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Divide to connect: Reorganization through R&D unit spinout as linking context of intra-corporate networks

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ABSTRACT

The paper examines the formation of clique-spanning ties in intra-corporate co-invention networks, by focusing on the impact of R&D unit spinouts. Using data on thirty-one spinouts in eight large U.S. information and communication technology corporations, we show that the reorganization of R&D units through corporate spinouts is associated with an increase in the extent to which inventors employed in the unit collaborate with inventors located in other cliques within the corporate co-invention network. Interestingly, the spinout effect spills over to all members of the clique of spun-out inventors, also including those who remain with the parent firm. The interpretation of these empirical findings, grounded on existing theories and on the views of inventors and executives involved in the reorganization events, suggests that corporate spinouts generate a shock in intra-corporate research collaboration dynamics, which loosens clique lock-in effects and contributes to reset cliques' boundaries in the intra-corporate research network.

1. Introduction

A key insight of the recent literature on the economics and management of innovation is that creativity does not take place in isolation, but is the outcome of a thick web of knowledge exchanges and collaborations both within and across organizations. Prior studies have shown that research collaboration networks tend to evolve over time towards a small world architecture (Watts, 1999). This specific network structure has two peculiar features: (1) locally cohesive cliques (also called communities or clusters), comprising groups of actors (e.g., R&D employees) densely connected to one another but sparsely connected to others, and (2) clique-spanning ties, or links that connect actors located in distinct and otherwise disconnected cliques (Ahuja et al., 2012).

For firms, a small world co-invention network represents a nearly ideal structure for fostering knowledge production and recombination, for two reasons. First, the density of collaboration within cliques induces high levels of structural cohesion (Granovetter, 1973; Moody and White, 2003), which conveys a normative order (Podolny and Baron, 1997), common values, cultures of action, social norms, procedures (Rowley et al., 2000), and the development of trust (Gulati, 1995). By easing knowledge sharing and fostering the transmission of fine-grained information among people embedded within cliques (Burt, 2001), these factors spur localized learning and independent exploitation of specialized technologies (Reagans and McEvily, 2003). Second, clique-spanning ties are instrumental for diffusing knowledge and information beyond the cliques' boundaries, thus facilitating the exploration and recombination of ideas and knowledge (Cowan and Jonard, 2004; Lazer and Friedman, 2007).

Despite broad consensus on the importance of small-world architectures for innovation, we still know relatively little about the mechanisms that lead to the formation of such structures over time. First, substantial effort has been devoted to understanding the cliquish nature of research networks (Rivera et al., 2010), yet much less is known about the factors that affect the formation of clique-spanning ties. Second, prior research has mostly examined clique-spanning ties in inter-firm (e.g., Powell et al., 2005; Rosenkopf and Padula, 2008) and in regional networks (e.g., Fleming et al., 2007; Ter Wal, 2013), and we still know little about whether these same mechanisms may have explanatory value in intra-firm networks, such as contexts where individuals are subject to bureaucratic and hierarchical constraints, which drive their collaboration efforts. Understanding how organizations may connect intra-firm cliques of R&D employees thus looks critically important in explaining the process of knowledge recombination at the intra-firm level (Katila and Ahuja, 2002; Tsai, 2000).

With this study, we aim to shed light on this issue by examining the process of intra-corporate clique-spanning tie formation in the context

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of structural reorganizations of corporate research and development (R&D) units. Extant literature has emphasized the importance of structural reorganizations for enabling knowledge integration across distinct domains (Argyres and Silverman, 2004; Gulati and Puranam 2009; Siggelkow and Levinthal, 2003). We focus on a particularly important type of reorganization: the incorporation of corporate R&D units into independent entities through corporate spinouts (Cirillo et al., 2014; Corley and Gioia, 2004).[1] Using an inductive approach (Moeen and Agarwal, 2017), we first frame our research questions in the context of extant literature on network dynamics and organizational design. We then examine the patterns of clique-spanning tie formation by 27,483 inventors in the intra-corporate collaboration networks of eight large U.S. information and communication technology (ICT) corporations and their 31 spun-out R&D units during the period 1980–2005.

Our empirical findings show that the reorganization of R&D units through corporate spinouts is associated with an increase in the extent to which corporate inventors collaborate with their peers located in other cliques and other units within the corporate co-invention network. Interestingly, this effect extends beyond inventors directly involved with spun-out units, also affecting their former colleagues remaining in the parent firm. Moreover, contrary to received theories, corporate inventors with high network constraints (or low brokerage) and those with specialized knowledge background are associated with the highest increase in their likelihood of post-spinout clique-spanning tie formation. Our results also highlight that the formation of clique-spanning ties between parents' and spun-out units' inventors are more frequent when spun-out units employ former parent firms' executives, yet the affiliation of parent firms' executives with the board of spun-out units is not associated with an increase in within-spinout clique-spanning ties. To help identify the precise mechanisms that explain our findings, we also complemented our econometric results with qualitative evidence gathered from interviews with corporate inventors and R&D managers. Our interviews suggest that the spin out of R&D units is associated with an increase in inventors' strategic autonomy—or the right to set research agendas and collaborations (Bailyn, 1985)—and lower coordination and communication costs, which motivate them spontaneously to undertake initiatives, ask for advice, and collect information from other corporate inventors, thus helping them recognize and explore knowledge interdependencies across intra-corporate cliques.

