

Conceptualizing knowledge-based entrepreneurship networks: perspectives from the literature

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Abstract Efforts to promote and support knowledge-based entrepreneurship as a vehicle for economic development are increasingly focused on the importance of networks to entrepreneurial success. This article reviews the extant empirical literature and finds a striking consensus among multiple disciplinary perspectives: not only are networks important, network characteristics also mediate resources important to entrepreneurial performance. Unfortunately, current conceptual frameworks do not adequately account for the unique nature of knowledge spillovers and their role in innovation and economic dynamism. The article suggests that scholars embrace the nascent knowledge spillover theory of entrepreneurship to guide future empirical research on entrepreneurship networks and focus intently on their impact on entrepreneurial performance—and therefore economic growth.

Keywords Entrepreneurship · Knowledge spillovers · Networks

JEL Classifications D85 · L14 · L26

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1 Introduction

Entrepreneurship, defined as the discovery, evaluation, and exploitation of future goods and services (Venkataraman 1997), is increasingly viewed as a critical ingredient in regional and national economic growth (Carree and Thurik 2006; Carree 2002). Knowledge-based entrepreneurship, manifest through high-technology startups, corporate spinouts, and university spinoffs, constitutes an especially important subset of entrepreneurship. New knowledge-based enterprises have a high propensity for survival (Lowe 2002; Pressman 2002; Mustar 1997), attract early stage finance (Shane 2004), and create new jobs while accelerating productivity (van Praag and Versloot 2007; Pressman 1999, 2002; Tornatzky et al. 1995).

Contributions of knowledge-based enterprises are based on the premise that new knowledge is a critical source of innovation, economic dynamism, and growth (Acs and Audretsch 1990; Romer 1990; Arrow 1962). While knowledge-based enterprises typically undertake little R&D, they are particularly adept at tapping into knowledge created by universities and large corporations (Audretsch et al. 2004, 2005; Almeida and Kogut 1999; Link and Rees 1990). Policymakers have therefore sought to encourage the formation and growth of university spinoffs through numerous policies and programs (Lowe and Gonzalez-Brambila 2007; Shane 2004).

The knowledge spillover theory of entrepreneurship (KSTE) has emerged as a useful framework for

guiding empirical investigations that can guide both research and policy decisions relating to innovation and entrepreneurship (Braunerhjelm et al. 2010; Acs et al. 2009; Audretsch et al. 2006). KSTE embraces Romer's (1986) views on the importance of new knowledge to innovation and economic growth but takes exception to neoclassical assumptions that all knowledge is necessarily economically useful or automatically spills over to other organizations. Knowledge is instead subject to institutional, geographic, and cost constraints (Almeida and Kogut 1999; Jaffe 1989; Jaffe et al. 1993) known collectively as the 'knowledge filter' (Audretsch et al. 2006).

The knowledge spillover theory of entrepreneurship is in its empirical infancy; studies employing this perspective have yet to specifically examine the relationship between knowledge spillovers and entrepreneurship networks. However, studies within the Management and Sociology disciplines find that social networks are an important ingredient in the entrepreneurial process, including enterprise founding, success, and turnover (Jack 2010; Hoang and Antoncic 2003; Zimmer and Alrich 1987). A social network is a conceptual construct comprised of a set of actors—and ties representing some relationship or absent of relationship between the actors (Scott 2000). Furthermore, recent research employing the KSTE perspective finds that technology, funding, and service networks are—conceptually—important determinants for commercialization success among knowledge-based enterprises (Hayter 2013).

This article seeks to answer the question: what is the role of networks in encouraging and supporting knowledge-based entrepreneurship? It does so by reviewing the extant empirical research from the sociology, management, and economics literatures individually then compares and contrasts each perspective derived therein. The article is not only the first to find that there is consensus among disparate literatures that networks are critical to entrepreneurship, it also shows that there are a number of network-, firm-, and individual-level factors that mediate the relationship between networks and entrepreneurship. The article looks for opportunities and challenges among these disparate literatures, then suggests that scholars employ KSTE for investigations of knowledge-based entrepreneurship networks—and their impact on entrepreneurial performance and economic growth.

