Spatial Distributions and Regional Agglomeration of High-Tech Regions and Venture Capital

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Introduction

In this paper, I will closely examine the Mark Granovetter's theories related to economic sociology and embeddedness. I will then apply those theories to the study of venture capital and high technology regions. My main research question encompasses the role of networks and social relations and their impact on the formation and development of high-technology clusters. Regions such as Silicon Valley (Greater Bay Area) and Route 128 (Greater Boston Area) are known as knowledge economies and contribute to great economic growth and innovation. While AnnaLee Saxenian spent her time researching the sociology of the emergence of Silicon Valley as a high-tech cluster, I will add to this research by applying the framework she used to study the role of networks within venture capital in Silicon Valley. Venture capital is particularly fascinating to study since this funding is the main driver stimulating local entrepreneurship and the regional economy.

Economic Sociology and High-Technology Regions

Mark Granovetter is a sociologist and Professor at Stanford University. Considered one of the fathers of economic sociology, he is well known for his theory on 'The Problem of Embeddedness'. Classical and neoclassical economists emphasized the formalist approach and believed that "rational, self-interested behavior [is] affected minimally by social relations" (Granovetter 1985, pp. 22). Mark Granovetter also discusses the other extreme: embeddedness. Embeddedness is essentially the interwoven nature of relationships in a social system. Granovetter's theory is supported by reformist economists and is known, within economic sociology, as the substantivist school of thought, "the argument that the behavior and institutions to be analyzed are so constrained by ongoing social relations that to construe them as independent is a grievous misunderstanding" (Granovetter 1985, pp. 22). In other words, social relations and networks should not be ignored when analyzing economic transactions. Whether you are a venture capitalist deciding to invest in a startup or a student investigating the rise of Atlanta as a technology region, social relations matter. Networks are important because they help develop trust and "discourage malfeasance" (Granovetter 1985, pp. 27). The Stanford Professor highlights the unique business culture in Japan, where personal relationships and friendships are the most important aspect of economic transactions. He explains that after work hours, businessmen go to bars and nightclubs, "where the vital personal contacts are established and nurtured slowly. Once these ties are set, they are not easily undone" (Granovetter 1985, pp. 33). People in business often speak about the distinct social norms and business culture in Japan, and most Americans and Europeans are shocked when they conduct deals with the Japanese. Here, Granovetter stresses the influence of longstanding interpersonal relationships on business in Japan. Similar elements reveal themselves in my exploration of the sociological structures and culture that exist in high-technology regions, specifically in Silicon Valley.

Methodology

Before diving right into the venture capital aspect of my research, I concluded that it would be necessary to explore high-technology regions. More specifically, I wanted to apply Saxenian's case study of Silicon Valley and further examine the sociological structures that contributed to the distinct collaborative culture that emerged in this tech-region. I selected Saxenian's case study because it highlights certain sociological elements including the Wagon Wheel, job-hopping, and the importance of social networks in the knowledge economy. These are phenomena that I will explore in the next sec-

tion. After researching the sociology of Silicon Valley as a high-tech cluster, I then focused on the role of venture capital as an economic agent within Silicon Valley. Compared to other regional economies, venture capital plays a distinct role in the Bay Area by linking the twelve economic agents together – this is another concept I will examine in the next section. In this paper, you will find my discoveries about the emergence of high-technology regions, the sociological structures that exist in Silicon Valley, and the distinct role that venture capital firms play in this high-tech cluster.

Findings

As I mentioned in the introduction, my fascination with knowledge economies and high-technology regions emerged from my exploration of AnnaLee Saxenian's case study on the rise of Silicon Valley. My interest in technology, start-ups, and entrepreneurship leads me to question why high-tech clusters are regionally concentrated. I will introduce this section by exploring Saxenian's case study because I believe it is critical in understanding the process of the emergence of a high-technology cluster.

Silicon Valley as a 'Distinctive Technology Community'—Saxenian Case Study

Saxenian classifies high-tech clusters as 'regional industrial systems' that are composed of three key dimensions: local institutions and culture, industrial structure, and corporate organization (Saxenian and Societies 1996, pp. 7). These three dimensions are interwoven within the economy and shape the "social and institutional setting" of the regional economy. These dimensions are closely interconnected, and one dimension cannot function without the other.

