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Entrepreneurial ecosystems and industry knowledge: does the winning region take all?

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Abstract Entrepreneurial ecosystems (EE) are composed not only of startups but also the organizations that support them. Theory has been ambivalent about whether an EE is spatially bounded or includes distant organizations. This exploratory study uses a time series of all Internet industry initial public offerings (IPO) to explore the locational changes not only of startups but also four key EE service providers: lawyers, investment bankers, venture capitalists, and board directors. We find that while the startups became only slightly more concentrated, the EE service providers concentrated more rapidly, as an industry center in Silicon Valley emerged. Our results suggest that over the industry life cycle, industry knowledge exhibits a tendency to spatially concentrate, and this results in a concentration of industry-specific EE service providers that is even greater than the more gradual concentration of startups. As a result, startups, wherever they are located, increasingly source EE services from the industrial knowledge concentration.

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Plain English Summary Using the entire life of the Internet industry, we show that entrepreneurial ecosystems are composed of local and extra-local service providers. Moreover, as the industry matured, the generic local entrepreneurial support service providers were replaced by those located in the dominant region which also had developed industry knowledge. The dominant region's support providers effectively became service providers for both local and distant entrepreneurs. The principal implication of this study is that local policymakers should understand and explain to local startups the value of EE members that are extra-local, as these actors may have intimate and current industry-specific knowledge necessary to successfully build their firm. Entrepreneurs should weigh carefully whether it is more efficient to use local EE service providers or those in the region with the greatest industry knowledge.

Keywords Entrepreneurial ecosystems · Venture capital · Internet · Industry knowledge · Law firms · Silicon Valley

JEL Classification M13 · O32 · G24

1 Introduction

Entrepreneurial ecosystems (EEs) are composed of startups and the organizations that provide assistance to them, which we term "entrepreneurial support

organizations" (ESOs) (Bergman & McMullen, 2021; Feldman, 2001; Roundy et al., 2017).[1] Thus, EEs not only encompass entrepreneurs but also includes other actors. For example, Spigel (2017) offers a comprehensive list, including human resource advisors, incubation, acceleration, co-working facilities, mentors, talent, universities, physical infrastructure, and open markets. Similarly, Mason and Brown (2014) list recruitment agencies, business consultants, mentors, and support activities, including both "hard (e.g., finance) and soft (e.g., advice) resources." Among those that provide critical assistance to startups are venture capitalists (VCs), law firms, and accountants (Mason & Brown, 2014; Spigel, 2017). ESOs provide specialized services to entrepreneurial firms and reciprocally benefit when and if the firms are successful. Moreover, as these service providers emerge, they alter the context within which entrepreneurs' function (Autio et al., 2014: 1099). There are many actors in an EE; in this paper, we limit our focus on four actors—lawyers, investment bankers, venture capitalists (VCs), and independent board directors—that play vital roles in the development of fledgling startups into successful firms.

We explore the premise that *knowledge about entrepreneurship process* can be separated from *industry knowledge* about what needs to be done to create a successful firm in an industry (e.g., recruiting management and labor, suppliers, and other firms). In Fig. 1, we graphically illustrate the proposed relationship between the entrepreneurial firm and entrepreneurial and industry knowledge. What the concept of industrial clusters (IC), industrial districts (ID), or regional systems of innovation (RIS) have in common is their interest in the concentration of businesses within an industry where the industrial knowledge or industry-specific knowledge resides, while many EEs are "… agnostic relative to industry or technology domain" (Autio et al., 2018: 77). Hence, what sets apart EEs from older concepts is the view that knowledge about how to support entrepreneurship is *generic* rather than *industry-specific*. The distinction regarding whether entrepreneurial knowledge is generic or industry-specific may hold keys to explaining whether EE actors must be in close proximity to the startup or whether the services can be supplied from outside the region (Autio et al., 2014).

This paper explores the spatial relationship between startups and four types of ESOs over the Internet industry's life cycle. Examining startup activity across the industry life cycle is important for a number of reasons. First, the level of startup entry is shaped by technological conditions (Acs et al., 2021) and industry life cycle, which has bearing on market saturation, competition, survival, and so forth (Agarwal & Audretsch, 2001). What also changes across the industry life cycle is the source and location of financial support or, more specifically, the nature of how startups are funded. Our research shows that over an industry's life cycle, the spatial concentration of ESOs occurs more rapidly than do the startups.

Agglomeration studies have repeatedly shown that industry knowledge is embedded in the network of local firms, suppliers, and other organizations (Arrow, 1971; Jacobs, 1969; Marshall, 1890; Romer, 1990). These studies confirm that organizations are embedded networks that co-produce particular products or services and knowledge. Of course, the embedded networks operate within regional contexts, which is an important point emphasized by Storper and Venables (2004: 357), who wrote, "… tacit and metaphorical knowledge is embedded in specific contexts." Regional innovation systems scholars observed that particular regions specialized in industry-specific innovations that were the result of knowledge that was endogenously developed (Cooke, 2001). This insight was extended by those studying EEs to suggest that certain regions came to specialize in creating new firms.

The formation of regional industry entrepreneurship was vital as new firms catalyzed the exploitation of new technologies and, as a result, often created new regions (Klepper, 2002; Klepper & Sleeper, 2005; Morrison & Boschma, 2019; Neffke et al., 2018). More recently, scholars have suggested that certain regions become hosts for specialized intermediaries that support and encourage entrepreneurship (Isenberg, 2010; Spigel, 2017; Spigel & Harrison, 2018) and that these intermediaries are capable of supporting startups outside their region.

[1] The term "ESO" in the literature often refers to incubators, accelerators, and small business development centers (Bergman & McMullen, 2021). We use the term more broadly to refer to VCs, law firms, accountants, and other professional services that are vital for building a new firm.

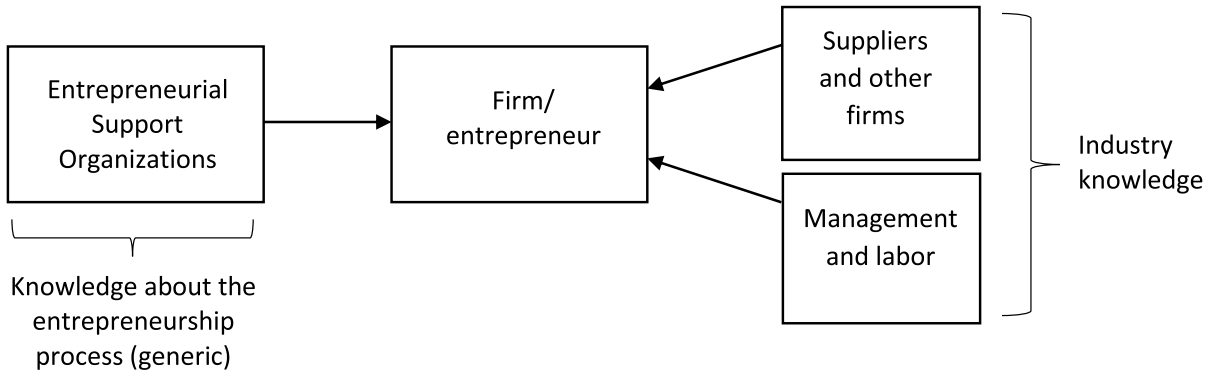

Fig. 1 The two types of knowledge that impact the firms in an entrepreneurial ecosystem

This population of organizations specialized in supporting entrepreneurs can be understood as an "entrepreneurial support network" (ESN) (Kenney & Patton, 2005). Although organizations that support entrepreneurship are at the heart of EE theorizing, few studies have been conducted on the coevolution of the location of startups and ESOs and how it interacts with the location of industry knowledge as an industry matures. Even less exploration has been done on the relationship between an industry life cycle and ESO geography, though it is implicit in the work of scholars such as Steven Klepper (2002, 2010; Buenstorf & Klepper, 2010) and in the EE concept (Acs et al., 2017; Spigel, 2017). Thus, because of the difficulty in identifying the "…surrounding support infrastructure" (Mack & Mayer, 2016: 2121) or the network of EE players in a way that enables analysis, the literature has an important gap. To address this gap, our study explores changes in the geography of a population of the most successful Internet firms and the organizations that supported them.

