionality (Baldwin and Clark, 2000). The minimization of interdependencies is central to the notion of "product modularity," which focuses on reducing the connection across sets of physical components, development activities, or organizational teams. Product modularity has been associated with flexibility to adapt and generate product variety (Ulrich, 1995); it also facilitates the evolution of designs and industries by allowing teams to work independently on loosely coupled problems (Baldwin and Clark, 2000). In the process domain, modularity has been proposed as a mechanism to reduce cost in design testing and to mitigate design oscillations in complex engineering projects (Loch, Terwiesch, and Thomke, 2001; Mihm et al., 2003). In the organizational domain, modularity has also been proposed as a source of flexibility to the organization (e.g., Ethiraj and Levinthal, 2004; Sanchez and Mahoney, 1996; Schilling, 2000).

While efforts to achieve product modularity can minimize coordination needs, interdependency remains an important factor to reckon with in complex product development efforts. Organizations use a number of formal and informal mechanisms to ensure the coordination of the technical interdependencies between design teams that cannot be eliminated without compromising the functionality of the product. Formal coordination mechanisms comprise decisions to assign product components to design teams, grouping these teams into subsystems led by a manager, and introducing special teams to facilitate horizontal coordination across design teams and subsystems (see Ford and Randolph, 1992, for a review).

Informal coordination mechanisms refer to spontaneous exchanges of task-related information between interdependent teams (Nadler and Tushman, 1997). These exchanges are particularly important in the development of new and complex products. The very novelty and complexity of such products makes it harder to anticipate the nature and the intensity of task interdependencies between the teams, which limits the effectiveness of formal mechanisms in coordinating interdependencies and strengthens the role of informal information exchanges between the teams (Gokpinar, Hopp, and Iravani, 2010; Henderson and Clark, 1990; Sosa, Eppinger, and Rowles, 2004).

The "Matching" between Task Interdependency and Communication Networks

Insofar as exchanges of task information between teams emerge to satisfy coordination needs, the informal communication network between teams should mirror the structure of task interdependencies between these teams (Henderson and Clark, 1990; MacCormack, Baldwin, and Rusnak, 2012; see Colfer and Baldwin, 2010, for a review). A team whose task is affected by the task of another team typically seeks to acquire the relevant information from the second team, which is expected to provide such information to the first (Gokpinar et al., 2010; Morelli, Eppinger, and Gulati, 1995; Sosa et al., 2004; Terwiesch, Loch, and De Meyer, 2002). These informal exchanges aggregate into a network of directed information flows between teams, which largely matches the network of task interdependencies between those teams.

BIOGRAPHICAL SKETCHES

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Yet, not all interdependencies are effectively matched with informal communication (Sosa et al., 2004). In fact, teams typically "ignore" (or pay marginal attention to) a number of interdependencies during a development process. Some level of neglect is perhaps unavoidable given the cognitive and resource limitations typically faced by teams, but interdependencies that are left unattended due to failures of informal communication between interdependent teams can at times result in substantial costs for firms in terms of redesign and rework to ensure product functionality (Gokpinar et al., 2010; Henderson and Clark, 1990). Hence, understanding the causes of these communication failures is important to ensure the smooth operation of the development process.

Previous research on mismatches between task interdependency and informal exchanges between the teams has emphasized the effect of spatial arrangements, the formal organizational structure, and the strength of the task interdependency on the likelihood of communication failures between interdependent teams (Sosa et al., 2004). Teams separated by physical distance are significantly less likely to exchange information than proximate teams are (Allen, 1977; Sosa, Eppinger, Pich, McKendrick, and Stout, 2002). People are less likely to communicate across organizational units, generating a "silo effect" that undermines cross-unit coordination (Gulati, 2010). Time and resource constraints make weak task interdependencies more likely to be neglected than strong ones are (Sosa et al., 2004).

