

How Investor Position Influences Innovation: A Complex Network Perspective

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Abstract

This study abstracts relational constructs into quantifiable network topological metrics, integrates multi-source large-scale venture capital and patent data for longitudinal analysis, and empirically examines, at the micro level, the pathways through which investors' network positions influence firm innovation. By introducing complex network metrics such as node centrality and constructing a syndication network, we quantify the value of major investors' network positions and their coopetition effects at the micro level. Concurrently, we employ patent counts as a measure of innovation performance and construct a patent collaboration network, using network degree and weighted degree to represent the breadth and depth of innovation, respectively, thereby systematically investigating the influence of venture capital network positions on collaboration mechanisms. Our findings reveal that, first, investors' central positions in the network exert a significant and positive effect on the patent output of their portfolio firms. Second, the impact of network position on innovation collaboration strategies is more nuanced: investors' proactive external ties actually suppress the breadth and depth of firm innovation. More critically, the reputation and activity levels of investors' direct neighbors also produce a significant negative effect on the breadth and depth of firm collaboration, suggesting that high-quality partners may induce a relational lock-in effect. Third, the breadth and depth of innovation collaboration serve as key mediating channels through which network position affects innovation output, with the mediating role of collaboration depth being particularly salient. Fourth, these mechanisms are moderated by both internal and external contextual factors: the heterogeneity of syndicate teams significantly amplifies the innovation returns from network position advantages, whereas favorable market conditions weaken the effectiveness of proactive tie-building strategies. Further causal analysis indicates that macro-level innovation policies significantly enhance innovation output, yet their effect primarily operates through direct empowerment rather than through restructuring collaboration networks. This study provides empirical support for bridging social capital theory and innovation research, and offers practical implications for managers in optimizing investment strategies and understanding the emergence and evolution of innovation ecosystems.

Keywords

Innovation Collaboration, Network Position, Collaboration Breadth and Depth, Complex Networks