Recently, important progress has been made in terms of understanding the relationship between an EE and its region. For example, Vedula and Fitza (2019) and Vedula and Kim (2019) show that a higher-quality regional EE contributes to the survival of entrepreneurial firms. Because our interest is in the evolutionary relationship between ESOs and startups, we employ a different strategy. We examined data from the entire population of startups that undertook an initial public offering (IPO) from the inception of the Internet industry in 1994 until 2017. This allowed us to identify changes in the location of IPO firms and their affiliated VCs, lawyers, investment bankers, and independent board members. This data makes it possible to capture the changing geography of the successive IPOs with their affiliated ESOs and thus to measure changes in the spatial location of ESO members over an industry's life cycle and to correlate that with the location of the startup firm. This methodology enables us to better understand the interaction between industrial and entrepreneurial support expertise.

In Sect. 2, we explore the previous literature on industrial cluster life cycles, EEs, and ESOs. Section 3 presents our propositions regarding the evolution of the locational relationship between the focal IPO firm and the type of ESO actor. In Sect. 4, we provide a brief history of the Internet industry as a context for our study, and we describe the data collection methodology. Section 5 describes the results and their implications for understanding the relationship between EE knowledge and industrial knowledge and how this changed as the Internet industry has evolved. In Sect. 6, the overall results as well as their implications are discussed. In the conclusion, we discuss the limitations of this study and possible new research directions.

2 Industrial cluster life cycles and entrepreneurial ecosystems

2.1 Industrial cluster life cycles

Life cycle models are primarily used to explain the growth and development of regional industries (e.g., Feldman et al., 2005; Menzel & Fornahl, 2010). The

stage in their life cycle has implications for the ways in which firms in an industry evolve and compete (Klepper, 1997; Menzel & Fornahl, 2010; Ter Wal & Boschma, 2011). Not surprisingly, studies of industrial cluster strongly suggest that clusters experience a life cycle closely related to, but not identical to, the life cycle of the underlying industry of the cluster. Of course, particularly dynamic clusters can transition from one industry to another, as, for example, Tuttlingen, Germany, transitioned from making swords to surgical instruments (Halder, 2004). A more systematic study done by Kim et al. (2022) derives a theoretically grounded measure of cluster dynamics, which they call cluster motion, and in examining the US computer and semiconductor industries, they document the dynamic nature of clusters both within and across regions.

There is evidence that the initial location of a cluster can be random and often impossible to predict beforehand (Storper & Walker, 1989). The reasons for a cluster's emergence are usually explained after the fact, but evidence suggests that new industries grow out of related industries in a "branching process," in which new, often surprising, activities spin out of existing activities (Frenken & Boschma, 2007; Jacobs, 1969). In studies of the automotive, television, and tire industries, Klepper (2002) confirmed that the likelihood of a new industry entrant in a region was higher if it had existing related firms there. This is largely because the individuals best equipped to launch new ventures in a particular field are high-level employees at established companies in the same or a closely adjacent field (Aldrich, 1999; Klepper, 2002; Klepper & Sleeper, 2005; Sorenson & Audia, 2000).

The role of networks has been given significant attention for understanding cluster life cycles (Ter Wal & Boschma, 2011). Typically, a dominant design emerges as the new industry expands (Anderson & Tushman, 1990). In a successful new industry, the number of new firms increases rapidly with an internal stable core–periphery network. Spatially, industrial clustering becomes evident. Regions where there are fewer firms are expected to experience a gradual decline in their share of startups as the "window of locational opportunity" closes (Storper & Walker, 1989). Accordingly, these regions should experience a dramatic decline in entrepreneurship in the maturing industry.

A related line of research places spinoffs at the center of the clustering process even in the absence of agglomeration economies. Sorenson and Audia (2000) found that no agglomeration economies were required to explain clustering, as increases in firm density in the early stages of the cluster raised the rate of both firm entry and firm exit. Because of imperfect information, new firms concentrated near incumbents even in the absence of cluster-based advantages described by Marshall (Boschma, 2015). Steve Klepper (2002) found that firm heritage and spinoff dynamics explained clustering. The emergence of a cluster is explained by the spatially linked capabilities of firms and their progeny. Both of these approaches suggest that the geographical concentration of firms increases as the industry matures.

2.2 Entrepreneurial ecosystems

EE draws its lineage from strategy and regional science disciplines whose principal focus were in understanding the varied performance of firms and regions, respectively (Acs et al., 2017). The idea that the geographic concentration of economic activities could improve productivity dates back to Alfred Marshall (1890). After Marshall, there was a nearly five-decade hiatus in research on industrial clusters, roughly coinciding with the dominance of the vertically integrated firm. Research by economic geographers on industrial clusters advanced rapidly in the 1980s and 1990s, as researchers such as Michael Piore and Charles Sabel (1984) and then AnnaLee Saxenian (1994) interpreted high-technology regions such as SV as industrial clusters. In 1998, Michael Porter (1998) synthesized this work and suggested that the sectoral, geographical, and socio-economic network attributes of clusters were vital to understanding business strategy.

The increased importance of entrepreneurship in economic development led to the introduction of the concept of "entrepreneurial ecosystems." What differentiates EE from a family of related concepts, such as industrial districts, regional industrial clusters, and regional innovation systems, is its starting point that is neither the market nor the government but the *entrepreneur* (Stam & Spigel, 2016). The ongoing vertical disintegration made startups and small businesses the regions' engines of economic development. EE theorists suggested that *individual agency* and the *interaction* among agents were missing from

contemporary discussions. Another important distinction is that unlike other concepts that focused on the *additive* aspects of elements, ecosystem considers the *complementarity* and the *combinatorial process* of these elements. However, it was also observed that the idea of EEs was as much of a policy construct as it is an academic concept for scientific study (Malecki, 2018). Broadly defined, an entrepreneurial ecosystem is a "… a set of interdependent *actors* and *factors* coordinated in such a way that they enable productive entrepreneurship" (Stam, 2015).

