Regional Advantage

Culture & Competition in Silicon Valley & Route 128

Annalee Saxenian, Harvard University Press, 1996

Basic differences between Silicon Valley & Route 128

The author argues that Silicon Valley has done well because of a regional network-based industrial system that promotes collective learning and flexible adjustment among specialist producers of various related technologies. The region 's dense social networks and open labor markets have encouraged experimentation and entrepreneurship. Companies compete intensely. But they also learn from one another about changing markets and technologies through informal communication and collaborative practices. Loosely linked team structures encourage horizontal communication across divisions and with outside suppliers and customers.

Silicon Valley 's decentralized system has encouraged the pursuit of multiple technical opportunities through spontaneous regroupings of skill, technology, and capital. Distinctions between large and small firms and between industries or sectors are minimal.

In contrast to Silicon Valley, the Route 128 region has been dominated by a small number of relatively integrated corporations. Its industrial system is based on independent firms that internalize a wide range of productive activities. Practices of secrecy and corporate loyalty govern relations between firms and their customers, suppliers, and competitors. This has promoted a culture that encourages stability and self-reliance. Corporate hierarchies ensure that authority remains centralized and information tends to flow vertically. The boundaries between and within firms and between firms and local institutions are much sharper in this independent firm-based system.

The independent firm-based industrial system flourished in an environment of market stability and slow-changing technologies because its leading producers benefited from the advantages of scale economies and market control. But under more volatile conditions, the system has come under pressure.

Route 128 seemed to have the early mover advantage compared to Silicon Valley. More than two centuries of industrialization laid the foundation for the postwar surge of activity in electronics in the Boston area. The Santa Clara Valley, by contrast, remained an agricultural region as late as the 1940s, famous primarily for its apricot and walnut orchards.

But different strategies were pursued by the two regions, leading to different consequences. Both Stanford and MIT encouraged commercially oriented research and courted federal research contracts in the postwar years. But MIT focused on building relations with government agencies and seeking financial support from established electronics producers. MIT felt that investing in technology start-ups was too risky and not consistent with prudence, discretion, and intelligence. In spite of the university's commitment to commercially relevant research, it kept firms at arm 's length. Whereas, Stanford's leaders, lacking corporate or government ties or even easy proximity to Washington, actively promoted the formation of new technology enterprises and forums for cooperation with local industry. This contrast – between MIT 's orientation toward Washington and large, established producers and Stanford 's emphasis on collaborative relationships among small firms –fundamentally shaped the industrial systems in the two regions.

The evolution of Silicon Valley

Silicon Valley 's origins are typically traced to the founding of the Hewlett-Packard Company (HP) in 1937. HP's fortunes, like those of many of its East Coast counterparts, were shaped by the war. A small cluster of prewar technology firms grew up alongside HP to provide a foundation for the region 's

emerging electronics industry.

Like in case of Boston, the Second World War marked a turning point for the Santa Clara Valley. Large numbers of people were attracted to war-related industries in the San Francisco Bay area. While military demand dramatically improved the fortunes of Northern California firms, the government awarded the majority of the wartime military electronics contracts to large East Coast companies.

In university education also, Silicon Valley was handicapped. Unlike MIT, Stanford had not been significantly involved in any of the exciting engineering and scientific activities associated with the war. Fred Terman, often called the father of Silicon Valley built the electrical engineering program at Stanford into one of the best in the country by recruiting promising engineering faculty and expanding its graduate programs. By 1950, Stanford was awarding as many doctorates in electrical engineering as MIT, despite its much smaller faculty.

Terman encouraged faculty and students to learn more about the region 's business and the opportunities there. Three initiatives helped Stanford to work closely with industry. First, Stanford established the Stanford Research Institute (SRI) to conduct defense-related research and to assist West Cost business. Second, Stanford opened its classrooms to local companies through the Honors Cooperative Program. Third, Terman promoted the development of the Stanford Industrial Park, one of the first such parks in the country. These innovations introduced in the 1950s, went a long way in promoting industry – university linkages.

A combination of university research, military spending, and entrepreneurial risk-talking gave momentum to the process of industrial development in the valley. By 1975 the region 's technology enterprises employed well over 100,000 workers. The Valley 's agglomeration of engineers, electronics firms, specialist consultants, venture capitalists, and supplier infrastructure was paralleled only by that of its East Coast counterpart. While Route 128 specialized in minicomputers, Silicon Valley excelled in commercial semiconductors.