The structure of this article is as follows. Section 2 reviews three strains of empirical entrepreneurship network research, along with the concepts within the knowledge-spillover perspective, discussing propositions that stem from each. Section 3 presents the findings of the review, along with opportunities within the extant literature. The article concludes with Sect. 4, a discussion of the findings and their implication for future research.

2 Perspectives on entrepreneurship networks

2.1 Network approach to entrepreneurship perspective

While the study of networks initially emerged from the mathematical and physical sciences, the application of networks to the study of entrepreneurship began primarily in sociology where networks are often seen as a *de facto* benefit to entrepreneurs (Knoke and Yang 2008; Scott 2000). This comes from earlier (non-entrepreneurship-related) network research that focuses on differences between strong and weak social ties; weak ties often provide access to heterogeneous information outside an individual's network of friends and family (Granovetter 1973). Burt (1992) sees relationships with acquaintances as 'structural holes' or rather ties that span across networks to connect new and different communities—and therefore new (and more) information, knowledge, and resources (Granovetter 1973).

Researchers within the discipline of management applied social network concepts to entrepreneurship whereby firms are embedded in networks of social, professional, and exchange relationships with other actors (Granovetter 1985; Gulati and Gargiulo 1999). This line of inquiry led to conceptual perspectives such as Brüderl and Preisendorfer's (1998) so-called 'network approach to entrepreneurship,' which posits that founders use their personal network of business contacts to acquire information and resources important to their enterprise. Therefore, networks and networking are of critical importance to firm performance (Lechner and Dowling 2003; Larson and Starr 1993); the more networking the better (Witt 2004).

Given that networks are assumed to have per se positive benefit for entrepreneurs and entrepreneurial firms, early research focused on mapping egocentric

Table 1 Literature within the network approach to entrepreneurship

McGrath and McGrath (2001), Bygrave and Minniti (2000)	Networks mitigate the cost and uncertainty associated with establishing a new firm
Watson (2007), Nicolaou and Birley (2003a, b), Donkels and Lambrecht (1997), Aldrich and Zimmer (1986), Birley (1985)	Networks and networking play a catalytic role in many aspects of organizational emergence and growth
Shane and Cable (2002), Brüderl and Preisendorfer (1998), Burt (1992)	Reputational networks reduce the cost of obtaining information, provide information, and mediate information asymmetries relating to new firm startup
Jack (2010), Hoang and Antoncic (2003), Nerkar and Shane (2003)	Networks provide information for entrepreneurs to understand “entrepreneurial opportunities”: potential markets and competitors
Vohora et al. (2004), Nicolaou and Birley (2003a), Franklin et al. (2001), Radosevich (1995)	Entrepreneurs who have industry experience are more likely to establish a new firm than university faculty members who typically lack the business acumen and related networks needed for successful spinoff
Aldrich and Zimmer (1986)	Networks provide resources important to new firm establishment and growth
Wright et al. (2007)	Social resources, defined as networks and partnerships enable firms to obtain technological, human, and financial resources and accelerate the growth of firms
Hite (2005), Renzulli and Aldrich (2005), Shane and Cable (2002), Uzzi (1997), Zimmer and Alrich (1987)	Networks provide access to early stage funding
Wright et al. (2007), Baum and Silverman (2004), Lee et al. (2001)	Venture capital networks not only provide funding, they are important for gaining access to professional management, technical assistance, and other important entrepreneurship services
O’Gorman et al. (2008), Walker et al. (1997)	Networks provide small entrepreneurial firms with marketing and distribution channels, business plan assistance, and links with potential customers, services that firms may lack in their early development
Aarstad et al. (2010), Baum et al. (2000), Dyer (2000), Dyer and Nobeoka (2000), Stuart et al. (1999)	Network alliances with other firms, including entrepreneurial firms, large companies, suppliers, and customers, are important to firm performance and may improve market valuations and may accelerate IPOs