The interest in EE is increasing dramatically. In a recent study, Rocha and Audretsch (2022) found that academic publications on industrial districts and clusters were declining, even as publications on regional clusters were growing gradually, while studies on EE were growing exponentially. Their conclusion was that industrial district and cluster concepts were constructed for industrial analysis, which were insightful to examining the manufacturing sector but less useful in explaining the advent of the IT revolution and the importance of SV-type startups. The EE framework, by contrast, is very useful because of its focus on digital startups/entrepreneurs rather than incumbents and large firms. For them, agglomeration was still important, but now it mattered for different reasons: not for economies of scale but for EE's networks, talent, and knowledge. Our research reinforces their findings, as we show SV ESOs built industry-specific knowledge that made them attractive to successful Internet firms no matter where they were located.

The key constituents of an EE are a variety of organizations that specialize in providing services to entrepreneurs. Andersson and Hellerstedt (2009) find an important role of knowledge-intensive business services (KIBS) in the innovation and growth of regions, specifically in startups. They find that as much as three quarters of KIBS founders in Sweden had prior work experience in the sector. This is precisely the value of ESOs. Although entrepreneurship is a fundamentally local phenomenon, scholars have also recognized the role of distant ESOs (see Brown & Mason, 2017; Spigel, 2017). The importance of these conduits is recognized by Ter Wal and Boschma (2011), who maintain that the cluster literature overstates the importance of proximity and underplays the role of extra-regional network actors. Our research confirms the ability of ESO actors to serve distant clients while also showing that the ESOs themselves become more concentrated in the location of deep industry knowledge—something that makes them more effective at providing what are understood to be generic ESO services.

Despite being central to the definition of an ecosystem, actors other than entrepreneurial firms and venture capitalists have received limited attention. EEs, like biological ecosystems, are communities that include not just entrepreneurs but also a variety of other actors, such as VCs, law firms, and accountants that provide specialized services for entrepreneurial firms (Clayton et al., 2018) and benefit when the entrepreneurial firm is successful (Kenney & von Burg, 2000). Essentially, an EE is a set of actors and institutions that assist in the creation and growth of startups. These actors are independent from the entrepreneurial firms and create value through their interaction with these firms.

Another key feature of the EE framework is its focus on complex *interactions* among actors and factors that facilitate co-existence, co-dependence, and coevolution (Acs et al., 2014, 2017). The EE approach overcomes the limitations of industry-level analysis as it departs from binaries such as intra vs. inter-industry or local competition vs. monopoly research and directs attention to the dynamic interaction of key agents and the evolutionary processes of EEs.

The EE, much like industry studies, also elevated the role of knowledge but recognizes two types of knowledge. The first type of knowledge is the knowledge possessed and shared by individuals and firms in the cluster regarding the production and marketing of products and/or services (Autio et al., 2018) that is *industry-specific*. The second type of knowledge is *generic* as it can be applied across entrepreneurship opportunities and is shared through an EE by networks of entrepreneurs and the actors that assist them (Stam & Spigel, 2016: 5). The relationships among these actors and firms, and how they influence each other, are conceptualized as analogous to the interactions among organisms in a biological ecosystem (Spigel, 2017).

Both industrial and entrepreneurial process knowledge can be diffused through an EE by a variety of actors, both local and distant.[2] Brown and

[2] The adjacent literature on knowledge spillover more directly examines the process of diffusion (for more, see Acs et al., 2009).

Mason (2017) refer to these EE actors as entrepreneurial connectors and a dynamic EE has networks of such actors in abundance. These social and professional networks include specialized financial intermediaries, such as the VCs in regions like the greater Silicon Valley (SV) region (Feldman & Zoller, 2012; Florida & Kenney, 1988a, 1988b). While the EE networks are expected to be embedded in an information flow or "buzz" based on face-to-face contacts, these networks need not be either exclusively local or industry based (Bathelt et al., 2004; Storper & Venables, 2004).

As EEs have become conceptually popular, scholars have recognized that there are gaps in our knowledge about the operation and evolution of EEs (Alvedalen & Boschma, 2017; Stam, 2015). Only recently have researchers begun studying the spatial dimensions of the ESOs (Vedula & Fitza, 2019), and even fewer study the spatial evolution of their relationships within an industry over time. The paucity of empirical studies is widely acknowledged (Brown & Mason, 2017; Malecki, 2018; Spigel, 2017), as are the difficulties faced, including the choice of appropriate metrics and the appropriate regional scale to be examined.

There are three interrelated issues with measuring EEs: skewness, lagged performance, and multiple levels of geographic analysis (Andrews et al., 2022). Most entrepreneurship research focuses upon small businesses, most of which do not grow. Only a small fraction becomes high-growth firms (HGFs). And an even small number of these HGFs become VC-backed unicorns (startups valued at more than $1 billion) and eventually list with an IPO. Measurement of an EE then needs to assess its region's performance on the skewed outcome of a few very successful firms. Another concern has to do with lagged performance of EEs. Assigning the entrepreneurial ventures to a region's EE is an empirically difficult task because there is usually a considerable lag between when the EE forms and when its startup rates are observed empirically. Finally, determining what level of geographic analysis to use (e.g., zip code, county, commuting zone, MSA) is a tricky subject because EE's spatial boundaries are not clearly defined.

To control skewness, Andrews et al. (2022) and Guzman and Stern (2020) offer a predictive analytic approach that assesses EEs based on both quality and quantity of startup activities. In contrast, to overcome the challenges of geographic analyses, Leendertse et al. (2021) propose a standardized index-based metric to measure EEs. But one commonly mentioned problem concerns the shortage of cross-sectional and longitudinal empirical research (Mack & Mayer, 2016), which makes accounting for lagged performance difficult. One suggested empirical approach stresses the processes that create resources within an EE and how entrepreneurs access these resources (Spigel & Harrison, 2018). Applying this approach requires measuring the phenomenon consistently over time and across comparable regions within the same industry, preferably beginning at the inception of the industry. Moreover, the metric chosen must in some way capture the resources created within the EE and accessed by entrepreneurs in all regions involved in the industry. We argue that the geographical distribution of the members of the ESN should change over time, and these changes can offer new insights into the evolution of EEs (Balland et al., 2015; Frenken et al., 2015).

Both geographic and lagged performance challenges are addressed in this study, which covers the entire life of an industry and thus provides an optic to understand how the geography of key EE service providers evolves over time.

2.3 Cluster life cycles and the evolution of entrepreneurial ecosystems

While industry life cycle models can be quite specific as to the degree to which firms concentrate geographically over the stages of the industry, there is less theorizing about the geographical evolution of EEs even as it widely appreciated that EEs are not static but rather evolve (Malecki, 2018; Spigel, 2017). The most notable of the EE life cycle models found in the literature is that developed by Mack and Mayer (2016) and the model proposed by Mason and Brown (2014). Mack and Mayer's model deals with EE development in a stylized manner much like Menzel and Fornahl (2010) in their industry life cycle model.

EEs, like clusters, pass through four stages: birth, growth, sustainment, and decline in Mack and Mayer's model. In the birth stage, the components of the EE are underdeveloped, and finance capital is limited. In the growth stage, the EE develops as more entrepreneurs emerge, and networks among entrepreneurs become denser. In the sustainment stage, firm births decline, deaths increase, and market opportunities begin to weaken. If EE actors cannot extend the sustainment stage, the EE may atrophy or decline (Mack & Mayer, 2016: 2121–2124).