The advances in the study of the dynamics of social networks suggest another, hitherto unexplored factor that may cause interdependent teams to neglect communicating. Network analysis has shown communication networks exhibit self-organizing principles that may independently affect the observed pattern of ties in the network (Lusher and Robins, 2013). This property of network structures suggests that endogenous processes of network formation can be an important factor in explaining the emergence (or the absence) of informal communication ties in product development organizations. Although such ties may emerge largely as a response to coordination needs between interdependent actors, the endogenous dynamics of the emerging communication network may moderate the effect of task interdependency on the communication between teams in ways that are both theoretically interesting and practically relevant for managers involved in new product development efforts. If this is the case, it would pose an interesting paradox: the same communication network that emerges to help teams coordinate their technical interdependencies may be leading some teams to neglect exchanging information about some of those interdependencies.

The possibility that the self-organizing tendencies of social networks can lead actors to enter exchanges that do not correspond to underlying interdependencies or to neglect forming ties with other interdependent actors has been suggested in studies of interorganizational and interpersonal networks. From an interorganizational viewpoint, Gulati and Gargiulo (1999) showed that the effect of the emerging structure of an alliance network can become a repository of information that shapes subsequent choices of alliance partners, reducing the salience of the underlying interdependency between firms as the driving force behind their partnerships. At the interpersonal level, Gargiulo and Benassi (2000) showed that managers whose communication network was characterized by a dense web of connections between their contacts were more likely to fail to coordinate critical interdependencies related to their work. More recently, Sosa, Gargiulo, and Rowles (2015) analyzed mismatches between technical interdependency and communication between design teams and showed that the likelihood of communication failure between interdependent teams was statistically associated with the position common third parties occupy in the triadic structure of the local communication network.

This article builds on previous research and explores how an important self-organizing property of communication networks may prompt failures in the informal exchanges of technical information between interdependent teams. More specifically, the article focuses on the effects of the tendency of communication networks to form closed triads—that is, to create ties between nodes sharing a common third party. Based on existing research (Gokpinar et al., 2010; Morelli et al., 1995; Sosa et al., 2004; Terwiesch et al., 2002), it is assumed that exchanges of technical information occur when a team whose task may be affected by the task of another team seek to acquire the relevant information from that team *and* when this second team effectively provides such information to the first. Communication failures can occur because teams neglect to request the relevant information from their interdependent counterparts, because the counterparts fail to respond to these requests, or both. Consequently, the discussion will focus on identifying how the structure of the communication network in which the acquirer and the provider team are embedded may affect their propensity to acquire or to provide information on their technical interdependencies, with an emphasis on the role of common third parties to the relationship.

The Effects of Common Third Parties on Inducing Triadic Closure

The possibility that the communication network that emerges to coordinate task interdependency between teams could itself affect the likelihood of communication between those teams is consistent with existing knowledge of the endogenous mechanisms that shape communication networks, and particularly, with the effect of common third parties in such networks. One such endogenous mechanism indicates that the presence of a common third party to two actors in a network can increase their propensity to engage in information exchanges, creating a close communication triad between the three actors. The argument is central to sociological theory. In its contemporary form, it was put forward by Coleman (1988, 1990) and Granovetter (1985), who stress the positive effect of common third parties (or "structurally embedded" relationships) on the emergence of trust and on the production of social norms that facilitate the exchanges between the two focal actors. Network scholars often discuss this tendency as triadic (or network) closure (Burt, 2005; Coleman, 1990).

Triadic closure implies that the presence of common third parties to a relationship makes actors more likely to trust and to understand each other, diminishing the uncertainty of their exchanges and enhancing their ability to collaborate. Common third parties also make actors aware that their actions can be monitored and that non-cooperative behavior can be easily made known to (or observed by) those third parties, having a negative effect on the reputation of the offending actor (Ahuja, 2000; Gargiulo, Ertug, and Galunic, 2009; Raub and Weesie, 1990; Reagans and McEvily, 2003; Tortoriello and Krackhardt, 2009). More generally, if two interdependent actors are closely associated with a third, they are more likely to develop a direct tie between themselves than they would in the absence of the third party. Going back to the context specific to this article, the triadic closure effect suggests that the likelihood of a communication failure between two interdependent design teams will be inversely proportional to the number of common third parties to the relationship.