A crucial point of study in her research is a comparison of Route 128 and Silicon Valley during the rise of the semiconductor computer industry; I will focus primarily on her analysis of Silicon Valley. She explains that Silicon Valley started as an agricultural economy, known for its fruit orchards, food processing industry, and distribution networks. In the 1940s, when Route 128 had become the center of electronics manufacturing, Santa Clara Valley was home to only a handful of electronics companies. However, during World War II, the Bay Area was the ideal gateway to the Pacific theater, so many government military contracts were sent to the region, contributing to regional economic development. The valley wanted to model its own technology hub after Route 128 (Powell, 2005), which would result in a "distinctive technological community" (Saxenian and Societies 1996, pp. 13).

One of Saxenian's crucial arguments is the concept of the 'Wagon Wheel', which was a famous bar in Silicon Valley that became a social gathering place for networking (1996, pp. 32). The Wagon Wheel represents a social setting where information is shared, and knowledge circulates. The Wagon Wheel represents the uniqueness of Silicon Valley infrastructure in the sense that relationships are easier to develop than in any other region in the country. She claims that "informal communication was often of more value […] in an industry characterized by rapid technological change" (1996, pp. 33). This ties into Mark Granovetter's theory of embeddedness and social relations: Granovetter highlights that social relations matter in economic transactions due to the development of trust (Granovetter 1985, pp. 24). Saxenian emphasizes the importance of social relations, explaining that people from competitor firms would exchange information to help themselves and each other. This was a foreign concept to people working on the East Coast in the 1940s where employees would be shunned for socializing with a competing firm. However, in Silicon Valley, people understood the benefit of feedback through personal ties: "Here [in Silicon Valley] they will not only sit down with you, but they will share the problems and experiences they have had. This is a culture in which people talk to their competitors" (Saxenian and Societies 1996, pp. 33).

In addition to employees engaging with people from competitor firms in the Wagon Wheel, Silicon Valley employees would switch around companies. Saxenian refers to this phenomenon as "job-hopping" and notes that this was a way for employees to gain fresh perspectives in the workplace (1996, pp. 34). Employees would bring previous knowledge and learning outcomes and apply them to new settings, where they would meet an entirely new team of colleagues, therefore expanding their social network. Saxenian explains that job-hopping not only became socially acceptable, but it became the norm in Silicon Valley. Silicon Valley employees

were confused as to why people on the East coast were staying at firms for the entirety of their careers (1996, pp. 35).

Now that I have provided an overview of the distinct sociological structures that are embedded in the high-technology region of Silicon Valley, I will now look at the way the venture capital industry operates. Many of the sociological structures put in place in Silicon Valley are also prevalent in the world of VC.

Venture Capital in Silicon Valley

It is important to analyze Saxenian's case study of the sociological structures and culture of Silicon Valley when studying the venture capital community. The ways in which Silicon Valley defined itself — with the Wagon Wheel and job-hopping — strongly influenced venture capital. While venture capital was prevalent in Route 128, the role of the firms was drastically different from the role of VC firms out in Silicon Valley, and it is important to acknowledge these differences.

During the rise of the semiconductor industry, wealthy individuals started investing in early-stage startup companies in Route 128. However, venture capital solely consisted of providing financial support for a startup. Silicon Valley revolutionized venture capital since investors tended to be successful technology entrepreneurs themselves. Not only did venture capital investors provide funding, but they also provided mentorship and introductions to people in their social network to help their portfolio companies grow.

While there are numerous individual actors that make up a complex industrial system, venture capital was a critical catalyst in the creation of Silicon Valley as a high-technology region as it helped develop certain industries, contributing to overall macroeconomic health. Mark Granovetter and Michel Ferrary, a professor at the University of Geneva, published a study on The Role of Venture Capital Firms in Silicon Valley's Complex Innovation Network. In their paper, they introduce the Complex Network Theory (CNT), which stressed inter-firm interactions and social networks within venture capital specifically in Silicon Valley. The main purpose behind CNT is to analyze the variety of interactions among numerous actors in an industrial system (Ferrary and Granovetter 2009, pp. 326). For instance, Frederick Terman, the father of Silicon Valley and a Professor at Stanford University, gave the initial $500 to his students, the co-founders of Hewlett-Packard (Saxenian and Societies 1996, pp. 35). In this case, Stanford University, an actor in the complex network, had ties to students. The students became founders and joined the startup network. Economic and financial ties were formed between these agents, and as Granovetter and Ferrary note, "Innovation and entrepreneurship are understood as resulting from the interactions of numerous economic agents" (2009, pp. 326). The idea behind their paper is that complex industrial systems are made up of nodes and ties — nodes being agents (companies, universities, venture capital firms) and ties being financial and economic linkages. Thus, innovation occurs.

