
*Comment on Kenney and von Burg,
'Technology, Entrepreneurship and Path
Dependence: Industrial Clustering in
Silicon Valley and Route 128'*

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Martin Kenney and Urs von Burg advance two claims in this paper. They assert first that the divergent performance of the Silicon Valley and Route 128 economies can be explained by the path-dependent technological trajectories of their leading industries rather than by the organization of their industrial systems. Second, they claim that these regional dynamics are best understood through an analytical separation between established firms and the environment supporting new firm formation. Both arguments are deeply flawed. Moreover, while the authors belatedly recognize the dynamism of the Silicon Valley and Route 128 economies (Florida and Kenney, 1990) they retain a weakness for inappropriate ecological metaphors. They still think firms are like seeds and trees (Saxenian, 1991).

1. *Technological Trajectories and Regional Divergence*

That Silicon Valley produces semiconductors while Route 128 historically specialized in minicomputers is, for Kenney and von Burg, a sufficient explanation of Silicon Valley's greater dynamism. They assert that each region's initial specialization defined a distinctive technological trajectory and created a 'path-dependent logic' of divergent development. Invoking 'accidents of history', they suggest that once William Shockley (co-inventor of the transistor) moved to Palo Alto, Silicon Valley's superior performance was assured. In this case the outcome is due not to the economics of increasing

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returns to scale, as Brian Arthur (1994) suggests, but to the region's early and fortuitous entry onto a more prolific technological pathway.¹

This argument is *post hoc* and reductionist. Kenney and von Burg fail to specify the mechanism by which technological trajectories are established and reproduced, or by which entire regional economies might become victims (or beneficiaries) of path dependency. Instead they recount familiar regional histories, refer to the benefits of proximity to semiconductor manufactures, and summon a series of genealogies of firm start-ups in different sectors. But the genealogies are simply descriptive, and often selective, mappings of firm start-ups that offer no explanation of the causal mechanisms at work in the two regions. Path dependency without a mechanism is nothing more than a recognition that history matters.

For evolutionary economists, technological trajectories and path dependency result from the way tacit knowledge is selectively organized in the routines and operating procedures of firms and other institutions (Nelson, 1982; Dosi, 1988) Kenney and von Burg make no such case. They imply, incorrectly, that Silicon Valley monopolized critical semiconductor know-how for more than three decades. This allows them to avoid asking why the sophisticated silicon capabilities that existed in Route 128—both in independent semiconductor manufacturers like Analog Devices and in the divisions of firms like Digital Equipment Corporation (which developed the state-of-the-art Alpha chip)—were not more widely exploited within the region. But this would force them to acknowledge deeper differences in the organization of firms and institutions that limited opportunities for information transfer, experimentation and learning in the region.

In *Regional Advantage* (Saxenian, 1994) I present evidence that a more open and decentralized industrial system advantaged Silicon Valley's entrepreneurs in emerging sectors, despite comparable technological capabilities. This occurred in the 1950s when Route 128-based Transitron and other early Bell Labs spin-offs lost their lead to more innovative semiconductor start-ups like Fairchild. It occurred again in the 1980s, when the workstation maker Apollo Computer was displaced by more flexible and specialized Silicon Valley firms like Sun Microsystems, in spite of its two-year lead in the market.

Since the book was published, this pattern has repeated itself in the networking sector.² Route 128 boasted many networking start-ups, including Artel, Bytek, Xyplex, Prominent, Proteon, Cascade, Chipcom, Wellfleet,

¹ Their Figure 1 simply states the obvious, that the semiconductor has manifold applications while the minicomputer has few. By Kenney and von Burg's logic, Silicon Valley should have been the advantaged location for minicomputers as well since they lie downstream of semiconductors and microprocessors.

² Thanks to Roy Moffa, co-founder and former Vice-President of Operations at Chipcom Corporation for information on the networking sector. Private correspondence dated September 9, 1998.

Banyan and Cabletron. These firms had state-of-the-art software technology, they had the hardware skills, and, in some cases, they had superior market penetration. Yet by the mid-1990s, networking was dominated by Silicon Valley-based producers Cisco, 3Com and Ascend. For Kenney and von Burg, this was victory was due to 'early entry onto the correct technological path', which unleashed a 'powerful virtuous circle of growth and advantage reinforcement in Silicon Valley'. They go on to claim that 'when the [Route 128] minicomputer industry collapsed it was the other capabilities, such as networking and system integration expertise, semiconductor design, and hard disk drive capabilities that were their most valuable assets'. How could a region's key technological capabilities be both its most valuable assets and yet be the explanation for its failure to enter the 'correct' trajectory? After all, who knows, *a priori*, what the 'correct' path is?

Rather than advancing *post-hoc* arguments about path dependency, Kenney and von Burg might look more closely at the organization of the East Coast firms and their relationships to the regional economy. The real question is why companies like Cabletron and Chipcom were repeatedly 'late to market'. For Cabletron, which dominated the router and switched network market for years, this tardiness most likely had to do with its extreme commitment to corporate self-sufficiency and secrecy: the vertical integration of manufacturing, the unwillingness to partner or even cooperate with others, and the geographic isolation in Rochester, New Hampshire. As with its corporate predecessor, DEC, this autarkic structure greatly limited its ability to monitor and respond to fast-changing technologies and markets. Even Chipcom, which self-consciously created a more open and networked organization, missed a major technological shift to switched networks and was unable to match the pace of risk taking and the marketing capabilities of its Silicon Valley-based competitors.