The triadic closure effect can be easily visualized in Figure 1. The component designed by team *i* can affect the components designed by teams *j* and *k,* resulting in the directed task interdependencies Y_{ij} and Y_{ik}, respectively. If informal communication emerges to attend task interdependency, one should expect to observe communication ties that "match" the observed interdependencies. For this to happen, teams *j* and *k* should request information from team *i,* which should provide the respective information to them. Yet, the communication networks in which these two interdependencies are embedded are significantly different. Teams *i* and *j* share four common third parties in the communication network (*a*, *b*, *d*, and *e*), whereas teams *i* and *k* have no common third party. The common third parties are likely to make *j* more aware of the effects the task interdependency Y_{ij} can have on *j*'s work, prompting team *j* to seek the necessary information from team *i* (see Obstfeld, 2005, for an example of this catalyst role of common third parties in product development efforts). The common third parties are also more likely to induce *i* to respond to these requests by sending the required information to *j.* Both mechanisms should increase the likelihood of observing a directed communication along the Y_{ij} interdependency. By the same token, the *absence* of common third parties to teams *i* and *k* should increase the likelihood that the interdependency Y_{ik} will be neglected. As it will be shown, this is one of the two aspects that form the "dark side" of the tendency toward network closure in social networks.

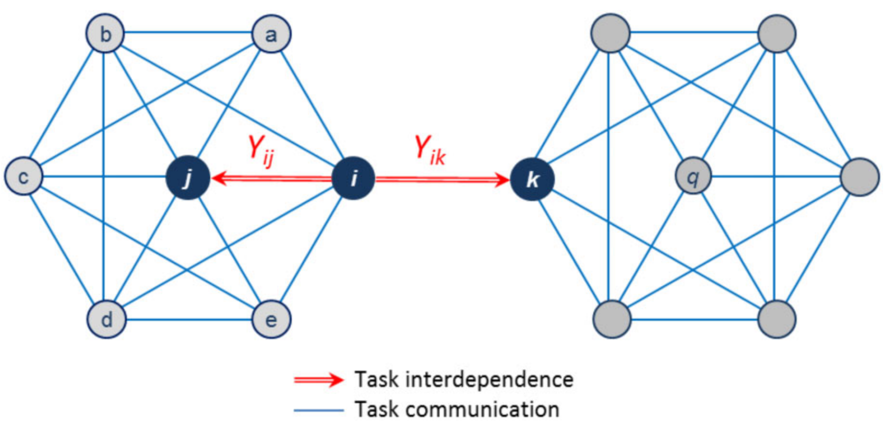

Figure 1. Interdependency and Common Third Parties in the Communication Network

The "Dark Side" of Triadic Closure

An implication of the tendency toward triadic closure is that the absence of common third parties should make *k* more likely to neglect requesting information from *i* on the interdependency Y_{ik}. If a request would be put forward by *k*, the lack of common third parties would make *i* more likely to ignore it, focusing instead on the request put by team *j*. At the system level, the tendency toward triadic closure in communication networks can have therefore two opposite effects on the attendance to task interdependency between teams: it will not only increase the likelihood that teams will attend to the interdependencies embedded in common communication parties, but it will also increase the likelihood that interdependencies that are not embedded in common third parties are neglected. In other words, there is a potential "dark side" to the triadic closure induced by common third parties that cannot be ignored.

The tendency toward triadic closure in social networks can have an additional, less apparent effect on the likelihood of communication failures between interdependent teams. While common third parties may induce interdependent teams to communicate, they may also prompt non-interdependent teams to exchange information. Going back to the example in Figure 1, common third parties may prompt *k* to communicate with *q,* despite the lack of task interdependency between the two teams. Communication ties in the absence of task interdependency may result in a suboptimal allocation of resources by the teams, since team members would be spending time exchanging information with other teams without an apparent reason to do so. This "excess" in communication is unlikely to be directly harmful to the design process, and in some cases there may be important (albeit nonapparent) reasons that compel teams to communicate (Gokpinar et al., 2010). Yet, the proliferation of communication ties between teams that share common third parties would naturally result in a dense web of communication ties among those teams, even though some of these teams may not be actually interdependent.