The absence of any pedigree and its distance from established economic and political institutions facilitated experimentation with novel and productive relationships. Terman promoted more open and reciprocal ties between Stanford and local industry than existed in the Route 128 region.

Firms were organized as loosely linked confederations of engineering teams. Without intending to do so, Silicon Valley 's engineers and entrepreneurs created a more flexible industrial system, one organized around the region and its professional and technical networks rather than around the individual firm. Many Silicon Valley entrepreneurs became millionaires. And some did flaunt their wealth. But they were often motivated less by money and more by the challenge of independently pursuing a new technological opportunity. Status was defined less by economic success and more by technological achievement.

In the valley, the venture capitalists were not finance professionals. They were entrepreneurs who created and built a company and then sold out. When problems occurred with any of their investments, they would step into the business and help out. Geographic proximity helped build and sustain these relationships.

Industrial fragmentation contributed to the flexibility and resilience of the industrial fabric. Competitive rivalries encouraged technological advance among local producers, but it was not a no-hold-barred battle. The Valley's business culture encouraged intense involvement and enthusiasm among the workforce. The system rewarded performance rather than seniority. It ensured the diffusion of understanding the knowledge of both the firm and the industry among all levels of the workforce, from lowest technicians to senior engineers.

The development of Route 128

Entrepreneurs along Boston 's Route 128 inherited and reproduced an industrial order based on independent firms. Secrecy and territoriality guided relations between individuals and firms. Traditional hierarchies prevailed within firms. Relations with local institutions were distant – even

antagonistic. As they grew, Route 128 companies built self-contained and vertically integrated structures. This created a regional economy consisting of a collection of autonomous enterprises, lacking social or commercial interdependencies.

Engineers generally went home after work rather than getting together to gossip or discuss their views of markets or technologies. The social gathering places that were common in Silicon Valley were rare on Route 128.

Stability and company loyalty were valued over experimentation and risk-taking in the Route 128 region. Interfirm mobility became a way of life in Silicon Valley during the 1960s and 1970s. But Route 128 executives considered job-hopping unacceptable and emphasized loyalty to the employer.

Risk-avoidance became self-reinforcing along Route 128. There were only a few role models like Ken Olsen and An Wang to inspire potential entrepreneurs. And they were often secretive and private individuals. Route 128 entrepreneurs tended to remain with the firms they started. They did not move on to start new ventures, as in Silicon Valley.

The Route 128 venture capital industry was managed by finance professionals rather than entrepreneurs. The VCs did not have the operating experience in the technology industry that would enable them to assist a business that ran into problems.

Employees in Route 128 firms typically worked their way up the corporate hierarchy and retired with a comfortable pension. The typical corporation in the region also had significant status differences. Formal lines of authority and procedures as well as salaries and benefits created barriers between functions and corporate ranks.

Crisis and recovery in the valley

Both Silicon Valley and Route 128 firms, after the boom of the late 1970s and early 1980s fell into a crises during the mid-1980s. Semiconductor industry leaders in the valley felt that the challenge was no longer to advance technology but mass manufacture standard devices. For the valley companies, used to a decentralized, network-based system, the shift to high-volume semi conductor production marked an important discontinuity. In their rush to achieve manufacturing scale efficiencies, they abandoned the social structure and institutions they had pioneered and began to attach greater importance to learning curves and economies of scale.

Silicon Valley ’s semiconductor firms transformed themselves to embrace the new mass manufacturing paradigm. But they did not recognize the impact of their break with the past. They saw the shift to mass production as a natural and inevitable stage in their industry ’s maturation. They brushed aside the open exchange and informal collaboration that had allowed them to design new products and develop innovative applications in an earlier era. They frequently abandoned the local culture and relationships that had been the source of their earlier dynamism. They distanced themselves from customers and antagonized equipment suppliers. Functional management hierarchies evolved. The production process became separated from R&D.

Faced with rapidly falling prices, valley companies attempted to shift the burden of increasingly severe business cycles onto their equipment suppliers, which tended to be small, undercapitalized firms by ordering heavily during boom times and canceling orders abruptly during downturns. They pitted key vendors against one another for price reductions in order to minimize costs. They were unwilling to fund the development of new equipment, seeking rather to buy the lowest-cost equipment. The semiconductor makers also refused to share proprietary product or process information with their vendors out of concern for the security of technical information in an increasingly competitive business.