When entrepreneurs are more embedded within social networks and have more ties to economic agents, there is a greater chance they relate to venture investment, which ultimately accelerates regional development, "The more connected an entrepreneur is, the better is his access to financial resources, to advice, to partners, and experts. According to CNT, the quality of interactions between agents determines the success of each agent and finally the achievement of the entire system" (Ferrary and Granovetter 2009, pp. 337). We can see this process if we look at the founding story of HP. The co-founders of HP were embedded in the network of Stanford University, so they were able to access the help of experts and investors, and they built HP in their garage. This ultimately benefited the entire entrepreneurial ecosystem – Silicon Valley. When entrepreneurs have more ties or relationships in the system – including organizations such as the university, venture funds, or corporate organizations – they are more likely to have access to the necessary resources to grow their business.

Venture capital played a uniquely critical role in the development of Silicon Valley as a high-tech region. Many high-tech clusters around the world have large universities, companies, and high-quality research laboratories, but the distinguishing feature of the Bay Area is the significant establishment of VC firms. In the next section, I will delve into the integration of venture capital firms within the overall high-technology cluster in Silicon Valley.

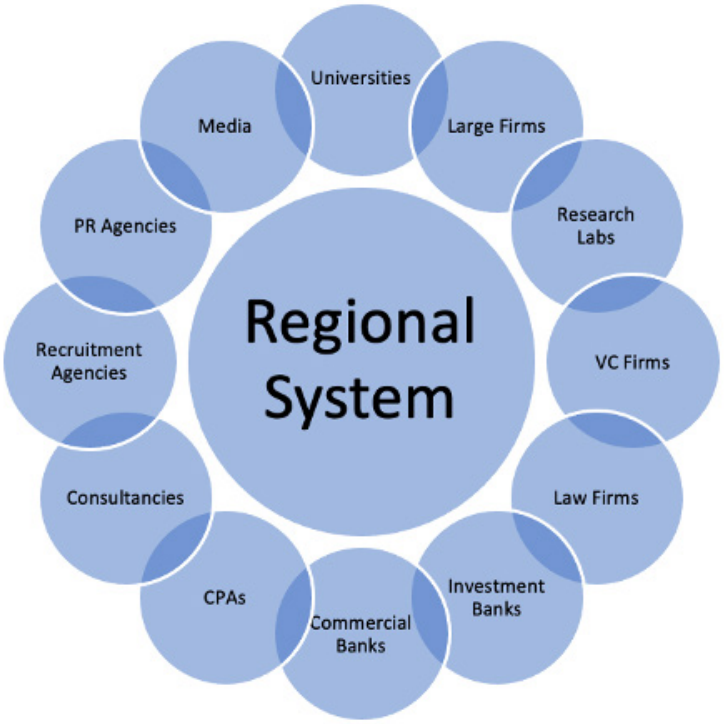

Figure 1: 12 Actors in Regional System (Ferrary and Granovetter)

