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Constraining entrepreneurial development: A knowledge-based view of social networks among academic entrepreneurs

Christopher S. Hayter

Center for Organization Research and Design, School of Public Affairs, Arizona State University, Phoenix, AZ 85004, USA

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ABSTRACT

While university spinoffs have become a well-accepted vehicle for regional economic dynamism, they face numerous developmental barriers associated with the unique academic context from which they are established. Recent research shows that homophilous social networks among faculty entrepreneurs constitute one such barrier, and yet few studies have investigated the specific characteristics of spinoff networks and their relationship to entrepreneurial development. This paper seeks to address this gap through a mixed-methods research design focused on the composition, contributions, and evolution of social networks among faculty entrepreneurs whose spinoffs are within various phases of entrepreneurship. Employing a knowledge-spillover conceptual lens, this study finds that social networks among early-stage academic entrepreneurs are important for spurring and supporting spinoff establishment, but if they do not evolve from their initial configuration, these networks can largely constrain subsequent stages of spinoff development. Social networks among successful spinoffs, however, evolve with the help of first-order—or boundary spanning—individuals who help socialize academic entrepreneurs to market-oriented motivations, values, and practices that they may not otherwise receive in an academic environment. Further, these individuals provide connections to other contacts who, in turn, provide additional spinoff-enabling resources and contacts. Based on these findings, a conceptual model is introduced that explains spinoff success as a function of network evolution. Implications for research and public policy are also discussed.

1. Introduction

University spinoffs—companies established to transfer and potentially commercialize technologies stemming from faculty research—constitute a unique type of entrepreneurial venture (Doutriaux, 1987; Shane, 2004). An emergent literature explores factors associated with spinoff success and finds, at least conceptually, that networks enable or constrain entrepreneurial development (e.g. Murray, 2004; Wright et al., 2007; O'Gorman et al., 2008; Hayter, 2013a). Academic entrepreneurs, defined here as university faculty who establish a spinoff company based on their research (Shane, 2004), play a particularly important role in the founding and development of university spinoffs. University spinoff companies are embedded within networks of social, professional, and exchange relationships with other actors (Granovetter, 1985) who provide resources important to venture success (Hoang and Antoncic, 2003; Jack, 2010). However, aside from a few, recent exceptions (Rasmussen et al., 2011, 2015), scholars have yet to undertake in-depth analyses of social networks among academic entrepreneurs.

A recent review relates this paucity of research to how theory has developed within the broader entrepreneurship network literature (Hayter, 2013b). Discussed in Section 2, at least three conceptual perspectives are used to frame empirical investigations of entrepreneurship networks. However, these predominant views do not account fully for the unique nature of knowledge, arguably the most important asset for technology-based ventures, including university spinoffs. Technology-based ventures are critical to regional economic growth (Feldman, 1994), but many ventures, especially within the early stages of entrepreneurial development, have yet to develop viable products, much less sales (Link and Ruhm, 2009; Audretsch and Link, 2012). Thus, related to academic entrepreneurship, network theory must not only account for the unique organizational, cultural, and geographic context associated with university spinoffs, it must also consider the inherent uncertainty, asymmetries, and transaction costs associated with economically useful knowledge (Audretsch et al., 2015).

Accordingly, the present investigation employs the knowledge spillover theory of entrepreneurship (KSTE) (Ács et al., 2004, 2009;

E-mail address: chayter@asu.edu

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Braunerhjelm et al., 2010). KSTE focuses on individual "agents of knowledge"—in the present case faculty entrepreneurs—and their specific role in knowledge spillover. With KSTE in its empirical adolescence, networks provide a contextual mechanism to explain *how* and *why* knowledge spillover occurs, along with its economic impact (Ács et al., 2009; Hayter, 2013b). Thus, a knowledge spillover approach is employed as an intellectual bridge that not only accounts for the unique nature of knowledge, it also aligns disparate themes in the empirical entrepreneurship network literature, an important step to accelerate the development of theory (Bonardi and Okhuysen, 2011).

This study seeks to address the following research question: What are the contact composition, contribution, and evolution of "business networks" among faculty entrepreneurs—and the relationships of these networks to entrepreneurial development among corresponding university spinoffs (Holm et al., 1999)? Given the aforementioned opportunities within the literature, a mixed-method, methodological approach is taken (Creswell, 2002): A social network analysis (SNA) survey is administered to a theoretically relevant population of academic entrepreneurs in New York State, an area of critical economic and scientific importance in the United States (U.S.). Subsequently, interviews are conducted with SNA survey respondents in order to understand the specific contributions of their network contacts and how their spinoffs evolved over time. Network data are then compared to the entrepreneurial development of the academic entrepreneur's spinoff company by employing Vohora et al.'s (2004) critical juncture framework.

