REGIONAL

CULTURE AND
COMPETITION IN
SILICON VALLEY
AND ROUTE 128

ADVANTAGE

ANNALEE SAXENIAN

WITH A NEW PREFACE BY THE AUTHOR

REGIONAL ADVANTAGE

CULTURE AND COMPETITION IN SILICON VALLEY AND ROUTE 128

AnnaLee Saxenian

To Jamie, who set the deadline

And to Marty, who helped me meet it

Regional Advantage

PREFACE TO THE PAPERBACK EDITION

▶ In early 1995, a journalist from Boston suggested that *Regional Advantage* was already outdated. He claimed that the book offered an accurate, if painful, portrayal of the experience of the Route 128 economy through the 1980s—but that the situation had fundamentally changed since 1990. He pointed to several recent software and networking start-ups, the formation of new business associations, and the restructuring of large firms like the Digital Equipment Corporation (DEC) as evidence of a turnaround of the regional economy.

This view, common in the Boston area today, poses a deeper challenge to the argument advanced in this book than may be evident at first glance. If the Route 128 technology industry has rebounded, then either the original claims of the book were wrong or the region's culture and institutions have been transformed. The former, of course, is more likely. After all, *Regional Advantage* concludes that nothing less than an opening of the boundaries among technology businesses and between these firms and surrounding financial, educational, and public sector institutions will enable the region to compete effectively with Silicon Valley. It is difficult to imagine a business community overcoming in such a brief time the culture and practices of secrecy, self-sufficiency, and risk-aversion consistently displayed by firms and other institutions in Route 128. Indeed the mechanisms of social and institutional change would need to be far more flexible than I have argued for such a change to occur.

The available data, however, do not support the notion of a regional turnaround. In fact, in the period from 1990 to 1992 (the most recent data available at this writing), Route 128 lost some 9,375 jobs in technology sectors ranging from computers and communications equipment to electronic components, aerospace, and instruments, and added only 1,048 new jobs in software (see Historical Data).

Even if the data do not indicate a recovery, is there other evidence that the Route 128 region is reinventing itself? Layoffs at the minicomputer firms have spawned a new generation of companies, many of which are rejecting the management models of their predecessors. Chipcom Corporation, a manufacturer of networking hardware, for example, was started in 1983 by veterans of Data General and DEC. While capitalizing on local expertise in computer networking, Chipcom's founders assiduously avoided vertical integration and maintained open corporate boundaries. Yet as with the region's other start-ups, the question remains whether even enlightened firms like Chipcom can compete without the advantages of a supportive regional environment, particularly when their competitors draw on an industrial infrastructure and culture that both demands and facilitates rapid change, openness, and learning.

Several other computer networking firms were started in the Route 128 region during the 1980s. By the early 1990s, however, the dominant players in the business—Cisco, 3Com, and Bay Networks—were based in Silicon Valley. And in 1995, Chipcom was acquired by 3Com. The merged company is now the second largest player in a $10 billion market that is growing more than 30 percent annually. Once again in the computer networking sector, as with semiconductors in the 1960s and microprocessor-based computers in the 1980s, the center of gravity in a dynamic new sector has shifted decisively to the west.

Chipcom is not an isolated example. Firms that were hailed as the upcoming stars of Route 128, from Powersoft to Wellfleet, have been acquired by or merged with Silicon Valley companies; others like Thinking Machines and Kendall Square Research have gone out of business. Even Lotus Development, the region's only nationally recognized software company, was acquired by IBM. These acquisitions of east coast companies by Silicon Valley competitors further slow cultural change in Route 128. When east coast companies are acquired the center of gravity for management invariably shifts to the west, diminishing the local supply of managers. Today there are very few people in the Boston area who are experienced in running big healthy technology companies.

Nor is this trend likely to change. Today Silicon Valley boasts far more start-ups in key areas like networking, wireless communications, multimedia, and internet applications. As in the 1980s, more than three times as many venture capital dollars are being invested in Silicon Valley technology start-ups than in New England ventures. Moreover,

the conservatism of the east coast venture capital community makes it very difficult for companies that boldly define new markets to gain funding: entrepreneurs with good ideas on Route 128 are either forced to scale down their vision quickly or hook up with venture capital from the west and are convinced to move to the Valley. This helps explain why, aside from Lotus, it is difficult to name a nationally successful Route 128 software company, while Silicon Valley has produced market leaders like Netscape, Oracle, Intuit, and Adobe.