Table 1 continued

Grandi and Grimaldi (2003), Hoang and Antoncic (2003), Lee et al. (2001), Hagedoorn and Schakenraad (1992)	Network partnerships with well-trusted organizations, including universities, provide a signal to other resource providers
Yli-Renko et al. (2001)	Networks provide access to new knowledge the exploitation of which is associated with competitive advantage new product development, product distinctiveness, and sales cost efficiency
Elfring and Hulsink (2003)	Firms engaged in radical innovation benefit from both strong and weak ties. Weak ties are important in the opportunity discovery process, while strong ties are important because of their ability to exchange tacit knowledge and trusted feedback on the nature and viability of companies

entrepreneurial networks followed later by more detailed investigations of relationship ties (Jack 2010; Knoke and Yang 2008; Scott 2000). Researchers often conceptualize networks dichotomously: ties exist or do not or are weak or strong (Jack 2010; Hoang and Antoncic 2003). Once entrepreneurial firms are ‘connected’ to networks, they have access to, for example, human, technological, and financial resources important to performance (Wright et al. 2007; Shane and Cable 2002; Aldrich and Zimmer 1986).

Table 1 below summarizes the extant empirical entrepreneurship network literature from the network approach perspective. From this research comes Proposition 1:

Proposition 1 *If relationship ties exist, networks are an important source of information and resources to entrepreneurial firms.*

2.2 Social capital perspective

While the network approach focuses primarily on whether or not a firm is connected to a network, the social capital perspective, which emerged from sociology, also sees networks as a source of resources but shifts attention to the *value* of specific relationship ties and characteristics of the network overall (Rodan and Galunic 2004; Nicolaou and Birley 2003a; b; Scott 2000). In opposition to Burt’s (1992) structural holes argument, Coleman’s (1988) social closure theory posits that the greatest value provided to individuals

(the unit of analysis) is from closed or densely connected networks—and the social capital embedded within them. Social capital results from trust among members and the resulting willingness for mutual assistance when needed (Coleman 1988). When high social capital exists, networks are governed by implicit, open-ended contracts supported by social mechanisms such as trust, power, and influence, and the threat of ostracism and reputation loss—as opposed to legal enforcement (Hoang and Antoncic 2003). This means that tradeoffs exist between the size of an individual's network and its density: as a network expands, social capital levels decline. Conversely, as networks become less dense, cohesion and coordination may decrease but productivity may improve from increased heterogeneity (Reagans and Zuckerman 2001).

In entrepreneurship networks, dense networks with high levels of social capital mediate barriers to collaboration (Hoang and Antoncic 2003). Furthermore, entrepreneurial networks provide a foundation for exchange through reputational credibility, certification of mutually known contacts, fairness and equity, and the prospect of future exchange (Shane and Cable 2002; Coleman 1988; Nohria and Eccles 1992) typically leading to improved entrepreneurial performance (Aarstad et al. 2010; Pennings et al. 1998). Social capital is especially important for the exchange of tacit knowledge not easily transmitted over physical or social distances (Tortoriello and Krackhardt 2010). Furthermore, social capital is based on individual characteristics such as trustworthiness, just as the capability to build social capital is based on individual networking skills (Batjargal 2010; Coleman 1988).

However, unlike the network perspective, being connected to a particular network does not guarantee access to new information and resources and, at worst, can have a detrimental impact on entrepreneurial performance. For example, firms can be locked into relationships with firms that have few new ideas, diminishing a firm's capacity for innovation (Gulati et al. 2000; Johannisson and Monsted 1997).

Table 2 presents the extant empirical entrepreneurship network research from the social capital perspective. Based on the research, several propositions are articulated:

Table 2 Network characteristics from a social capital perspective

Kim and Aldrich (2005)	Tie strength and duration impact resource and information flows between individuals
Besser and Miller (2011)	Trust is a key component in network performance and help determine resource exchange levels
Tortoriello and Krackhardt (2010), Aarstad et al. (2010), Hoang and Antoncic (2003), Reagans and McEvily (2003), Yli-Renko et al. (2001)	Social capital enhances the quality of knowledge flow and acquisition within networks
Walker et al. (1997)	The development and nurturing of social capital influences network formation and industry growth in biotechnology
Aarstad et al. (2010), Lechner et al. (2006)	Network size may be related to entrepreneurial success; larger networks infer great "reachability" whereby existing contacts can be used to gain access to other who hold important information or resources
Bechky (2003), Von Hippel (1994), Tushman (1977)	Even if networks exist, complex knowledge developed in differentiated areas of technological expertise or within different organizations is difficult to mobilize and transfer across organizational boundaries due a lack of a common language and shared meanings
Rowley et al. (2000)	Industry may matter: strong ties in a highly interconnected strategic alliance network, like the semiconductor industry, negatively impact firm performance; strong ties are positively related to firm performance in the steel industry
Hoang and Antoncic (2003)	Being a part of the <i>right</i> network determines firm success