In so doing, the paper makes three distinct contributions to the entrepreneurship network literature: (i) following the extant literature, the study affirms that social networks provide valuable resources and contacts within the unique context of academic entrepreneurship; (ii) however, because of this unique context, early entrepreneurship networks are generally constraining, widening the social distance between academic entrepreneurs and networks important to the success of their spinoff; and (iii) by constructing a taxonomy of network evolution, the study also shows that academic entrepreneurs must rely even more on network intermediaries—boundary spanners—and, potentially, policy innovations to improve entrepreneurial development among spinoffs.

The remainder of the paper is outlined as follows. Section 2 discusses the academic literature related to traditional scientific networks, entrepreneurship networks, and networks among academic entrepreneurs. Section 3 introduces the study methodology, the empirical results are presented in Section 4, including a network taxonomy for spinoff development, and the paper concludes in Section 5 with implications for research and public policy.

2. Previous research

2.1. Knowledge spillover entrepreneurship

Knowledge spillover perspectives of entrepreneurship presume that new knowledge is a critical source of innovation, economic dynamism, and growth (Ács and Audretsch, 1990). KSTE embraces Romer's (1990) assumption that new knowledge is the source of innovation, productivity, and economic growth. Knowledge is created by incumbent firms and research organizations, such as universities (Utterback, 1994), but often goes unexploited. In turn, knowledge spills over to knowledge-based ventures that, even though they may undertake little R&D, are particularly adept at utilizing new knowledge created by other sources (Audretsch et al., 2004, 2005).

KSTE also embraces geographic aspects of knowledge; once created, knowledge tends to spill over within geographically bounded regions, promoting clustering among firms in similar industries (Feldman, 1994; Jaffe et al., 1993; Jaffe, 1989). Integral to clustering is the formation of "entrepreneurial support networks" that aid in the transmission and absorption of knowledge (Saxenian, 1994; Kenney and von Burg, 1999; Piore and Sabel, 1984), otherwise termed an "incubator region" (Schoonhoven and Eisenhardt, 1989), a "social structure of innovation" (Florida and Kenney, 1988), or an innovation or entrepreneurial "ecosystem" (Clarysse et al., 2014; Bahrami and Evans, 2000). Recent research, however, calls into question the primacy of clustering effects, especially within the life sciences, an area particularly well-suited for university contributions (Kenney and Patton, 2005).

KSTE takes issue, however, with traditionally theoretical assumptions that all knowledge is economically useful and spills over "automatically." Knowledge is instead subject to institutional, geographic, and cost constraints (Bercovitz and Feldman, 2008; Feldman, 1994; Jaffe, 1989; Jaffe et al., 1993). Audretsch et al. (2015) posit that spillover is also affected by the properties of knowledge itself. First, the economic value of knowledge is relatively uncertain, especially compared to the more certain nature of information. Second, knowledge is characterized by asymmetry across economic agents; the same knowledge may be assigned different values—or have different expected values—by different economic agents. Third, while the transaction cost for sharing information across economic agents is trivial, the tacit nature of knowledge often requires face-to-face communication, increasing transaction costs.

As mentioned, more empirical research is required to develop KSTE, especially *how* and *why* knowledge spillover occurs (Ács et al., 2009). Due to the uncertain nature of knowledge, KSTE recommends that scholars investigate the role of individual knowledge agents in contrast to a focus on firms. For example, in the present case, academic entrepreneurs are not only responsible for the production of knowledge, they are also the progenitors of entrepreneurial action through which new knowledge is diffused and potentially transformed into useful applications (Ács et al., 2009; Braunerhjelm et al., 2010). In his review of the extant empirical entrepreneurship network literature, Hayter (2013b) recommends that scholars combine the KSTE with network approaches in order to link micro-level entrepreneurial behavior, especially knowledge-intensive entrepreneurship, with broader economic development outcomes and accelerate the development of theory (Bonardi and Okhuysen, 2011). Further, knowledge exchange is bi-directional; while the literature conceptualizes knowledge spill over as "one way," its economic impact relies upon knowledge input from other sources, especially related to its commercialization (Hayter, 2013a).

2.2. Quantifying university spinoff development

Recent research ties knowledge spillovers to the establishment and performance of university spinoffs (Audretsch et al., 2015; Hayter, 2013a). Scholars have used a number of output measures to proxy spinoff performance, including sales growth (Roberts, 1991), sales per employee (Blair and Hitchens, 1998), patents and scientific articles (Zucker et al., 2002), and profitability (Samson and Gurdon, 1993). More recent studies frame spinoff success in terms of technology commercialization (Link and Ruhm, 2009) and employment (Hayter, 2015). Despite their use, scholars lament the inability of output measures to account for technical and developmental progress among early-stage university spinoffs (Shane, 2004). Interestingly, Astebro et al. (2013) find that academic entrepreneurs (within a Swedish context) undertake much higher income risk compared to their university jobs yet realize negligible financial gains.

A spinoff's capability to achieve various performance milestones offers an alternative to output measures. Most common