The formation of the Massachusetts Software Council and the Massachusetts Telecommunications Council are positive signs of change in the region. These groups have rejected the oppositional politics of the Massachusetts High Technology Council and instead provide support services and networking opportunities for local firms. Most significantly, they have distanced themselves from the short-sighted tax cutting agenda that has impoverished the region's public institutions. The question remains whether these new associations and others will be able to create a broader culture of collaboration in the region.

It is perhaps telling that while *Regional Advantage* has provoked significant interest among regional policy-makers and business executives from Oregon to New Mexico, the response of the Route 128 community to the book has been largely indifferent, if not hostile. In part, this reflects the insularity of an old-line industrial community—the very problem the book describes. But it exposes a deeper problem as well: the absence of opportunities in the region for collective discussions. In Silicon Valley a myriad of forums bring together individuals from different firms and industries, from public and private sectors, and from financial, educational, and training institutions. These gatherings, both formal and informal, enable individuals—often determined competitors—to discuss common problems, debate solutions, and define the shared identities that enable an industrial community to transcend the interests of independent firms. Only such an industrial community can create and recreate regional advantage in today's competitive global economy.

The Japanese response to *Regional Advantage* remains most striking. Although the book barely mentions Japan, it has generated remarkable and sustained attention from Japanese policy leaders and industry executives—a group that has repeatedly demonstrated its ability to learn quickly from foreign industrial experience.

The greatest long-term threats to the Silicon Valley economy are not simply from Japan (and the rest of Asia), however. Closer to home, continued reductions in public funding for California's educational institutions—from its elementary and secondary schools to the sophisticated network of community colleges, state universities, and the University of California system—jeopardize the rich supply of technical talent and the research base that have historically supported the regional economy.

Nonetheless, Silicon Valley continues to flourish in the 1990s. By 1994, twenty of the region's technology companies boasted more than $1 billion in sales (compared to only five in the Route 128 region) and collectively Silicon Valley technology firms surpassed $106 billion in sales. These firms are expanding their ties with the Pacific Rim—exploiting their access to its booming markets and a highly skilled Asian workforce. Moreover, the three-year-old Joint Venture: Silicon Valley Network has engaged literally hundreds of policy-makers, entrepreneurs, executives, consultants, and educators in ongoing efforts to enhance the region's collaborative advantage.

In short, important organizational and cultural differences continue to define the divergent fortunes of the Silicon Valley and Route 128 economies. This does not mean that change is not possible. Cultures and institutions are not static, they are continually created and recreated through conflict and struggle as well as routines, habits, and practices. As a native of the Boston area, I may wish that the Route 128 region turns itself around quickly; as a scholar, I know that it is likely to take decades to overcome the management practices, culture, and institutions that have hindered the region in the past.

San Francisco
August 1995

▶ Jeffrey Kalb resigned from the Digital Equipment Corporation in the spring of 1987. Kalb was one of the minicomputer giant's rising stars, and his departure was yet another blow to a company that had recently lost dozens of talented executives. Frustrated and burned out, Kalb returned to his native California, joining the exodus of engineers from the technology region around Route 128 in Massachusetts to its West Coast counterpart, Silicon Valley.

Kalb's move reflected more than a desire for a sunny climate. By the late 1980s the locus of technological innovation in computing had shifted decisively to the West. Experienced engineers moved to Northern California to join a new generation of companies or, like Kalb, to try their hand at entrepreneurship.

Kalb founded the MasPar Computer Corporation in early 1988. MasPar was typical of a wave of specialized start-ups that were fueling an economic boom in Silicon Valley. The firm concentrated on massively parallel computing, an architecture that increased the speed and power of computer systems by having tens of thousands of processors work in parallel, rather than sequentially, to process information.

