

Investigating Network Effects with Open Innovation: The Role of Network Centrality and Network Density on Improving New Product Development Success

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Abstract

There are two key perspectives to the sourcing of ideas for product innovation. The first, closed innovation is the more traditional take on product innovation and is a paradigm of self-reliance. In closed innovation, the innovating firm generates its own ideas and then develops them (Chesbrough, 2003a). Here the boundary of the firm acts as a barrier for the source of ideas, as all ideas for innovation come from within the confines of the organization. A number of factors influence the shift away from closed innovation, making closed innovation no longer sustainable.

The second perspective, open innovation, is a new logic for innovation. Open innovation is the ability of a firm to use ideas and inputs from outside the firm and to also allow other firms to use the innovating firm's underutilized ideas (Chesbrough, 2003a; 2003b). This openness suggests that the boundary of the firm may be pervious and knowledge beyond the boundary of the firm may indeed be valuable. Firms following open innovation value, seek out, and gather external knowledge as a key practice while pursuing innovation.

Previous research has shown that firms can benefit with open innovation (Huston & Sakkab, 2007), and additional research has emphasized how firms can seek out the necessary inputs for innovation (West & Bogers, 2014). Recently, other research has shown that success is dependent upon the presence of external inputs to innovation as well as the extent to which firms are connected with other firms (Sisodiya, Johnson, & Gregoire, 2013). These inputs and degree of connectedness motivate the primary research question: What role do spillovers and supplier relationships play in enhancing success with open innovation? Thus the moderating effect of spillovers and interfirm relationships on the link between open innovation and firm success is investigated here.

Network spillovers, the extent to which a firm operates within a knowledge-rich environment (Owen-Smith & Powell, 2004), are essential to success with open innovation as spillovers represents the inputs firms must have access to in order to benefit from following open innovation. These inputs are extremely valuable, as they can be obtained from interfirm relationship partners, involvement in research communities, and even through employee turnover from competitor firms. Networks of relationships are critical for a firm pursuing open innovation, as they provide the source of inputs necessary for innovation.

Technological innovations are rather complex, and during their development, innovating firms must often interact with other firms (Kessler, Bierly, & Gopalakrishnan, 2000). Using

social network theory and the concept of social ties, relationships between innovating firms are studied to identify those characteristics that may improve success with open innovation. The author considers the moderation of the open innovation and firm success link by network centrality and network density.

Network centrality considers the degree to which an entity within a network is connected to others (Sparrowe, Liden, Wayne, & Kraimer, 2001). Network centrality is a position of hierarchy because central entities have ties to all other entities within a network, and because these ties then provide firms access to and possibly even control over valuable resources (Burt, 1982). Network central firms can control and could possibly adjust the flow of information within a network (Ibarra, 1993). While maintaining a central role, network central firms can serve as a channel for the flow of information which can then be useful in bringing in knowledge from other firms.

Another characteristic that is important to consider is *network density*, which is an evaluation of the overall strength of relationships an entity has in a network (Antia & Frazier, 2001). The strength of relationships is important as it represents the commitment exchange partners may have to each other. Strong ties may help entities transfer complex knowledge (e.g., Hansen, 1999), where dense networks provide firms with the potential for greater cooperation and information sharing with other members of networks (Uzzi, 1996; Sparrowe, Liden, Wayne, & Kraimer, 2001). With interfirm relationships, an innovating firm may have a few strong ties to other firms resulting in high network density relationships. These dense relationships help innovating firms coordinate exchanges when seeking out inputs for new product development.

Using primary and secondary data gathered from 236 high tech firms, the author tests the hypotheses using two measures of performance: product innovativeness and firm financial performance. After accounting for missing data, 214 responses were used in the final analysis. Results support expectations that network spillovers and interfirm relationships are critical to success with open innovation. Importantly, these results suggest that firms may benefit by participating in research communities that foster the sharing of knowledge either through strategic partnerships or research forums. Results also indicate that firms may want to evaluate their position in innovation communities, as certain network positions may grant unique opportunities to access novel inputs for innovation. From a policy perspective, members of geographic communities may seek out mechanisms to enhance the sharing of information (e.g., network spillovers) between for profit and non-profit organizations to facilitate the exchange of knowledge, which in turn positively influences performance.