The formation of dense communication clusters in a network may have additional negative consequences for the attention to technical interdependencies in new product development efforts. Research suggests that actors embedded in such networks are less likely to establish ties with parties outside the network, even when task interdependencies prompt them to do so. This effect was documented in a field study of communication between technical managers in a large computer manufacturing (Gargiulo and Benassi, 2000). Managers that were embedded in a thick web of exchanges with other managers were significantly more likely to fail to attend to new interdependencies with colleagues outside their clusters. Going back to the example in Figure 1, *k*'s attention is likely to be drawn toward the dense cluster of communication ties of which it is a part, and away from interdependencies with teams outside that cluster. In other words, the fact that *k* is embedded in a dense cluster of exchanges resulting from the tendency to triadic closure may increase the likelihood that it will fail to request information on its interface with *i*, which is not part of that dense cluster.

Can the Presence of a Common Third Party Inhibit Communication?

The discussion so far has argued that, consistent with the tendency toward triadic closure in social networks, the presence of common third parties should increase the likelihood of communication between interdependent teams. Although an implication of this effect is that interdependencies between teams that do not share common third parties are more likely to be neglected, this does not consider the possibility that the communication between the interdependent actors may be against the interest of the common third party and thus that the presence of such a third party may actually hinder the communication between the interdependent actors.

The network closure argument portrays the third party as a relatively passive catalyst of trust or as a potential enforcer of cooperative norms, whose role is to facilitate (or even induce) the exchanges between the two focal actors. In either case, the interests of the common third party are assumed to be served (or at least, not affected negatively) by the communication between those two focal actors. Yet, it is possible that the common third party may have an interest in *preventing* communication between the two focal actors. This possibility is familiar to network scholars who have focused on the advantages actors derive from bridging between otherwise disconnected third parties—that is, for being the third party in an "open" triad. The argument is familiar in classical sociological theory (see Simmel, 1950, on the *tertius gaudens*, or "third who benefits"). More recently, the idea has taken a central stage in structural holes theory (Burt, 1992, 2005).

The essence of structural holes theory is that a common third party connected to two focal actors who do not have a direct tie with one another enjoys information and control advantages over these two actors (Burt, 1992). The lack of a direct connection between the two focal actors makes them dependent on the common third party for information about each other, which confers the common third party the power to control the information flows. The benefits accruing to individuals, teams, and organizations occupying this "brokerage" position in open triads have been documented in a large number of studies, going from firms in alliance networks (e.g., McEvily and Zaheer, 1999) to managers in a variety of business settings (e.g., Burt, 1992, 1997; Gargiulo et al., 2009; see Burt, 2000, for a review of the literature). Because being the intermediary in an open triad confers advantages to the common third party, one should expect that actors in such position may have an incentive to prevent the communication between the two other actors in the triad if such communication may negatively affect those advantages.

This possibility is explored in a recent article that analyzes the role of common third parties in the task-related communication network of a new product development effort (Sosa et al., 2015). Analyzing data on interdependency and communication networks between the teams responsible for designing the different components of a major aircraft engine, the authors show that the presence of a common third party actually *reduces* the likelihood of observing a direct communication tie between two interdependent teams when such communication would create a cyclic triad involving the three parties.

Figure 2 depicts a cyclic triadic structure with directed communication ties between two interdependent teams i and j and common third party k. The double-line arrow represents the exogenous task interdependency between the teams, so the task of team j affects the task of team i. The solid lines represent task-related informal communication between teams. The curved dotted line represents the directed communication tie that would be formed if

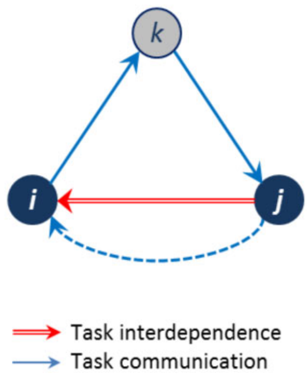

Figure 2. Cyclic Communication Triad between Two Interdependent Teams and a Common Third Party

team j would send task-related information to team i. In this triad, team j receives information from k, which in turns receives information from i. The communication tie from j to i would create a cycle $j \rightarrow i \rightarrow k \rightarrow j$ in the information exchanges within the triad.