In an interview in 1991, Kalb looked back on his decision to start MasPar in Silicon Valley:

> There's a fundamental difference in the structure of the industry between Route 128 and here. Route 128 is organized into large companies that do their own thing. At Digital, we had our own capabilities for everything, not just little things, but boards, chips, monitors, disk drives, everything. It's very difficult for a small company to survive in that environment, where you can't get components easily. It's not any one individual thing. It's the amount of energy it takes to get everything . . .

There are a large number of experienced people here who have retired but are still active in the industry and are available as consultants, members of boards of directors, or venture capitalists. There is a huge supply of contract labor—far more than on Route 128. If you want to design your own chips, there are a whole lot of people around who just do contract chip layout and design. You want mechanical design? It's here too. There's just about anything you want in this infrastructure. That's why I say it's not just one thing. It's labor, it's materials, it's access to shops, and it's time.

You can get access to these things back there sooner or later, but when you're in a start-up mode, time is everything. Time-to-market is right behind cash in your priorities as a start-up. When things are right down the street, decisions get made quickly. It's not one thing, but if you spend lots of time on airplanes and on the phone, playing phone tag, you can get an overall 20–30 percent slowdown in time-to-market . . .

The Valley is very fast-moving and start-ups have to move fast. The whole culture of the Valley is one of change. We laugh about how often people change jobs. The joke is that you can change jobs and not change parking lots. There's a culture associated with that which says that moving is okay, that rapid change is the norm, that it's not considered negative on your resume . . . So you have this culture of rapid decisions, rapid movement, rapid changes, which is exactly the environment that you find yourself in as a start-up.

In the early days of the semiconductor industry there were certain places that everybody frequented and the standing joke was that if you couldn't figure out your process problems, go down to the Wagon Wheel and ask somebody. Well there's still a lot to that. We talk about the information sharing in Japan, with these major programs that cause information to be shared. There's a velocity of information here in the Valley that is very high, not as high as it used to be, but I can assure you that it is much higher than it is in most other areas of the country. This means that relationships are easier to develop here than in the East. Unless you've actually worked in it, you don't really recognize how very different the Silicon Valley infrastructure is.
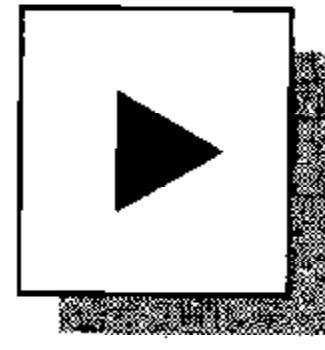
SAN
FRANCISCO

● Berkeley

● Oakland

ALAMEDA

● Fremont

● Palo Alto

Mountain ● Sunnyvale
View ●
● Santa Clara
Cupertino ● ● San Jose

SANTA
CLARA

SAN
MATEO

SANTA
CRUZ

Scotts Valley ●

Santa ●
Cruz

Silicon Valley and Environs

Route 128 and Environs

Contents

Introduction:
Local Industrial Systems

▶ During the 1970s Northern California's Silicon Valley and Boston's Route 128 attracted international acclaim as the world's leading centers of innovation in electronics. Both were celebrated for their technological vitality, entrepreneurship, and extraordinary economic growth. With common origins in university-based research and postwar military spending, the two were often compared. They were also widely imitated. As traditional manufacturing sectors and regions fell into crisis, policymakers and planners around the world looked to these fast-growing regions and their "sunrise" industries as models of industrial revitalization and sought to replicate their success by building science parks, funding new enterprises, and promoting links between industry and universities.

This enchantment waned during the early 1980s, when the leading producers in both regions experienced crises of their own. Silicon Valley chipmakers relinquished the market for semiconductor memory to Japanese competitors, while Route 128 minicomputer companies watched their customers shift to workstations and personal computers. Both regions faced the worst downturns in their histories, and analysts predicted that they would follow the path of Detroit and Pittsburgh to long-term decline. It appeared that America's high technology industry, once seen as invulnerable, might not survive the challenge of intensified international competition.