Table 2 continued

Mosey and Wright (2007)	A structural hole exists between scientific research networks and industry networks important to the success of university spinoffs; academic entrepreneurs with prior business experience more easily bridge this gap
Jack (2010), Jack et al. (2008), Johannisson and Monsted (1997), Walker et al. (1997)	Networks can be constraining, isolating, damaging, and diminish diversity
Inkpen and Ross (2001), Gulati et al. (2000), Burt (2005)	Knowledge redundancy in closed networks may negatively affect firm performance: firms can be locked into unproductive relationships and processes where know-how and other resources are wasted
Lechner et al. (2006), McEvily and Zaheer (1999)	Entrepreneurs should adopt a multiplicity or ‘relational mix’ of ties that cross boundaries associated with the adoption of competitive capabilities
Batjargal (2010), Zhao and Aram (1995)	Networking skills of entrepreneurs have positive effects on the structural changes of entrepreneurial networks over time; networking benefits fast growing firms
Ensley et al. (2002)	Cohesion among startup team members is related to new firm growth
Huggins and Johnston (2010)	Firms investing in the development of inter-firm networking capabilities and other external knowledge networks enjoy higher levels of innovation

Proposition 2a *Networks can enable or constrain entrepreneurship, depending on characteristics of the network.*

Proposition 2b *Resource ‘flow’ depends on social capital levels.*

Proposition 2c *Characteristics and capabilities of entrepreneurs mediate how well they can make use of network resources.*

2.3 Relational view perspective

The so-called relational view (Dyer and Singh 1998) of entrepreneurship networks is derived from the Coasian perspective within economics that views a firm as an organization for reducing transaction costs (Kale et al. 2000; Walker et al. 1997; Williamson 1979; Coase 1937). From this perspective, networks are thus explained as a hybrid form of organization between the market and the hierarchy of the firm. Specifically, networks are a source of “relational rents” and competitive advantage when firms exchange, combine, or co-invest in resources and capabilities thereby reducing transaction costs (Dyer and Singh 1998).

While successful network relationships may enable firm performance, internal firm business plans and strategies change over time (Wright et al. 2007; Druilhe and Garnsey 2004) and so networks should as well; the relational view embraces a dynamic perspective of networks. Entrepreneurs—described as ‘prospectors’ by Wright et al. (2007)—spend considerable time searching for the right approach to value creation during the first years after startup based on information, resource, or knowledge needs.

Human and Provan (1997) find that by being embedded within a network, a firm may have a variety of (so-called multiplex) relationships compared to firms that do not actively participate in a network. This concept is found in other bodies of literature, such as supply chain management where Dyer (2000), for example, recommends the ‘transactional’ management of low-value relationships, while strategic partnerships should be managed through a variety of knowledge sharing agreements such as cooperative R&D projects, co-investment, and other forms of risk sharing.

Scholars have long focused on internal technological and managerial competence (Malerba and Marengo 1995) as it relates to firm performance; this analogy applies to the relational view of entrepreneurship networks. Research finds that entrepreneurial success is not only dependent on the network per se, but also on the *capability* of firms to identify and connect to networks while taking advantage of the inter-firm benefits they provide (Kale et al. 2002). In the literature, this is otherwise known as network capability (Walter et al. 2006), network competence (Ritter and Gemünden 2003), or alliance capability