Insofar as the information exchanges depicted in Figure 2 may induce further adjustments in the design of the components designed by these teams, the structure has the potential to derive in an endless cycle of modifications affecting all three teams. Although cyclic interdependency patterns are not uncommon in new product development efforts (Mihm et al., 2003; Smith and Eppinger, 1997), they are difficult to manage and increase the likelihood of errors (Sosa, Mihm, and Browning, 2013). In this context, it is unlikely that the common third party would encourage information exchanges between j and i. Rather, the third party is more likely to encourage teams j and i to "freeze" their interface to avoid triggering the cycle.

The previous discussion suggests that the presence of a common third party may inhibit the direct exchange of information between two interdependent teams if such an exchange could trigger a cyclic pattern of information exchange between the three teams. Sosa et al. (2015) find evidence supporting this idea. Their statistical network analysis, based on estimating exponential random graphs models of the interdependency and informal communication networks between the teams designing different components of an aircraft engine, shows that cyclic triads like the one depicted in Figure 2 are significantly less likely to occur in their data. This finding is consistent with an approach to managing iterative problem solving recognized in the new product development literature (Eppinger, Whitney, Smith, and Gebala, 1994; Mihm et al., 2003). When a set of tasks are related to each other in a cyclic manner, the teams involved may decide to "cut" the communication cycle by removing, freezing, or making assumptions about one of the interdependencies in the cycle, which allows them to carry out their activities in a sequential rather than in the iterative way (Mihm et al., 2003).

An example of this behavior can be observed in teams responsible for designing holistic functional requirements of a product, such as the weight management of an airplane or the fuel economy of a vehicle. While all components can affect these functional requirements (and hence the task of team k, which is responsible for the functional requirement), some design teams take priority over others due to the criticality or complexity of their components. If the component designed by team i is one of these critical components, the team will be allowed to make the necessary design choices, which will have to be accommodated by team *k*. To meet its functional target, *k* would then set design constraints (e.g., weight targets) for team *j* to ensure that *j*'s component meets the new requirements. At the same time, *k* is likely to request *j* to "freeze" the interface with *i*'s component to avoid design oscillations. This may lead team *j* to focus on its own component and to neglect communicating with *i*, simply assuming that this would not be necessary because the changes *j* is introducing should not have an effect on *i*. Yet, this assumption entails risks: if the changes in *j*'s component actually end up affecting *i* in ways that may compromise the reliability, life span, or functionality of the component, the designers may not find out about it until later in the process, forcing them to engage in costly rework to correct the problem (Gokpinar et al., 2010; Sosa et al., 2004).

Conclusion and Venues for Future Research

This conceptual article argued that although informal communication between teams emerges out of those teams' effort to coordinate their task interdependencies, the self-organizing tendencies of communication networks may shape the behavior of teams in ways that makes the emerging communication network depart from the underlying network of technical interdependencies between those teams. Focusing specifically on the effects of common third parties in a communication network, this article argues that in some cases the presence of a third party may reinforce the predisposition of the interdependent teams to exchange information. In others, the presence of a common third party may prompt teams to exchanges without an apparent technical need to do so. Finally, and more importantly, the presence of a common third party may induce interdependent teams to neglect exchanging information on their technical interdependencies.

The arguments presented until now have focused on a particular self-organizing tendency of communication networks—namely the tendency to achieve triadic closure. This tendency implies that teams that share common third parties in the communication network should be more likely to exchange information than those lacking such common third parties. Although this tendency should facilitate the emergence of communication ties between interdependent teams, it was also argued that it may prompt non-interdependent teams to exchange information in the absence of apparent reasons to do so. In some cases, these exchanges may correspond to interdependencies that are unveiled during the development process; in others, they may be simply superfluous. Aside from consuming some team resources, these "superfluous" communication ties are not necessarily harmful. Yet, their proliferation may redirect the teams' attention away from interdependencies that are not embedded in common third parties, increasing the likelihood that these interdependencies are neglected.

The argument also explored the possibility that the presence of common third parties may *prevent* triadic closure, inducing interdependent teams to neglect exchanging information in cases that such exchanges may trigger a cycle that can negatively affect the work of the common third party (Sosa et al., 2015). In doing so, the idea that common third parties can only act as catalyst of communication between their contacts was called into question. The possibility that they act in ways that dissuade teams from establishing such communication is contrary to the triadic closure principle, but it is consistent with structural holes theory (Burt, 1992), which envisages that actors may seek to keep their associates apart to maximize their ability to control the information flows in the network.