The performance of these two regional economies diverged, however, in the 1980s. In Silicon Valley, a new generation of semiconductor and computer start-ups emerged alongside established companies. The dramatic success of start-ups such as Sun Microsystems, Conner Peripherals, and Cypress Semiconductor, and the continued dynamism of large companies such as Hewlett-Packard and Intel, were evidence that Silicon Valley had regained its former vitality. Route 128, in contrast,

showed few signs of reversing a decline that had begun in the early 1980s. The once-hailed "Massachusetts Miracle" ended abruptly, and start-ups failed to compensate for continuing layoffs at the region's established minicomputer companies, Digital Equipment Corporation, Data General, Prime, and Wang. By the end of the 1980s, Route 128 producers had ceded their longstanding dominance in computer production to Silicon Valley.

Silicon Valley is now home to one-third of the 100 largest technology companies created in the United States since 1965. The market value of these firms increased by $25 billion between 1986 and 1990, dwarfing the $1 billion increase of their Route 128–based counterparts.[1] Although the two regions employed workforces of roughly the same size in 1975, between 1975 and 1990 Silicon Valley firms generated some 150,000 net new technology-related jobs—triple the number created on Route 128 (see Figure 1). In 1990 Silicon Valley–based producers exported electronics products worth more than $11 billion, almost one-third of the nation's total, compared to Route 128's $4.6 billion.[2] Finally, Silicon Valley was the home of 39 of the nation's 100 fastest-growing electronics corporations, while Route 128 claimed only 4. By 1990 both Southern California and Texas had surpassed Route 128 as locations of fast-growing electronics companies.[3]

Why has Silicon Valley adapted successfully to changing patterns of international competition while Route 128 appears to be losing its competitive edge? Despite similar origins and technologies, these two regions evolved fundamentally distinct industrial systems after World War II. Their different responses to the crises of the 1980s revealed differences in productive organization whose significance had been unrecognized during the rapid growth of earlier decades—or had been seen simply as superficial disparities between "laid back" California and the more "buttoned up" East Coast. Far from superficial, these differences illustrate the importance of the local determinants of industrial adaptation.

Silicon Valley has a regional network–based industrial system that promotes collective learning and flexible adjustment among specialist producers of a complex of related technologies. The region's dense social networks and open labor markets encourage experimentation and entrepreneurship. Companies compete intensely while at the same time learning from one another about changing markets and technolo-
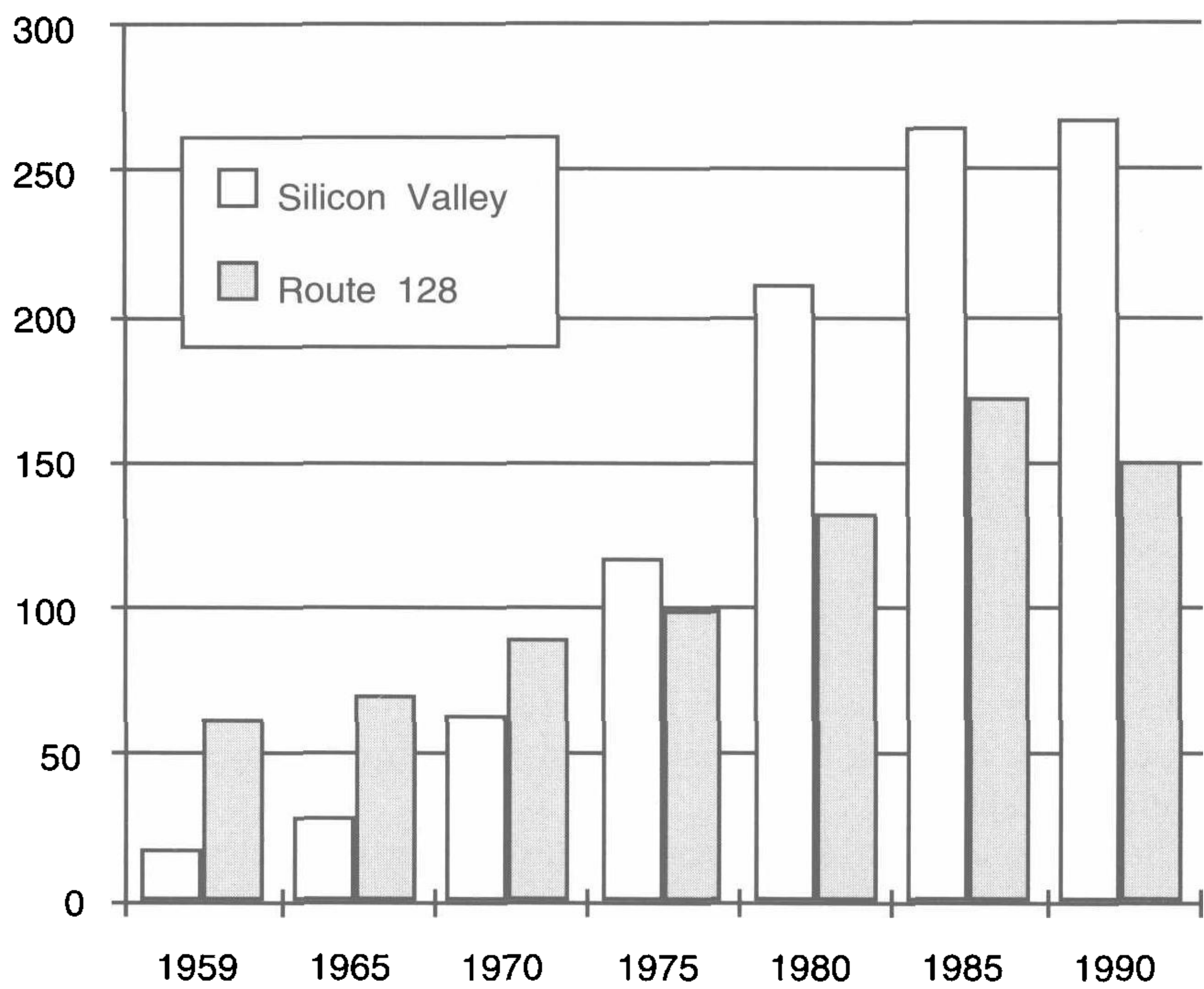
Figure 1. Total high technology employment, Silicon Valley and Route 128, 1959–1990. Data from *County Business Patterns.*