The Valley semiconductor firms saw little need for the ongoing interaction with customers that had characterized custom production. They became preoccupied with rewriting the specs for a successive generation of high-volume products, and gained a reputation for their arrogant “take it or leave it” attitudes.

The leading Silicon Valley firms like National, Intel, and AMD built bureaucratic organizations that centralized authority and undermined the autonomy of formerly independent business units. In the process, they sacrificed organizational flexibility.

Though Silicon Valley ran into a crisis following the collapse of the semiconductor memory business, it recovered smartly. A wave of start-ups and the restructuring of several large firms fueled industrial diversification and renewed regional growth.

While Silicon Valley was no longer the tightly knit community of technological pioneers of earlier decades, the culture of relative openness, the fast pace of business activity, and the cooperative practices that distinguished the region remained intact. There were many failures in Silicon Valley in the 1980s. But valley entrepreneurs viewed failure as an opportunity for learning.

The formation of new businesses enabled many more technical paths to be pursued in Silicon Valley than would have been possible in either a traditional large firm or a region with less fluid social and industrial structures. The Valley entrepreneurs of the 1980s, like those of earlier decades, were typically engineers who had not been allowed to pursue new ideas within the region 's established companies.

The decline of Route 128

Meanwhile, the decline of Route 128 continued. Route 128 's independent firm based system which had provided economic scale and organizational stability in an earlier era, became a liability by the 1980s. Due to vertical integration, technical capabilities and know-how in the region remained locked up within large firms. The paucity of horizontal communications stifled opportunities for experimentation and learning. Traditional corporate structures limited the development of managerial initiative and skill. While Route 128 's skill base and supplier infrastructure were ahead of most other regions, by the mid-1980s they were neither as technologically sophisticated nor as diversified as is the Valley. The decline of Route 128 accelerated as many of its most experienced and ambitious engineers decided to move to the Valley sensing more opportunities there.

The Valley's resurgence

The Valley's new start-ups explicitly rejected the corporate models of their predecessors. They pioneered not only products but also corporate strategies and structures, revitalizing the traditions of innovation and responsiveness that had characterized the Valley in its early decades. They quickly realised that they were no match for low-margin Japanese commodity producers. So, they decided to concentrate on design-intensive, high value-added specialty and semi-custom semiconductors. They introduced specialized, design-intensive devices that allowed them to define new markets and avoid the price wars common in commodity markets. Their flexible and decentralized organizations allowed them to respond rapidly to market changes. They produced small quantities of complex, high-value-added components. Instead of attempting to achieve scale economies, these chipmakers introduced a continuing stream of differentiated products.

The semiconductor start-ups in the valley also increased their flexibility by unbundling semiconductor production. Whereas established firms had designed, manufactured, and assembled integrated circuits in-house, the new firms typically focused on either chip design, manufacturing or marketing. Reliance on external manufacturers allowed small semiconductor makers to avoid the cost and risk of a fabrication facility and to use multiple foundries to optimize their designs.

Strategies pursued in Silicon Valley turned out to be highly effective. They restored the vibrancies of the past. Commodity chips generated 80 percent of worldwide semiconductor industry revenues in 1983, but by 1990 their share had fallen to 33 percent.

The Valley also outgrew its origins as a center of semiconductor production during the 1980s to become a complex of computer-related specialists. The new semiconductor firms allied themselves with computer start-ups in order both to influence and to respond to changing systems requirements.

The computer companies in turn incorporated specialty or semi-custom chips in smaller, more differentiated systems.

The new generation of computer start-ups that emerged in the Valley during the 1980s adopted strategies similar to those of their semiconductor counterparts. Firms such as Sun Microsystems, Silicon Graphics, MIPS Computer Systems, MasPar, and Pyramid Technology created new markets and developed differentiated services and applications. They did not just concentrate on lowering manufacturing costs on standardized systems.