A dynamic model that relies upon the role spinoffs play in the development of a cluster has been proposed by Mason and Brown (2014). This model resembles Klepper's model of industry life cycles. EEs evolve from an embryonic stage (few startups, few dealmakers, and limited VC) to a scale-up stage characterized by many new firms and a dense EE. The primary means by which this transition occurs is through a spinoff process where local successful firms become the source of further new firm formation. This spinoff process does more than produce new firms; it also ignites a process of entrepreneurial recycling that results in the transfer of entrepreneurial learning within the EE through the generation of dealmakers, advisors, venture capitalists, and non-executive directors to the EE (Brown & Mason, 2017: 18).

These resemble the model developed by Feldman et al. (2005) in explaining the role of entrepreneurs in building industrial clusters, Brown and Mason's model shows how entrepreneurs in the process of building a firm not only contribute to the development of an industrial cluster, but also contribute to the evolution of the EE within the cluster. This model while useful may not capture the dynamic in systemically important new industries, because, as we show, over time, four key EE constituents become less local and concentrate in one region, SV. Effectively, firm entrepreneurship continued nationally, but certain key EE services became markedly more spatially concentrated.

3 Propositions regarding the focal firm and its ESOs

The four EE actors examined in this study are a subset of the actors and institutions that comprise an entrepreneurial ecosystem, but they are among the most important actors in an EE. Moreover, these actors are well defined as is the nature of their relationship to each other and to the focal firm they are assisting.[3] This precision of definition and characterization of the interactions among these actors addresses a criticism made of the EE approach that it does not present a clear analytical framework that explicitly indicates the nature of the causal relation among actors advancing entrepreneurship (Stam, 2015).

Due to the difficulty in collecting data, most studies of EE are based on a static framework that describes relationships within an EE while not considering how these relationships have evolved (Alvedalen & Boschma, 2017). Because geographical information on these four actors is presented accurately and consistently for these firms in their IPO registration documents, this study is both a cross-sectional analysis and a dynamic analysis of an entrepreneurial support network, for specific entrepreneurial functions in a single industry since its inception.

In this section, we state our expectations regarding the changes in the spatial distribution of our EE actors over the life cycle of the Internet industry. To reiterate, the industrial life cycle literature suggests increasing concentration in terms of the location of firm entrants but has given far less attention to the EE member location.

[3] Any description of an EE for purposes of analysis cannot include every actor that may conceivably contribute to regional entrepreneurship. For example, we were unable to assemble data on leadership, culture, regulations, tax policies, business consortiums (business associations, trade unions), angel investors, and physical infrastructure. Spigel's (2015:56) relational configuration of an EE lists several actors in the areas of finance (VC director), mentoring (non-VC director), and support services (firm lawyer and investment banker) that assist in the promotion of regional entrepreneurship that may exist in any region. While universities and support service incubators are material attributes with a tangible presence in a region, we were unable to consistently identify them for every IPO. The accelerator/incubator roles of mentorship, learning from peers and credentialing often overlap with what VCs do; and not surprisingly, many VCs are active and instrumental within the accelerator/incubator communities. We suspect that universities, in particular, would play a much more important role in a study of EEs in the history of the biotechnology industry and that their importance would be revealed in the founding of biotech IPOs.

3.1 Focal Internet firms: startups and those undertaking an IPO

Explanations of clusters based on either agglomeration economies (Marshall, 1890) or firm inheritance (Klepper, 2010) suggest that firms and industry knowledge will tend to concentrate over time.[4] Because in the USA new firm formation in the information technology industries nearly always requires venture capital investment, we confined the firms in our study to those funded by venture capitalists. Given the remarkable strength of the SV, observers assumed it would rapidly become the dominant location for new firm entrants (Zook, 2002). Therefore, we propose that:

> Proposition 1: As the industry matures, the proportion of new Internet firms will become more spatially concentrated.
> Proposition 2: As the industry matures, the proportion of Internet IPOs will become more spatially concentrated.

3.2 The focal firm's law firm

Capable legal counsel is vital for incorporating a startup in a way that can accommodate rapid growth and preparing the firm for the corporate governance changes necessary when receiving venture capital and later undertaking an exit (Suchman, 2000). The intimacy of the relationship between the firm's founder(s) and its counsel suggests that they will be located in close proximity to each other. Yet lawyers embedded in an EE where substantial industry knowledge has accumulated might offset the advantage of less knowledgeable lawyers located close to the focal firm. For this reason, we propose that at the inception of an industry, when industry-specific knowledge is scattered and thus there is no advantage to having a distant lawyer, local ones are likely to be predominant. However, if industrial knowledge concentrates regionally, the presence of lawyers located in the industrially dominant region is likely to increase:

> Proposition 3: In the industry's early phase, the firm's lawyer will likely be spatially proximate. As the industry matures, the startups will be more likely to choose a lawyer located in the dominant region that is the site of the most industrial knowledge.

3.3 Investment bankers

Investment bankers (IBs) collaborate with the firm's management and existing investors to prepare the firm for a public offering. Investment bankers have been concentrated in New York City (NYC), but other regions and, in particular, SV have local investment bankers (Kenney, 2000). Therefore, in the early stages, we expect the lead investment bankers to be dispersed but with significant concentrations in both SV and NYC. However, as the industry matures and industry knowledge concentrates, we expect a shift to the region where the Internet industry knowledge, as opposed to investment banking knowledge, is concentrated. Therefore, we propose that:

> Proposition 4: In the industry's early phase, the IBs will have noticeable concentrations in NYC and SV, but as the industry matures, startups are more likely to recruit their IB from SV where the Internet industry knowledge has become concentrated.

3.4 Venture capitalist board members

VCs are central EE actors because they provide the funds, advice, and connections that contribute to startup growth (Florida & Kenney, 1988a, 1988b; Gompers & Lerner, 2004). Ample evidence suggests that VCs prefer to invest in firms in close proximity to their offices (Chen et al., 2010; Florida & Kenney, 1988a; Sorenson & Stuart, 2001). Since the 1980s, venture capital, while remaining concentrated in SV, NYC, and Boston, has dispersed. Therefore, we propose that:

> Proposition 5: Initially, the VC directors will be dispersed, and firms will access VC from a variety of locations; however, as industry knowledge con-

[4] Klepper's study of the automobile and television industries shows that increased concentration over time is the industrial pattern most commonly observed, but that there are exceptions such as the television industry due to differences in the initial geography of industrial knowledge (Klepper 2003: 2–3).

centrates, firms will increasingly use VC directors from the dominant region.

3.5 Non-venture capitalist board members

Non-VC directors assist firms in a variety of ways, such as, providing connections, advice, signaling quality to investors, and contributing to corporate governance (Pfeffer, 1972). The variety of services performed suggests that when there is no concentration of industry knowledge, the non-VC directors are likely to be spatially dispersed. However, as the industry and knowledge concentrates, we would expect the concentration of non-VC directors to increase in the emerging dominant region:

Proposition 6: Initially, the non-VC directors will be widely dispersed, and firms will access knowledge extra-regionally; as the industry matures and industry knowledge is concentrated, firms will appoint non-VC directors from the dominant region.