Table 3 Relational view of the entrepreneurship network literature

Dyer and Singh (1998)	A firms critical resources may span boundaries; inter-firm resources and routines can be created
Baum et al. (2000)	When firms are established, variations in network composition relate to entrepreneurial performance
Partanen et al. (2008), Greve and Salaff (2003), Starr and MacMillan (1990)	Entrepreneurs build networks that vary according to the phase of entrepreneurship: strong ties may be more relevant during the founding and early growth stages when startups need access to critical resources while weak ties can be turned into collaborative business relationships; different types of networks and relationships are important in the transitional periods between the growth phases
Greve and Salaff (2003), Hite and Hesterly (2001)	Networks evolve over time to adapt to a firms changing resource needs: as firms grow, entrepreneurial networks shift to include both embedded and arms-length relationships, with such relationships intentionally managed to explore growth opportunities
Kale et al. (2002)	Firms with alliance experience and with a dedicated alliance function are more successful; better alliances lead to better stock performance
Ritter and Gemünden (2003)	“Network competence” has a strong positive influence on the extent of interorganizational technological collaborations and on a firm’s product and process innovation success. Access to resources, network orientation of human resource management, integration of intraorganizational communication, and openness of corporate culture impact network competence

Table 3 continued

Partanen et al. (2008)	“Cognitive capital” represents trust and values underpinning potential collaborations with alliance partners
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(Kale et al. 2002). Certainly, robust capabilities are tied to resource levels; Walker et al. (1997) find that managing relationships requires ongoing attention and resources of which organizations may have only limited amounts.

Table 3 provides an overview of the empirical entrepreneurship network literature from the relational view perspective; several propositions are deduced:

Proposition 3a *Networks are a ‘hybrid’ option between the market and the transaction cost-reducing characteristics of firms internalizing economic activities.*

Proposition 3b *Relationship ties must be managed strategically to maximize resource provision and quality to the entrepreneurial firm; strong and weak ties can be managed concurrently over time.*

Proposition 3c *Networks are dynamic and change over time; this explains why firms may not want to internalize economic activity.*

Proposition 3d *Internal firm capabilities mediate its ability to take advantage of network resources.*

2.4 Knowledge spillover perspective

With regard to the knowledge-spillover perspective, networks are known for their role in the dissemination of knowledge and economic growth (Cockburn and Henderson 1998). Knowledge spills over within geographically bounded regions, and this promotes clustering among firms in similar industries (Audretsch and Feldman 1996; Feldman 1994; Jaffe et al. 1993; Jaffe 1989); Piore and Sabel (1984) find that clustering occurs from the formation of industrial networks that aid in the transmission and absorption of knowledge.

Saxenian’s (1994) investigation of Silicon Valley finds that the region’s “social and professional

Table 4 Knowledge-spillover perspectives on entrepreneurship networks

Murray (2004), Zucker et al. (2002), Zucker and Darby (2001)	Networks are beneficial for overall firm productivity and R&D capability
Vohora et al. (2004), Nerkar and Shane (2003)	Networks and experience that professionals build over their careers enable them to recognize commercial value in new knowledge and therefore recognize entrepreneurial opportunities
Audretsch et al. (2004, 2005), Almeida and Kogut (1999), Link and Rees (1990)	Entrepreneurial firms are adept at utilizing the knowledge networks of universities and large corporations
O’Gorman et al. (2008), Audretsch et al. (2005), Dietz and Bozeman (2005), Gulbrandsen and Smeby (2005), Roberts (1991)	University scientists who have collaborative relationships (networks) with industry, receive industry funding, or possess industry experience have a higher propensity to patent, license, consult, and establish a company
Murray (2004), Nicolaou and Birley (2003a, b), Franklin et al. (2001), Radosevich (1995)	Faculty members with long academic careers rarely have the networks and business acumen needed to successfully manage a company
O’Gorman et al. (2008), Rothaermel et al. (2007), Johansson et al. (2005), Murray (2004), Rappert et al. (1999)	Formal networks can help counterbalance an entrepreneur’s lack of industry experience providing assistance to write and develop a business plan, raise early stage finance, commercialize technology, and develop links with potential partner firms and customers
Martinelli et al. (2008), Landry et al. (2002), Meyer-Krahmer and Schmoch (1998)	Informal networks often facilitate more formal linkages that facilitate collaborative research, spinoff, and licensing arrangements with established firms
Rothaermel et al. (2007), Moray and Clarysse (2005), Roberts (1991)	The individual composition of an intra-firm network in the form of the founding entrepreneur, their collective industry experience, management capability, and knowledge are critical factors to the success of a spinoff
Radosevich (1995), Franklin et al. (2001)	A “surrogate” manager is recommended for university spinoffs due to their commercial experience, their motivation for financial gain, and their networks for recruiting staff and raising capital