The ideas presented in this article seek to introduce the endogenous dynamics of communication networks into the study of the relationship between task interdependency and informal communication in new product development organizations. In doing so, the article called attention to the possibility that the very informal structure that emerges out of efforts to coordinate needs that cannot be attended by formal coordination mechanisms may prompt teams to attend to some interdependencies at the expense of others. Using social network theory and evidence from previous empirical studies, it was shown that communication failures between interdependent teams are likely to be systematically associated with the presence of certain local network structures. These ideas also highlight the importance of bringing insights from social network analysis into the study of new product development (Sosa, 2014).

The possibility that the self-organizing tendencies of communication networks may induce interdependent teams to neglect exchanging information on some of their technical interdependencies can have important practical implications for managers in complex product development projects. Managers know that formal organizational boundaries can have the undesirable "side effect" of hindering information exchanges across those boundaries, and expect informal communication networks to act as a remedy. Yet, the argument presented here suggests that the remedy may at times have undesirable side effects. In particular, the possibility that the presence of a common third party can inhibit in some cases informal communication between interdependent teams should prompt managers to identify such and manage such cases. Building on some recent findings by Sosa et al. (2015), this article suggested that this possibility is more likely when three-party coordination can result in cyclic exchanges that can trigger design oscillations affecting the work of the common third party. While these oscillations may be undesirable, efforts to prevent them can result in coordination disruptions that are also undesirable, because they can affect the performance or durability of the affected components and subsystems (Gokpinar et al., 2010; Sosa et al., 2004). By focusing on the behavioral consequences of the endogenous tendencies in communication networks, this article highlighted the possibility that managers may face a trade-off between avoiding oscillation disruptions that can jeopardize the completion of the project and introducing coordination disruptions that can negatively affect the integrity of the product. Because this trade-off is more likely to appear in situations that can trigger cyclic communication patterns, it is suggested that managers should pay special attention to the behavior of teams whose technical interdependencies make them prone to fall into such patterns.

Advancing the research agenda in this direction poses challenges in terms of theory development, data collection, and analytical strategies. From a theoretical viewpoint, it is necessary to deepen the understanding of the interplay between the exogenous structures of technical interdependencies that generate coordination needs and the emerging network of informal exchanges between actors in the product design organization. This requires the systematic exploration of other self-organizing principles of social networks, such as the tendency to focus the attention on "central" actors (also known as "preferential attachment"). Advancing the understanding of these issues will also require access to longitudinal data on technical interdependencies and informal communication, which could allow the examination of the co-evolution of both networks and the extent to which the endogenous tendencies of the communication network may override the exogenous forces of interdependency.

From a methodological viewpoint, the analysis of the self-organizing tendencies of social networks poses a number of challenges due to the non-interdependence of the observations that is intrinsic to the notion of an "endogenous" dynamics. If the data allow researchers to establish the sequence and timing of the communication events, the evolution of a communication network can be modeled, avoiding the complex simultaneous structures of dependence while still capturing the endogenous dynamics of the network using a relational events analytical framework (Butts, 2008).

When data on the sequencing and timing of the communication are not available, different methods have been developed to render the analysis of network dynamics possible. One such method seeks to model the interdependency of ties directly by resorting to exponential random graph models, which allow for modeling an observed network as a function of both endogenous and exogenous parameters (see Lusher, Koskinen, and Robins, 2013 for a comprehensive review; Sosa et al. 2015, for an application to new product development networks). Focusing specifically on modeling longitudinal network data, Snijders (2005; see also Snijders, van de Bunt, and Steglich, 2010) proposed an actor-oriented model in which actors change their choice of partners following a stochastic optimization of an objective function (see Ripley and Snijders, 2013, for a software implementation). These methods, and the increasing availability of detailed electronic records of communication between the relevant actors, suggest scholars can make substantial progress in understanding how the endogenous dynamics of networks affect the likelihood of communication failures between interdependent teams. This article helps to advance future research in this direction.

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