gies through informal communication and collaborative practices; and loosely linked team structures encourage horizontal communication among firm divisions and with outside suppliers and customers. The functional boundaries within firms are porous in a network system, as are the boundaries between firms themselves and between firms and local institutions such as trade associations and universities.

The Route 128 region, in contrast, is 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, reinforcing a regional 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 thus remain far more distinct in this independent firm–based system.

NETWORKS VERSUS INDEPENDENT FIRMS

The Silicon Valley and Route 128 economies are not isolated examples of the two types of industrial systems. Independent firm–based systems dominate the industrial geography of the United States and large parts of Europe. They are typically associated with capital-intensive industries such as oil, rubber, machinery, and automobiles, and they have been analyzed by students of the large-scale corporation. These analyses have little to say about the organization of regional economies, however, primarily because the traditional vertically integrated corporation tends to internalize most local supplies of skill, technology, and other resources. As a result, even when regional theorists examine large corporations, few link the social, institutional, and technical fabrics of different localities.[4]

There is, in contrast, a growing literature on the dynamics of regional network–based industrial systems, which have been identified in many parts of the world and in many historical periods.[5] In these systems, which are organized around horizontal networks of firms, producers deepen their own capabilities by specializing, while engaging in close, but not exclusive, relations with other specialists.[6] Network systems flourish in regional agglomerations where repeated interaction builds shared identities and mutual trust while at the same time intensifying competitive rivalries.

The most studied contemporary examples of regional network–based systems, the small-firm industrial districts of the Third Italy, specialize in traditional industries such as shoes, textiles, leather goods, furniture, and ceramic tiles. Germany's Baden-Württemberg is known for its mix of small and medium-sized makers of machine tools, textile equipment, and automobile components alongside giant electronics corporations. Similar flexible industrial clusters have been identified in Denmark, Sweden, Spain, and Los Angeles.[7] While each of these variants of network systems reflects distinctive national and regional institutions and histories, their localized social and productive interdependencies are comparable to those in Silicon Valley.

The successes of Japanese industry are similarly attributable, at least in part, to network organizational forms. The Japanese corporation is