By the end of the 1980s, the Valley was the home of increasingly diversified networks of specialized equipment, component, subsystem, and software producers, including firms that specialized in disk drives (such as Conner peripherals, Maxtor, and Quantum), networking and communications products (such as 3Com, Excelan, Cisco, and Bridge Communications), computer-aided design and engineering systems (Daisy Systems, Cadence Design, and Valid Logic Systems), and color displays (SuperMac, Radius, and RasterOps). During the 1980s a new crop of manufacturers of semiconductor equipment and materials (such as Novellus Systems, Lam Research, and Genus), makers of disk drive equipment and components (such as Read-Rite, Komag, and Helios), and providers of contract manufacturing services (such as Solectron, Flextronics, and Logistix) emerged in the Valley.

While the Valley's entrepreneurs rejected the experience of their crisis-ridden predecessors, Route 128 entrepreneurs tended to model their companies after the region's large minicomputer firms. Many of these new firms created inward-looking organizations that were as out of touch with customers and market trends as those of their predecessors. As a result, the decline of Route 128 could not be reversed.

During the 1980s, the Valley transformed itself. The categories by which businesses traditionally defined themselves became irrelevant. Intense competitors became partners, sectoral lines merged and faded as technology advanced. The distinctions between large and small firms all but collapsed.

Companies like Sun Microsystems and Silicon Graphics responded to rising development costs, shrinking product cycles, and rapid technological change by building production networks from the bottom up. By focusing on their core competencies and purchasing the remainder from specialist suppliers, they created a network system that spread the cost of developing new technologies, reduced product-development times, and fostered reciprocal innovation.

The Valley's computer firms redefined relations with their most important suppliers during the 1980s. They began treating them as partners in a joint process of designing, developing, and manufacturing innovative systems. Loyalty grew out of a reciprocal decision to honor unwritten obligations as well as contracts and not to take advantage of one another when market conditions changed. Suppliers became involved in the design and development of new systems and components at a very early stage, and they often became integrated into the customer's organization in the process.

The Valley-based computer makers often preferred local suppliers, particularly for technologically complex or customized parts. This desire for geographic proximity was not reducible to cost considerations. Most saw the advantages of timely delivery but also recognized that it was difficult to create over long distances the trust and teamwork needed for collaborative supplier relations. As a result, the Valley's cluster strengthened further.

In the early 1990s, the region's computer firms collaborated with media and publishing companies and consumer electronics firms to create innovative multimedia and interactive entertainment and education products. They built on telecommunications technologies to introduce new generations of video conferencing, electronic mail, and handheld communications devices. The boundaries of the computer industry thus continued to dissolve as local producers continued to define new products, markets, and industries.

Concluding Notes

The author concludes that industrial systems built on regional networks are more flexible and

technologically more vibrant than those in which experimentation and learning are confined to individual firms.

Local factors continue to be important even in a globalising economy. Geographic proximity promotes the repeated interaction and mutual trust needed to sustain collaboration and to speed the continual recombination of technology and skill. When production is embedded in these regional social structures and institutions, firms compete by translating local knowledge and relationships into innovative products and services. Industrial specialization becomes a source of flexibility rather than of atomism and fragmentation.

The historical evolution of a cluster is significant. Route 128 's technology firms inherited a business model and a social and institutional setting from an earlier industrial era. When technology remained relatively stable over time, vertical integration and corporate centralization offered needed scale economies and market control. But when technologies and markets become more volatile, the horizontal coordination provided by interfirm networks became more important. They enable firms to retain the focus and flexibility needed for continuous innovation.

The semiconductor crisis of the mid-1980s in the valley underscores potential weaknesses of its decentralized system. Network systems, like all forms of productive organization, are fragile constructs that must be continually renewed and redefined to meet new economic challenges.

The author emphasizes that regional policy is likely to be as important as macroeconomic or sectoral polices to ensuring industrial competitiveness in the 1990s. Regional policymakers have to create institutions that promote a decentralized process of industrial self-organization without sacrificing individual autonomy and flexibility. Regional policy must be designed to catalyze and coordinate rather than directly manage relations among the myriad public and private actors that populate a regional economy.

Industrial fragmentation, the source of flexibility in network systems, is also the source of its greatest vulnerability. The dynamism of an industrial system based on regional networks depends crucially on institutions that transcend the interests of individual firms, industries, and political jurisdictions. It allows companies to respond jointly to shared challenges.

The decentralized industrial structure and strong territorial linkages of regional network-based system demand collective action at two levels. First, the specialist producers in network system must depend on the external provision of a wide range of collective services that spread risk and pool technological expertise. Second, institutions that provide capital, research, managerial and technical education, training, assistance to entrepreneurs and market information must be set up.