These findings provide novel insights into research streams in intra-corporate collaboration networks evolution. They highlight that the reorganization of a R&D unit through corporate spinout may generate a shock in the entire intra-corporate R&D collaboration network that is associated with an increased connectivity between different groups of corporate inventors, breaking the inertial forces induced by structural embeddedness (Baum et al., 2003). Consistent with our inductive approach, we discuss the theoretical implications of our findings in light of existing theories, to reveal inconsistencies and gaps and to highlight compelling explanations. By doing so, we advance theoretical and empirical understanding of the dynamics of intra-corporate co-invention networks.

[1] In this study, we refer to corporate spinout as the incorporation of either part or entire R&D unit that remains part of the corporate co-invention network as either a partially or wholly owned subsidiary, a client, or a supplier of the parent firm. By these means, we exclude spinouts or spin-offs as entrepreneurial ventures – i.e., employee ventures that are independent. An example of this definition of corporate spinout is Xerox's R&D unit PARC. Formerly known as Xerox PARC, it is one of the five R&D labs of the Xerox Corporation. In 2002, Xerox spun-out the PARC unit into an independent, wholly owned subsidiary, later known as Palo Alto Research Center Incorporated (or simply PARC Inc.). After the corporate spinout, the unit did not change geographical location, it maintained 230 of its 270 employees (40 employees were laid off), and it remained as part of the Xerox Corporation's co-invention network.

2. Motivation and research questions

Extant literature on the dynamics of small-world structures in research collaborations has stressed the tendency of collaboration networks to progressively segment into semi-isolated cliques of dense interactions (Rivera et al., 2010; Ahuja et al., 2012). This tendency is driven by structural embeddedness, which constrains the set of partners with which it is feasible to collaborate (Baum et al., 2003). The origins of this inertia can be traced to the fundamental role of collaboration networks in helping R&D employees improve their performance. Networks facilitate access to information (Granovetter, 1973; Burt, 1992) and enable coordination and collective action (Gulati, 1995; Gulati and Gargiulo, 1999). Since actors (e.g., R&D employees) have a limited amount of time and resources, they face a trade-off between minimizing the risk of defection and opportunism, on one hand, and securing the flexibility to adapt the composition of the network to coordinate new interdependencies, on the other hand (Gargiulo and Benassi, 2000). The establishment of collaborations with familiar ties—such as prior direct ties or their common third parties (Krackhardt, 1998)—is more desirable than the generation of new unfamiliar ties, as the former diminish the uncertainty of actors' knowledge exchanges and enhance their ability to cooperate in the pursuit of a common interest (Gargiulo and Benassi, 2000). Actors linked through ties embedded in a clique are more likely to conform to the norm of reciprocity (Gargiulo and Benassi, 2000). They can trust each other (Gulati, 1995), diminish the risk of opportunism (Granovetter, 1985) and develop common understandings and human capital (Gulati, 1995). The emergence of cliquish structures thus conveys a clear normative order that can help actors share knowledge (Burt, 2001), spur localized learning and exploitation of specialized technologies (Reagans and McEvily, 2003) and thus improve their performance (Podolny and Baron, 1997). Despite these benefits, the establishment of strong social bonds also filters information reaching actors (Uzzi, 1997) and it increases the opportunity costs of initiating new collaborations (Gargiulo and Benassi, 2000). In so doing, a cliquish structure eventually diminishes actors' autonomy to develop the collaborations that are essential to diffuse knowledge and information beyond the boundaries of specific cliques (Gargiulo and Benassi, 2000) and, thus, to explore and recombine novel ideas and knowledge (Cowan and Jonard, 2004; Lazer and Friedman, 2007).

Because network evolution entails strong inertial dynamics, the process that leads to the formation of clique-spanning ties is difficult to understand. Prior studies mostly enquired the evolution of R&D networks in inter-firm (e.g., Powell et al., 2005; Rosenkopf and Padula, 2008) and in regional contexts (e.g., Fleming et al., 2007; Ter Wal, 2013), yet we still know little about whether these findings can be generalized or even extended by analogy to intra-firm collaboration networks where actors, such as R&D employees, are subject to bureaucratic and hierarchical constraints, which should drive their collaboration efforts. Understanding how firms can overcome such inertia is of great importance for managing knowledge recombination in intra-corporate R&D activities. Almost by definition, collaborations that bridge cliques are relatively rare and entail path-breaking behavior. Questions arise: What motivates R&D employees to bridge the gap between isolated cliques in intra-firm collaboration networks? Who engages in such behavior?

Extant literature points to the prevailing systems of incentives and rewards, which in turn depend on the nature of research activity. For example, Gambardella et al. (2015) suggest that when research projects are outside the core businesses of firms, R&D employees should be given full autonomy in project execution (which presumably includes selecting collaborators) and offered monetary premiums. Moreover, individual scientists and engineers who form collaboration links in intra-corporate co-invention networks are subject to hierarchical structures and managerial control; their decisions about the direction and the implementation of research projects—including relevant choices about whom to collaborate with—may be dictated by