4 Setting, data, and methodology

The knowledge necessary to establish an Internet firm was widespread at the inception of the industry. The Internet began as a federally funded network (known as ARPAnet) and connected universities across the country. Further, the crucial creation of a "language" for creating websites was undertaken at CERN in Geneva, Switzerland, in 1992, and this was provided to any interested parties. The early Internet browsers were developed at universities around the world, and the most famous of these, Mosaic, was developed at the University of Illinois and provided freely to all. These open-source building blocks for Internet applications were widely available. This suggests that the basic knowledge necessary to enter the fledgling internet industry was not initially concentrated in any particular location. Not surprisingly, technologies were developed, and websites emerged in a variety of locations (Zook, 2006). Recognizing the opportunity, VCs almost immediately began funding startups seeking to commercialize the Internet.

The opportunity ignited a Schumpeterian gold rush, as entrepreneurs formed new firms. The rapid adoption of the Internet and growth of these new firms was accompanied by enormous excitement and a public desperate to purchase shares in new Internet firm listings. A flood of IPOs ignited what came to be known as the "dot-com bubble." In 1999 and early 2000 and at the height of the frenzy, as Fig. 2 shows, there were 308 Internet IPOs. Then, the market collapsed, and hundreds of these firms went bankrupt with investors suffering tremendous losses. For a decade, there were few Internet IPOs. It was only during the recovery from the 2008/2009 stock market collapse, the emergence of the Web 2.0, and the corresponding surge in Internet and smartphone use that investors again became receptive to Internet IPOs.

For this reason, we divided the industry history and population of 581 Internet IPOs into three periods based on the investment context. As Fig. 2 illustrates, Period 1 was from 1995 to the dot-com burst in 2000. During Period 2, from 2001 to the beginning of the Great Recession in 2008, few IPOs occurred, and thus, we drop this period from further analysis. Period 3 was from 2009 to 2017. Because of our focus on the locational changes and to dampen annual variations, our analysis compares the differences between Periods 1 and 3.

Our data includes only startups that had never been listed before and were not spinoffs of an existing firm. The information was extracted from US Securities and Exchange Commission filings. The locational data was established by Internet searches. The underwriters' law firm's address was used to infer the location of the lead investment banker (thus, this location is approximate). We searched for the address of every VC on the board of directors, and, following Chen et al. (2010), we attributed the individual's location to their actual location, not the VC firm's headquarters.

5 Results

Given that our time period is 23 years, we expected that the industry would exhibit the clustering that often accompanies maturity. The Internet industry contrasts to many industries where maturity sets in relatively soon and new entrance stops. In the Internet industry, while there were fewer firms established and conducting IPOs in Period 3 than in Period 1, the flow of IPOs revived from the previous decade. In Table 1, we provide the changes in concentration

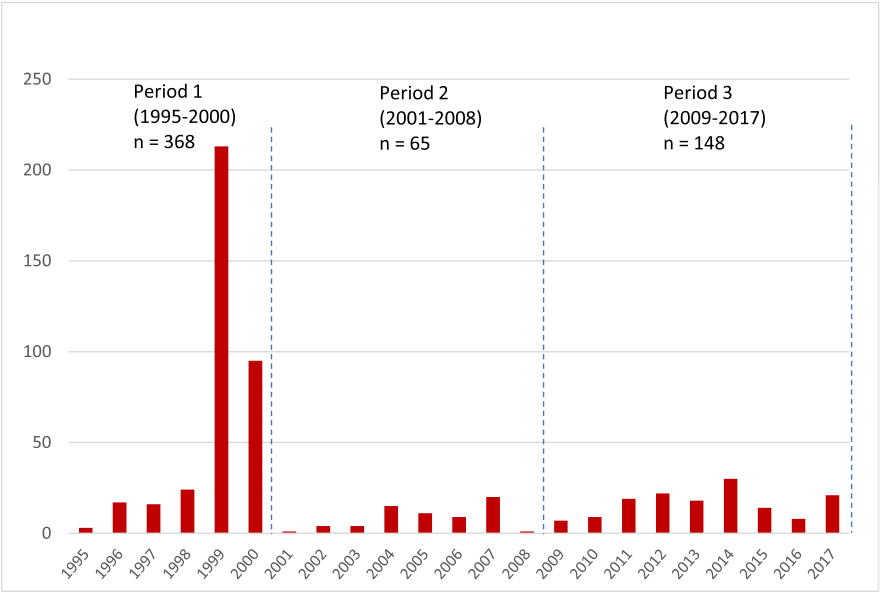

Fig. 2 Internet IPOs by year and periods, 1995–2017, $n = 581$

between the two periods with respect to SV, which became the dominant region. Our first six propositions, derived from theory, confirm our expectations of both increased industrial concentration and increased ESO concentration.

5.1 Location of VC-funded Internet firms and those undertaking an IPO

From the previous literature, it was expected that the spatial concentration in terms of both startups and IPOs would increase (Propositions 1 and 2). As Table 2 indicates, SV that was already significant in Period 1 became more central in Period 3 but clearly was not dominant. The number of SV startups increased from 19.4% in Period 1 to 29% in Period 3 of the total in each period—its share of total startups increased significantly. This provides evidence that industry knowledge was increasing in SV. The greatest declines were in the weaker regions. This startup data partially confirms previous results and shows an increased concentration of industry knowledge and presumably entrepreneurial inspiration (Buenstorf & Klepper, 2010; Klepper, 2010; Sorenson & Audia, 2000; Vedula & Fitza, 2019). Yet, even in Period 3, entrepreneurs around the country continue to establish new and successful startups.

In all three periods, SV had a greater percentage of startups than any other region. This success is almost certainly due to the strength of the existing EE but also the presence of firms in adjacent industries. In contrast, in Period 2, SV actually lost market share in terms of IPOs, possibly because it reacted more forcibly to the collapse of the public market for Internet

Table 1 Propositions, percentages in Periods 1, 2, and 3 and inter-period change for the SV region

	Period 1 1995–2000 (%)	Period 2 2001–2008 (%)	Period 3 2009–2017 (%)	Change from Period 1 to Period 3 (%)
Proposition 1: VC-Backed startups	19.4	22.2	29.0	+9.6
Proposition 2: IPOs	33.4	28.1	38.5	+5.1
Proposition 3: law firms	38.6	35.9	47.3	+8.7
Proposition 4: investment banks	42.7	35.9	52.0	+9.3
Proposition 5: venture capital	49.0	59.6	72.1	+23.1
Proposition 6: non-VC directors	22.7	24.9	46.2	+23.5

Table 2 Measurement of IPO and venture capital-funded startup concentration by periods (in percent)

	SV	Mass	NYC	SoCal	Second tier ($n=3$)	Other regions
All Internet startups*						
Period 1 1995–2000	19.4	5.6	11.5	11.0	12.3	40.3
Period 2 2000–2008	22.2	5.6	10.9	10.6	12.9	37.8
Period 3 2009–2017	29.0	3.7	15.3	11.7	10.6	29.6
Period 3 minus Period 1	9.6	−1.9	3.8	0.7	−1.7	−10.7
IPOs						
Period 1 1995–2000	33.4	9.5	9.5	8.2	13.9	25.5
Period 2 2000–2008	28.1	10.9	4.7	12.5	15.6	28.1
Period 3 2009–2017	38.5	7.4	8.1	10.8	13.5	21.6
Period 3 minus Period 1	5.1	−2.1	−1.4	2.6	−0.4	−3.9