Table 4 continued

Hayter (2010, 2013), Shane (2004)	Venture capitalists not only provide much needed early stage financing to university spinoffs, they also help connect entrepreneurs to networks that can help provide management and technical expertise important to the commercialization of their technology
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networks operated as a kind of meta-organization through which engineers, in shifting combinations, organized technological advance,” particularly within the semiconductor industry (p. 35). Saxenian’s conceptualization of individuals as agents who possess endowments of knowledge corresponds to know-how or tacit knowledge not easily codified and typically embodied in individuals, organizations, and processes (Audretsch and Feldman 1996). Similarly, from the KSTE perspective, entrepreneurship is the vehicle by which the knowledge filter is penetrated with individual scientists, engineers, or other knowledge workers recommended as the appropriate unit of analysis, a view held by other perspectives (Bekkers et al. 2006; Almeida and Kogut 1999; Audretsch 1995).

While scholars employing knowledge spillover perspectives have yet to employ social network analysis techniques to study entrepreneurship networks, networks are conceptually important for understanding entrepreneurial performance (Hayter 2013). Table 4 below outlines the extant literature. From the literature, the following is deduced:

Proposition 4a *The knowledge spillover perspective accounts for the unique nature of knowledge, including difficulties with its appropriation, and recognizes that there is social and economic value in the dissemination of new knowledge into society.*

Proposition 4b *While little empirical research exists, networks are recognized for their importance in the spillover of knowledge, and therefore their importance to innovation and economic growth.*

Proposition 4c *Individual ‘absorptive capacity’ is critical to the transmission and commercialization of new knowledge.*

3 Findings

3.1 Consensus within the literature

When the original question posed early in this article is revisited—what is the role of networks in encouraging and supporting knowledge-based entrepreneurship—the review finds a striking consensus regarding the critical importance of networks to entrepreneurial performance; this article is the first to suggest this among disparate disciplines. If we accept this proposition, however, several other areas of consensus (represented in Fig. 1) emerge beyond the relatively simple network approach to entrepreneurship networks (Brüderl and Preisendorfer's 1998):

Network type: Entrepreneurs can be embedded within social networks that, depending on their type, may or may not provide the necessary opportunities or resources important for establishment, operation, and growth. This supports KSTE's assumption that new knowledge does not spillover to organizations automatically; entrepreneurs may not be in the right type of network.

Tie content: Specific information and/or resources that entrepreneurs receive from members of their network: Entrepreneurs may be embedded in networks with individuals important to the success of their enterprise but may or may not be receiving the *right* resources.

Enablers or barriers to transmission: Entrepreneurs may be in the right network, receiving the right information and resources, but information and resource flow may depend on network barriers or enablers; entrepreneurs may not be receiving *enough* resources. In addition to the importance of social capital to resource transmission, this concept fits well with the relational view's notion of information asymmetries and KSTE's knowledge filter.

Internal capabilities affect network utility: The ability of an entrepreneur and an entrepreneurial firm to take advantage of information and resources provided by a network—and their capability to understand whether or not new knowledge is economically useful—is determined by their internal capability to do so. Examples include networking skill for the social capital view (Batjargal 2010), network competence in the relational view (Ritter and Gemünden 2003), and absorptive capacity for KSTE (Cohen and Levinthal 1990).

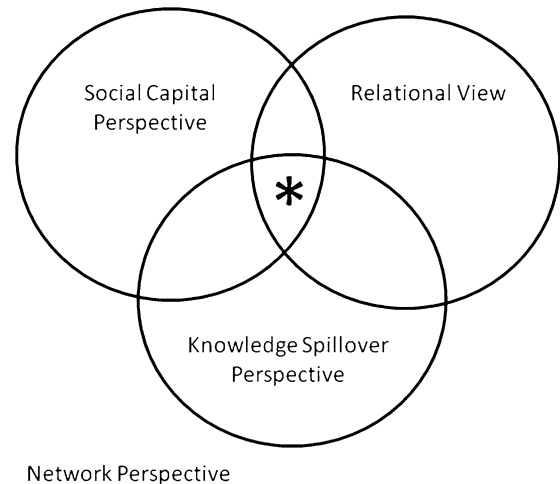


Fig. 1 Consensus (*asterisk*) in the literature among disparate conceptual perspectives