Venture Capital is an Integrated Agent in Silicon Valley

Ferrary and Granovetter argue that there are twelve key economic agents that play a role in the complex network of Silicon Valley, and that venture capital firms are the element that creates additional linkages and interactions, contributing to innovative dynamics that developed. There are twelve agents that are critical when creating a successful high-tech region and startup ecosystem: universities, large firms, research laboratories, VC firms, law firms, investment banks, commercial banks, certified public accountants (CPA), consulting firms, recruitment agencies, public relation agencies, and media (Ferrary and Granovetter 2009, pp. 335). Each of these agents must interact with each other as they each provide a different function. Going back to Saxenian's iconic example with HP, Professor Terman at Stanford University was the first angel investor of Hewlett-Packard when his two students wanted to create their own venture. The founders of HP also returned this favor and strengthened their relationship with Terman when it came to hiring and recruiting (Saxenian 1996, pp. 24). Terman introduced people who had come to him to the founders of HP, and they ended up getting jobs at the firm. This is just one example of how the different agents are intertwined in the creation of tech regions and the development of successful startups. The role of the venture capitalist is not clearly defined, but VC investors provided guidance and connections for entrepreneurs so that they can grow their businesses. These connections could be a venture lawyer or an investment banker if the startup needs capital. Because of the uniqueness of the role of a venture capitalist, VC firms' roles in the complex network system "enables specific interactions between agents" that contribute to a successful startup ecosystem such as Silicon Valley. Below in Figure 1, is a representation of the twelve economic agents that comprise a regional technology cluster. From this we can visualize the variety and diversity of actors that are involved in the greater regional economy that Saxenian discusses in her examination of Silicon Valley.

When looking at the economic ties among the twelve agents in a high-technology region, the agents with the most ties are the VC firms. There are the most interactions between the VC and the other eleven agents. The reason for this is because of informal functions. While there is one formal function of a venture capitalist, to finance startups, venture firms have infinite informal functions. According to Granovetter and Ferrary, some of these informal functions include selecting or sourcing start-ups, accumulating entrepreneurial knowledge,

embedding start-ups, and networking the cluster.

While it may be difficult to argue that VC firms are the 'glue' that hold the cluster of agents together, VC firms are the agents that ultimately fund start-ups and the additional ten agents:

> *VC firms fund start-ups directly and other agents of an innovative cluster indirectly. A start-up partly uses its funding to pay for the services of law firms, consulting groups, PR agencies, and recruiting agencies. Through the funding of start-ups, VC investments sustain different service providers. Start-ups also use their funding to recruit employees trained in local universities. Thus, indirectly, VC funds the labor market of the cluster. The creation of start-ups is thus a business activity that involves different agents that are indirectly paid by VC money. For this reason, VC investment is more than just the funding of start-ups; it is, more broadly, a source of funding for the entire innovative cluster (Ferrary and Granovetter 2009, pp. 334).*

It is essentially venture capital firms that empower the network, starting with the funding of a startup. An example of this would be when a VC funds a start-up, and then the start-up needs to hire a law firm to patent an idea and needs to hire a consulting firm to get expertise on a product strategy. Technically the VC funds that go to the start-up are funding the operations of the law firm and the consulting agency.

Throughout my research, I focused on the applications of economic sociology, more specifically highlighting networks and social relations, on the emergence of high-technology regions and the role that venture capital plays as an economic actor in Silicon Valley. In the next section, I will elaborate on a few research limitations and future directions that I can take in the next steps of my research.

Limitations and Future Directions

I conducted this research primarily in one semester, and one of my goals was to interview key people in the venture capital industry. However, due to a time constraint and conflicts of interest among firms, I was unable to include my interview findings in this paper. Furthermore, I also wanted to explore the role of universities in startup creation and the development of high-tech clusters. In both Route 128 and Silicon Valley, research universities stimulated top caliber research that led to university spin-offs. In other words, the university acted as an entrepreneurial ecosystem, further promoting the regional economy. This next semester, I will be conducting a case study on Cornell University as an entrepreneurial ecosystem, examining the organizations on campus (accelerators, incubators, student-venture funds, clubs, and research labs) and the relationships among these organizations. By looking at the organizational sociology of Cornell's entrepreneurial ecosystem, we can better understand what it takes to make a university more entrepreneurial, further promoting Ithaca as a tech region.

Conclusion: Importance of Using Sociology to Study High-Technology Regions and VC

At first, one might not see the connection between sociology, high-technology regions, and venture capital. Start-ups, entrepreneurship, and venture capital are all about the network effect and social relations. As Mark Granovetter argued, social relations and networks are critical in economics. Silicon Valley is probably the most successful and fastest-growing tech-region, and this is attributed to the collaborative sociological structures that existed in the first place. From colleagues chatting after work or entrepreneurs discussing their business ideas to investors at the Wagon Wheel, no other tech-region embraced these social norms. In order to recreate the emergence of tech clusters like Silicon Valley, other regions such as Austin, TX and Salt Lake City, UT should also embrace these distinct sociological structures and practice mimeticism of Silicon Valley.

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