Kenney and von Burg state in their conclusion that 'there were simply more seeds, more opportunities and more successes in Silicon Valley'. *Yet this is precisely the phenomenon that needs to be explained*—and unsupported references to technological trajectories or path dependency are simply inadequate. After all, it would be nonsensical to argue that the industries that dominate Silicon Valley today, and in which it, once again, has a significant competitive advantage, such as software, biotech and Internet applications, are part of the same technological paradigm as semiconductors.

2. *Reinventing Dualism: Economy 1 and Economy 2*

Kenney and von Burg reject the claim that Silicon Valley's superior dynamism

is based on the organization of its firms or their relationships to one another or local institutions. However, they do offer their own model for understanding regional economies. In an updated variant of dualist thinking, they divide the economy into two sectors: large, established firms (Economy 1), and entrepreneurs and small firms (Economy 2.) Each segment is associated with a set of institutions: the former with universities and corporate research labs, the latter with venture capital and other business services that support start-ups. While Kenney and von Burg have abandoned earlier characterizations of the small firm sector as backwards, they maintain the misleading assumption the two sectors are conceptually distinct and analytically separable.

This distinction would bewilder anyone who has worked in Silicon Valley. Firms like Netscape and Yahoo! are only the most recent examples of the rapid pace at which the region's start-ups become 'established' firms and blur the boundary between new and old. Large firms like Sun and Hewlett Packard have meanwhile decentralized such that some of their specialist divisions are hard to distinguish from start-ups. The labor markets and social structures of these two sectors are completely interpenetrated as well. Individuals in Silicon Valley regularly leave jobs at established firms to join start-ups, and vice versa, all the while maintaining networks of cross-cutting personal and professional relationships. Nor is it uncommon for individual engineers working at large firms to make angel investments in promising start-ups—or for established firms to organize venture divisions to support new ventures in related industries. Finally, entrepreneurs collaborate regularly with universities and corporate research labs, while established firms rely heavily on local investment banks, venture firms, lawyers, market research firms and consultants. In short, there is no meaningful distinction between 'Economy 1' and 'Economy 2' in Silicon Valley.

The case of the corporate research labs underscores the limits of such dualist accounts. To be sure, Xerox PARC and IBM San Jose (Economy 1) have been prolific sources of new technologies for Silicon Valley start-ups, and the local venture capital community (Economy 2) has actively commercialized them. Yet, as Kenney and von Burg note, comparable labs in other locations have failed to produce such dynamic start-ups. This is the case even in places like Route 128, which boast well-established venture capital industries. Moreover East Coast research labs, from MIT's Lincoln and Rad Labs to those sponsored by General Electric, Raytheon, EG&G and Xerox, were historically larger and better funded than those in California (Rosegrant and Lampe, 1992). However, they were also exceedingly secretive and autarkic. The region's researchers were routinely forbidden to discuss their work—not the best way to encourage information exchange or collective learning.

Once again, organization precedes technology. It is precisely the openness,

multiplicity and diversity of interconnections in Silicon Valley that allows economic actors to continually scan the environment for new opportunities and to invest in novel technologies, markets and applications with unprecedented speed. The autarkic structure of firms and institutions in Route 128, by contrast, have historically discouraged precisely the decentralized flows of information, skill and capital that encourage such technological experimentation.

3. Collective Learning or Path Dependence?

Silicon Valley's regional advantage lies not in its early entry onto a prolific technological pathway, but in an institutional environment that supports continuous innovation and collective learning—one that by its very nature undermines technological trajectories or path dependency. In the post-war period, the region's engineers rejected the management models and practices of mainstream corporate America in their efforts to preserve the flexibility and innovative dynamism of their early entrepreneurial successes. The institutions and social structures they created combine intense interfirm communication and learning with a continually deepening social division of labor. As a result, growth in Silicon Valley today occurs more through the conceptual advances and innovations that derive from specialization, experimentation and recombination than from the scale economies associated with progress along a predetermined technological paradigm.

Kenney and von Burg's analysis offers little hope for regions like Route 128. Having missed the initial technological wave it is difficult to see how their analysis would permit even an economy with as much skill, capital and know-how as the Boston area to compete. Yet if the technological lock-in they describe is, in fact, a product of the autarkic management models of the large minicomputer producers, then the region's future remains less determined. The economic revitalization of the US Midwest in recent decades is only one example of how firms on the 'wrong' trajectory can avoid the dead-end of regional path dependency (Hall, 1997). Changes in management strategies, institutions and practices are a defining feature of industrial history. Indeed, it is precisely this capacity for self-reflection, learning and strategic reorientation that distinguishes economic actors from trees and seeds.

Acknowledgements

Special thanks to Gary Herrigel, Marty Manley and Steve Weber for helpful comments on earlier drafts. The final version is, of course, my responsibility alone.

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