3.2 Variations in the literature

In the main, variations within the literature may be attributed to characteristics of the frameworks themselves. As discussed, Brüderl and Preisendorfer's (1998) network approach has an inherently positive view of networks as an important source of information and resources. While the social capital perspective is the most well developed, it has been criticized by Witt (2004) and other scholars as “oversocialized” (p. 409) because of its sociological lineage; it fails to take into account rational, profit-driven aspects of entrepreneurship (Huggins and Johnston 2010). The relational viewpoint sees networks as dynamic, while the other two perspectives implicitly have a more static viewpoint (Druilhe and Garnsey 2004). And both the social capital and relational viewpoints embrace knowledge as an important resource, but fail to account for the public goods properties of knowledge (Yli-Renko et al. 2001; Reitan 1997; Audretsch 1995).

From the knowledge-spillover perspective, networks are conceptually important, providing resources and conduits for knowledge flow, but little (if any) empirical research exists relating to entrepreneurship.

4 Empirical opportunities and the path forward

Despite the impressive commonalities presented above, auspicious voids remain in the entrepreneurship network literature. First, while much effort has

been placed into mapping and understanding existing entrepreneurship networks, there has been little study of the content, durability, direction, and strength of relationship ties while understanding the quality and value of what they provide to entrepreneurs (Jack 2010; Walter et al. 2006; Coviello 2005). Second, there is little understanding as to the role of entrepreneurship networks in various critical junctures or milestones (Vohora et al. 2004; Hoang and Antoncic 2003), the impact of various social and economic environments on networks (Birley 1985)—like for those among faculty entrepreneurs in universities, for example—or how networks evolve over time, especially relative to the entrepreneurs themselves (Jack 2010; Hoang and Antoncic 2003). Finally and most importantly, there have been few, if any, systematic efforts to examine the relationship between the content and nature of networks and entrepreneurial outcomes such as firm establishment, performance, and evolution (Renzulli and Aldrich 2005).

Another significant theme in previous reviews of the literature—and also reflected here—is the lack of cohesion among the disciplinary lines of research and the related lack of a useful theoretical perspective to guide empirical investigations (Jack 2010; Hoang and Antoncic 2003). As such, this challenge is acute for conceptualizing knowledge-based entrepreneurship; the extant empirical research views knowledge as simply ‘another resource’ without attention paid to its unique spillover properties and role in innovation and economic growth.

This is where the conceptual value of KSTE and empirical investigations of entrepreneurship networks clearly converge. As mentioned, KSTE embraces the importance of new knowledge for economic growth but takes exception to more traditional economic assumptions that knowledge spills over automatically and that all knowledge is economically useful. KSTE suggests that entrepreneurship is an important vehicle for the spillover of new knowledge and therefore critical to economic growth and dynamism.

The contribution of this article is to introduce social networks as a ‘contextual variable’ for KSTE potentially explaining *how* and *why* new knowledge may spill over. While a review of the extant empirical entrepreneurship network literature shows some variation among various conceptual perspectives, a strong consensus exists as to the importance of networks, predicated on specific network characteristics, to

entrepreneurial performance. Not only can networks act as critical conduits for information, resources, and new knowledge, they can also connect entrepreneurs with individuals—funders, researchers, and advisors—who may help them determine the economic value of new knowledge, thereby addressing some of KSTE’s conceptual concerns with endogenous growth theory (Acs et al. 2009).

Therefore, a vast research frontier exists for scholars who employ KSTE to guide future empirical investigations of the specific composition and characteristics of knowledge-based entrepreneurship networks, their impact on entrepreneurial performance, and how networks, entrepreneurs, and organizations collectively evolve over time. Armed with KSTE, scholars should focus on network variations among different knowledge-based enterprises, including university spinoffs, corporate spinouts, student ventures, and others. It is with this information that policymakers will be better equipped to design programs and policies to both encourage and support knowledge-based entrepreneurship.

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