Source: Crunchbase, accessed June 16, 2020

*9954 startups with more than 10 employees classified as Internet services. See Appendix Table 12 for definitions of the regions

Table 3 Herfindahl–Hirschman index for Internet IPOs, startups, and EE actors over eleven regions for Periods 1, 2, and 3

	Internet startups	Internet IPOs	Law firms	Investment bankers	VC directors	Non-VC directors
Period 1 1995–2000	0.11	0.16	0.20	0.26	0.28	0.12
Period 2 2001–2008	0.12	0.14	0.18	0.21	0.39	0.13
Period 3 2009–2017	0.15	0.19	0.27	0.33	0.53	0.25
Period 3/Period 1	1.3	1.2	1.4	1.3	1.9	2.1

firms. While the proportion of firms established in SV has increased, it has not yet resulted in the winner-take-all spatial pattern described in the literature, either in terms of startups or IPOs—entry and success was still possible outside Silicon Valley.

To examine these changes statistically, we use Herfindahl–Hirschman index (HHI) that measures concentration.[5] The index measures the concentration of firms or EE actors over 11 regions; however, it is important to recognize that the regions differ massively in size as SV is the San Francisco Bay Area, while a number of other regions are comprised of multiple states (see Appendix Table 12).

The level of regional HHI concentration differs among EE actors. As can be seen in Table 3, the concentration in Period 3 is the lowest among the startups and IPOs, and the increase has been relatively minor. In particular, and surprisingly, there was a slight *decrease* in the concentration in IPOs. As we expected, the concentration increased for each of the four EE actors. For the law firms that were already only slightly more concentrated than the IPO firms,

[5] The Herfindahl–Hirschman Index is defined as $H = \sum_{i=1}^{11} S_i^2$ where S_i is the proportion in region i of the total number of firms or actors in 11 regions. H increases as regional shares are more concentrated and therefore more unequal.

Table 4 Company law firms by location of source and target in Period 1

	Source (location of law firm)						
Target (location of focal firm)	Mass	NYC	SoCal	SV	Other	Total	Target % of total
Massachusetts	32	1	0	1	1	35	9.5%
New York	1	32	0	0	2	35	9.5%
Southern CA	0	2	18	9	1	30	8.2%
Silicon Valley	0	0	2	119	2	123	33.4%
Other	10	11	1	13	110	145	39.4%
Total	43	46	21	142	116	368	100%
Source % of total	11.7%	12.5%	5.7%	38.6%	31.5%	100%	81.5% local

The "Other" category includes the other seven regions. See Appendix Table 12

Table 5 Company law firms by location of source and target in Period 3

	Source (location of law firm)						
Target (location of focal firm)	Mass	NYC	SoCal	SV	Other†	Total	Target % of total
Massachusetts	10	0	1	0	0	11	7.4%
New York	2	10	0	0	0	12	8.1%
Southern CA	0	1	8	7	0	16	10.8%
Silicon Valley	0	0	0	57	0	57	38.5%
Other	3	10	1	6	32	52	35.1%
Total	15	21	10	70	32	148	100%
Source % of total	10.1%	14.2%	6.8%	47.3%	21.6%	100%	74.3% local

The "Other" category includes the other seven regions

the service did increase. The investment bankers were already quite concentrated regionally, and this increased to 0.33, which is considered high concentration. The most remarkable percentage increases occurred among VC and non-VC directors, though the ratios are quite different. In terms of VC directors, the Period 3 HHI of 0.53 indicates extremely high concentration as SV became the dominant region. For non-VC directors, the ratio of change was the greatest of all as the location of non-VC directors concentrated significantly and overtook that of the startups, themselves. In the following sections, we discuss these changes for each of the four key EE constituents.

5.2 Company law firms

Given the intimacy of the relationship a startup has with its legal counsel, we expected that in Period 1, the firms' counsel would be spatially proximate. Our expectation was that the power of proximity would decline as the industry matured and its knowledge became more spatially concentrated. In Period 1, as Table 4 shows, 81.5% of all IPOs were served by local law firms. This was particularly evident in SV where 119 of 123 IPOs were served locally. However, SV lawyers served 23 firms outside the region. In agreement with our expectations, as shown in Table 5, in Period 3, the number of firms serviced locally decreased to 74.3%. The change was that SV lawyers increased their share of the total by 8.7%, with most of the gain due to it servicing all of its local IPOs. NYC also slightly increased its share. Despite these increases, legal counsel remained proximate though there was a 7.2% increase in inter-regional servicing. With regard to this most intimate of EE services, the attraction of distant and presumably more capable legal service providers increased only slightly. Our results suggest that the increasing concentration of

Table 6 Lead investment banker by location of source and target in Period 1

	Source (location of investment banker)						
Target (location of focal firm)	Mass	NYC	SoCal	SV	Other	Total	Target % of total
Massachusetts	28	4	0	1	2	35	9.5%
New York	7	24	0	0	4	35	9.5%
Southern CA	0	2	10	17	1	30	8.2%
Silicon Valley	0	3	8	109	3	123	33,4%
Other	16	46	2	30	51	145	39.4%
Total	51	79	20	157	61	368	100%
Source % of total	13.9%	21.5%	5.4%	42.7%	16.6%	100%	57.1% local

The "Other" category includes the other seven regions

Table 7 Lead investment banker by location of source and target in Period 3

	Source (location of investment banker)						
Target (location of focal firm)	Mass	NYC	SoCal	SV	Other	Total	Target % of total
Massachusetts	9	1	0	1	0	11	7.4%
New York	2	6	1	1	2	12	8.1%
Southern CA	0	2	5	9	0	16	10.8%
Silicon Valley	0	0	0	57	0	57	38.5%
Other	8	17	3	9	15	52	35.1%
Total	19	26	9	77	17	148	100%
Source % of total	12.8%	17.6%	6.1%	52.0%	11.5%	100%	60.1% local

The "Other" category includes the other seven regions

industry knowledge had only a minor effect in eroding importance of proximity.

5.3 Lead investment banker

The lead IB shepherds the focal firm through the IPO process and thus joins the firm's ESN relatively late. As Proposition 4 suggested, we expected Internet industry knowledge would become increasingly more important than general EE knowledge; therefore, the IB would increasingly be located in SV. As Tables 6 and 7 show, this proposition was confirmed as SV increased its IPO share from 42.7 to 52%. The high initial market share was almost certainly a legacy of the fact that SV IBs already had significant experience with technology IPOs. In Period 3, SV IBs took market share from the other regions (except SoCal). NYC, which was and is the headquarters for the most important IBs, is particularly interesting because it experienced a significant loss of market share even for its own IPOs. Increasing industry knowledge dominated IB industry skills with which NYC is amply endowed. Once again, SV firms were no longer served by external IBs; it had become autarchic. For IBs, industry knowledge appears to have tipped the decision by entrepreneurs to use IBs in SV.

5.4 Venture capital directors

Because of the dispersed and minimal initial industry knowledge, in Proposition 5, we suggested that in Period 1, VC investment would be dispersed and, as the previous literature has shown, VCs would invest locally (Florida & Kenney, 1988b; Sorenson & Stuart, 2001). The expectation was that, in Period 3, as industry knowledge increased, the local bias would be overcome, and entrepreneurs would source their venture capital from the dominant region.

Table 8 Venture capital directors by location source and target in Period 1

	Source (location of venture capital director)						
Target (location of focal firm)	Mass	NYC	SoCal	SV	Other	Total	Target % of total
Massachusetts	37	4	0	12	11	64	10.5
New York	4	18	1	7	9	39	6.4
Southern CA	6	5	13	22	6	52	8.6
Silicon Valley	16	13	7	201	33	270	44.4
Other	14	24	5	56	84	183	30.1
Total	77	64	26	298	143	608	100
Source % of total	12.7	10.5	4.3	49.0	23.5	100	52.5 local

The "Other" category includes the other seven regions

Table 9 Venture capital directors by location of source and target in Period 3

	Source (location of venture capital director)						
Target (location of focal firm)	Mass	NYC	SoCal	SV	Other	Total	Target % of total
Massachusetts	3	0	1	17	2	23	7.1
New York	1	6	1	16	11	35	10.7
Southern CA	2	2	6	18	4	32	9.8
Silicon Valley	4	2	2	129	5	142	43.6
Other	5	6	2	55	26	94	28.8
Total	15	16	12	235	48	326	100
Source % of total	4.6	4.9	3.7	72.1	14.7	100	49.4 local

The "Other" category includes the other seven regions

As we expected, in Period 1, there was a remarkable amount of extra-regional investment. SV did benefit because of its legacy as a technology-driven VC concentration, as it already was the home of 49.0% of all VC investors (Table 8). Moreover, due to SV's existing concentration of VCs, one might have expected it to be largely autarchic. And yet, in Period 1, 25.6% of SV VC directors were extra-regional. NYC and Boston VCs were active and supplied more VC directors outside their regions than they did internally. In this early period, when industry knowledge still remained dispersed; VCs from other regions could participate.

In Period 3, the situation changed dramatically (see Table 9). Now, 72.1% of all the VCs were located in SV—an increase of nearly 23%. Moreover, resembling the pattern with the lawyers and IBs, SV had become nearly autarchic, as only 9.2% of its VCs were extra-regional. The most telling change was that SV became the source of almost as many VC directors to other regions (106) as it provided locally (129). The percentage of local VCs declined in every other region, as they became dependent upon SV. This suggests that the increase in industry knowledge in SV was so powerful that firms in other regions sought the investments and services of SV VCs over those in their own EE.

5.5 Non-VC directors

Because the non-VC directors perform so many different functions, they are the most eclectic group. In Proposition 6, following Klepper, we suggested that during Period 1, which was at the industry's formation, many different types of knowledge would be needed. Thus, we expected the directors would be sourced from a wide variety of locations. Our conjecture that in Period 1 knowledge would be widely

Table 10 Non-VC directors by location of source and target in Period 1

	Source (location of non-VC director)						
Target (location of focal firm)	Mass	NYC	SoCal	SV	Other	Total	Target % of total
Massachusetts	43	11	4	10	20	88	8.4
New York	4	44	4	5	37	94	8.9
Southern CA	0	10	37	16	42	105	10.0
Silicon Valley	8	40	14	174	101	337	32.0
Other	17	58	18	34	301	428	40.7
Total	72	163	77	239	501	1052	100
Source % of total	6.8	15.5	7.3	22.7	47.6	100	45.4 local

The "Other" category includes the other seven regions

Table 11 Non-VC directors by location of source and target in Period 3

	Source (location of non-VC director)						
Target (location of focal firm)	Mass	NYC	SoCal	SV	Other	Total	Target % of total
Massachusetts	9	4	1	12	13	39	7.9
New York	3	6	1	9	19	38	7.7
Southern CA	0	8	19	13	14	54	10.9
Silicon Valley	6	12	18	131	23	190	38.3
Other	3	14	9	64	85	175	35
Total	21	44	48	229	154	496	100
Source % of total	4.2	8.9	9.7	46.2	31.0	100	40.9 local

The "Other" category includes the other seven regions

distributed was confirmed; as Table 10 indicates, less than half (45.4%) of all non-VC directors were local. SV was home to only 22.7% of all directors—a lower percentage than that of its share of listing firms (33.4%). SV barely provided the majority of its own directors (51.6%). Remarkably, SV provided fewer directors to other regions than NYC did (65 vs. 119). The greater dispersion of non-VC directors suggests that the useful knowledge was quite diffused. To reinforce this perception, NYC had only 7.2% fewer non-VC directors than did SV. The remarkably dispersed sourcing may be because the Internet firms were diverse and thus required not only technologists but also advisors and connections to marketing, advertising, media, and logistic capabilities. This likely impelled these IPO firms to seek talent in other regions.

In Period 3 (see Table 11), the locational calculus changed significantly as the industry matured and Internet-related industry knowledge became more concentrated in SV. SV now sourced of 68.9% of its directors locally—an increase of 17.3%. Further, SV share of the total increased dramatically to 46.2%. With the exception of SoCal, the share for all the other regions decreased; particularly affected were the scattered "other" regions. Yet, in contrast to some of the other actors, it was not autarchic and continued to secure directors from other regions. Conversely, for most other regions, SV now provided as many non-VC directors as did the recipient region. With the exception of SoCal, most other regions experienced declines with the weaker regions experiencing the greatest decline.

The spatial dispersion of the non-VC directors was the greatest of all EE actors and in neither period was 50% sourced locally, though. SV was the only region to locally service over 50% of its non-VC directors. While in Period 3 an increasing

number of the non-VC directors were located in SV, it continued to source a greater percentage of its non-VC directors from outside the region than for any other group of ESOs. This suggests that SV firms still felt it necessary to access knowledge externally (Bathelt et al., 2004).

6 Discussion

Our paper addresses a number of gaps in the EE literature and also endeavors to reconnect the EE literature to that of industrial clusters. First, we considered the location of EE actors over an industry's life cycle, both the startups and organizations and individuals that assist entrepreneurs. Second, we demonstrated that the dynamics of spatial concentration can differ between entrepreneurial firms and EE actors. Third, we demonstrated that the locational dynamics may differ between various EE service providers. Fourth, we provided suggestive evidence that the rise of dominant EE, in a particular industrial sector, appears to be predicated upon developing both EE and industry knowledge.

As our HHI shows, the maturation of the Internet industry led to some concentration of both startups and IPO firms. And yet, SV still has not completely dominated other regions, as startups and IPOs continued to be established throughout the US. The entrepreneurial capability necessary to establish a firm successful enough to attract VC support and, even to build a firm successful enough to achieve an IPO, remains dispersed.

The location of ESOs, from the inception of the industry, was more concentrated than that of either the startups or IPO firms. The location of all ESO actors became more concentrated and shifted in favor of SV. Interestingly, for both VC and non-VC director services, SV increased the number of directors provided internally even as it continued to access personnel from outside the region, as the argument made by Bathelt et al. (2004) would suggest. The most important pipeline particularly in Period 3 was from SV to the other regions, as its merger of industrial and knowledge creation led to the emergence of EE actors whose services were desirable to Internet entrepreneurs outside the region.

As the literature suggests, EEs are made up of various actors providing different services to entrepreneurs. Our research explored the tensions that exist in the EE literature. The first of these is proximity to the entrepreneurs. The second is proximity to the center of industry knowledge. Industry and EE service knowledge become co-located even though the entrepreneurs continued to be dispersed. The ESOs concentrated ever more powerfully, and, in our case, ESOs in locations with generic EE skills lost their attraction to even their local Internet entrepreneurs.

The ESO that showed the greatest affinity for proximity was between the focal firm and its law firm. This is unsurprising as the firm's outside legal counsel must develop a strong in-person relationship with the firm's founders and leaders, as counsel must be privy to valuable and intimate information—something only likely to occur if there are high levels of in-person trust (Suchman, 2000). As we expected, proximity only decreased from 81.5 to 74.3% in Period 3. For legal counsel, the centrifugal force of increasing industry knowledge does not appear to have been sufficiently powerful to dominate the benefits of proximity.

The location of IBs is particularly important for those interested in EE dynamics. Even the superior generic IB skills that NYC had for taking a firm public lost attractiveness. The merger of industry and EE knowledge allowed SV to increase its share of IB business. This increase may also be linked to the increased concentration of the key financial intermediaries, the VCs.

With the exception of the entrepreneurs, the private actor that has received the greatest attention is the VCs. The increase in the HHI concentration was remarkable, and in Period 3, this was largely driven by the fact that 72.1% of all VC directors were in SV. Moreover, in Period 1, 74.4% of all SV VCs were local, but this increased to 90.8% in Period 3—the region had become roughly autarchic. This was reinforced by the increasing number of non-local entrepreneurs that looked to the region for the funds, knowledge, and connections that SV's VCs possessed. By Period 3, SV had become part of the EE for Internet startups. This reinforces the intuition that, as least, some EE constituents need not be proximate.

The non-VC directors provide a wide variety of services to the firm. In Period 1, the locations of the non-VC directors were remarkably scattered, likely because the knowledge valuable to firms had

not yet become concentrated. In Period 3, there was significantly greater local concentration as SV increasingly provided non-VC directors to other regions. Yet, even SV continued to source non-VC directors extra-locally. This continued spatial dispersion is likely due to the wide variety of skills that this diverse group brings to the entrepreneurs. The non-VC directors appear to play what Bathelt et al. (2004) term the "pipeline function of bringing information and resources from outside the region." This seems to be true even for SV which had become autarchic in terms of the other ESO constituents studied. To return to the fundamental insight, in the industry formation stage, startups tend to secure EE services from a variety of locations as there is no dominant location where industry knowledge creates a competitive advantage for the service provider. In this particular industry, we saw SV increase its share of firms and IPOs but even more rapidly increase its share of ESOs. The dominance of SV indicates that local EEs actors may find it difficult to compete with the external ESOs if valuable industry knowledge concentrates in a particular region. For the peripheral locations, the centralization of ESOs may become even more problematic, if the industry core region causes the relocation of either new firms or ESO organizations (Kwon & Sorenson, 2021).

7 Conclusions and limitations

Our study has limitations. The first limitation is that it is an exploratory study of a single industry. The location of EE actors in other industries could exhibit different locational and evolutionary paths. A second limitation is an artifact of our data in that it analyzes the ESO members at the time of the IPO and may miss those that were affiliated with the firm earlier. This could also be the case with the non-VC directors. Finally, we only look at four EE actors and thus omit many others including auditors, executive recruiters, incubators, and local universities. Also, we do not measure either EE skills or industry knowledge directly; rather, we infer them from the increased concentrations of ESOs within a region. For these reasons, any generalizations and policy recommendations derived from this research should be cautious.

Yet, our ability to identify different EE actors has the advantage of providing a more encompassing and *evolutionary* perspective that includes identification of the location of the individuals providing the service. We provide a middle ground between the rich case studies of single regions that enumerate and describe the various actors that assist entrepreneurs and the quantitative studies that almost always narrowly focus on a single actor, such as the VC firm, university, or incubators.

The EE literature has always suffered from somewhat of a schizophrenic attitude regarding the significance of industrial knowledge. While there are aspects of the services an EE provides that are generic and thus not industry-specific, all entrepreneurial firms are either members of an industry or are in the process of building firms that will create a new industry, as is our case (Feldman et al., 2005). As the industry matures, entrepreneurs must make decisions about whether generic EE services, found either locally or externally, are sufficient. At the inception of an industry, generic EE services are all that is available. However, as the industry matures, an industrial cluster can emerge that is able to provide EE services with industry knowledge. This was the case for the Internet as SV soon developed such an industry-specific advantage. When such an industry center emerges, as we showed, local generic EE service providers may be bypassed by their local entrepreneurs.

Policymakers wishing to build an EE should understand that it will be difficult to provide all services locally. Perhaps, they should focus first on ensuring that the region develops experienced local legal talent. To illustrate, building upon Feldman et al. (2005), universities might contribute to the region by hiring local attorneys to assist in licensing for their entrepreneurial spinoff firms. Similarly, incubators could direct their tenants toward local lawyers, as this would have a greater likelihood of reinforcing the local EE. Developing a local VC industry may also be a goal, but our data shows that as the industry matures, generic local VCs appear to be less favored. This suggests that expectations for the local VCs should be modest, as a successful local entrepreneur in an existing industry is likely to search for VCs from a location where industry knowledge is concentrated.

The recognition that industry and EE skills are analytically different is an important contribution, as is the observation that such skills can be accessed extra-regionally and this is normal. Longitudinal research on other industries could provide a better understanding of whether EE skills without specific industry skills are sufficient to promote the emergence of synergistic high-value economic development. We found that regions such as NYC and Boston that had generic EE service providers were ultimately edged out by SV with its combination of industry-specific and EE knowledge.

The interest in EEs has resulted in greater attention to the organizations that support entrepreneurship. The bulk of the quantitative research has used panel data that treats EEs as static and not emergent and evolving—a violation of the very premise of what an ecosystem is. Studies of EEs should consider industry dynamics. By examining the changes of EE actors over the life of an industry, we have provided another perspective. Greater appreciation and attention to the context within which the startup, its industry, the local EE, and extra-local EE actors act can further advance EE research and contribute to policymaking.

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Appendix 1

Table 12 Regional definitions

MA	Massachusetts
NYC	New York
Southern California	Los Angeles, Orange, San Diego, Santa Barbara, and Ventura counties
SV	Alameda, Contra Costa, Marin, San Francisco, San Mateo, and Santa Clara counties
DC area	Washington, DC; Montgomery and Prince George's Counties in Maryland; Arlington and Fairfax Counties; and Fairfax and Alexandria in Virginia
Texas	Texas
Washington	Washington
Midwest	All Midwestern states
Other East	All areas in the Eastern states, not including MA, NY, or the DC area
Other South	All areas in the Southern states, not including Texas or the DC area
Other West	All areas in the Western states, not including Washington, SV, or Southern California
Top 4	SV, Southern California, NYC, and Massachusetts
Second tier	DC Area, Texas, and Washington
Other regions	Midwest, other East, other South, and other West

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