

REGIONAL HISTORIES AND THE CYCLE OF INDUSTRIAL INNOVATION: A Review of Some Recent Literature

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Most mainstream models that attempt to account for the local occurrence of innovative activity and the rate and pattern of its spatial diffusion build on an ahistorical method of inquiry borrowed from neo-classical economics, an apparatus geared in any case toward explanations of spatial economic convergence rather than regional differentiation (cf. Hagerstrand 1953; Berry 1971; Krumme and Hayter 1975; Norton and Rees 1979). Disequilibrium theories that attempt to account for stubborn tendencies toward the spatial polarization of innovative activity in the real world also focus mainly on the explication of abstract economic factors (in general, internal or external economies and diseconomies of scale) which may trigger or inhibit the interregional or international transmission of growth (Myrdal 1957; Vernon 1966, 1979; Krugman 1979; Markusen 1985). None of these theories accounts for the actual location of innovative activity, much less the influence that local culture and history may have on the innovative process. Even much of the radical literature tends to reduce evidence of local specificity to rigid displays of class structure; it is unable, therefore, to admit any locally-specific non-class effects as factors in the historically-specific generation and diffusion of technological change (Blaikie 1978; Gregory 1985).

Other accounts, typically inspired by or associated with the French "regulation" school, insist however on the theoretical necessity of specifying both the historical and cultural context in which innovation and diffusion processes occur (Aglietta 1976; Piore and Sabel 1984; Lipietz 1986; Boyer 1987; Cohen and Zysman 1987; Florida and Kenney 1987; Scott and Storper 1987, 1988; Storper and Walker 1989). In these accounts, innovation and diffusion processes in regional economies are shaped not just by some semi-autonomous logic of science or capital and the existing structure of market demand; they are shaped, as well, by a series of historically-determinate regulatory mechanisms -- stable institutional arrangements and established social routines based, among other things, on place-bound political coalitions, producer-supplier linkages, patterns of household organization, ideology, and local custom. These arrangements serve as a social support structure for the prevailing "regime of accumulation" -- a historically-specific pattern of institutional arrangements that help the regional economy to

stabilize the inherently unstable macroeconomic allocation of economic resources between accumulation (profit and investment) and consumption.

The arrangements themselves are not historically stable. Productivity begins to falter (the law of diminishing returns inevitably sets in) and a new regime of accumulation must be constructed based on the development of new technologies and/or a radical reorganization of work. The institutionalization of the new regime is not automatic, however; the institutional arrangements and social routines necessary to support accumulation based on a new technology may be very different from existing arrangements and routines built to sustain the previous accumulation regime. The construction of a new social structure for innovation is thus a historically-indeterminate process of social and political conflict. It is through an examination of such conflicts, as reflected in the changing locational strategies of firms and the local politics of a particular regional economy, that we can see the impacts of local culture and history on the occurrence and diffusion of technological innovation in that economy.

The Regional Location of Innovation

Technological innovation (and/or the reorganization of work) constitutes one part of the solution to a crisis in the dominant regime of accumulation and its associated mode of regulation. The second part of the solution involves the construction of new institutional arrangements and social routines that are compatible with the new technological basis of accumulation. Quite frequently, these shifts are associated with simultaneous shifts in the locational structure of production: specifically, shifts in the regional locus of innovative activity. Local or regional culture and history play a big part in the origin, expansion, and decline of these new innovative growth centers.

The precise location of an innovative industry may be, in fact, a product of historical accident. "A window of locational opportunity" opens in time as a new type of production activity begins to localize in space (Scott and Storper 1987). To the extent that the main forces driving location decisions are agglomeration economies, early firms put down by "historical accident" in one or two locations will attract other firms to those places by the very fact of their prior presence.¹ Other firms are attracted for the same reason, until the industry ends up clustered in the one or two early-chosen places. In this view, which has been formalized by Brian Arthur (1986), the order of settlement is a crucial determinant of the extent to which an innovative industry clusters in one region rather than another. But that order is not itself determinate; it is a matter of chance, a consequence of historical accident.

By this logic, the innovative regional economy we know as "Silicon Valley" took root in Santa Clara County, California, because certain key actors -- Schockley, Varian, Hewlett, and Packard -- happened to start firms near Stanford University in the 1940s and '50s. Once there, however, the "local labor expertise and inter-firm market they helped to create made subsequent location there extremely advantageous for the thousand or so firms that followed them" (Arthur 1986). Arthur's historical-dependence model helps to explain *where* "Silicon Valley" actually occurred, and his attention to agglomeration economies explains to some extent *why* Silicon Valley grew.

Arthur's model does not explain, however, why *all* of the potential sites for Silicon Valley (Orange County, Phoenix, the Denver-Boulder region, Dallas-Fort Worth) were located far from existing industrial agglomerations in the Northeast and Midwest. As I noted before, historical shifts in the technological and institutional context for continued accumulation or economic expansion often involve simultaneous shifts in the geographic locus of innovative activity. I will now contend that aspects of local culture and history play a crucial role in the abandonment of old production centers and the choice of new ones.

The cultural traditions of an established industrial community often conflict with the needs of innovative, technologically-dynamic firms. Established communities have built up a local "mode of regulation," or stable institutional arrangements and social routines with respect to production activities, management-labor relations, and municipal politics that provide social coherence to an accumulation regime which has itself been created on the basis of a particular (perhaps now obsolete) technology of production. These arrangements do not emerge automatically; they are the result of prolonged social and political conflict, the stuff of local history. They include specific traditions regarding work rules, seniority rights, and methods of occupational reproduction that shape the responsibilities and performance capabilities of both managers and workers at the point of production (Storper and Walker 1983; Clark 1981, 1989). They also include the settled traditions of municipal politics; for example, the extent to which firms are obliged to face such things as high land taxes, strict zoning regulations, or tight environmental restrictions (Scott and Storper 1987).

Such settled traditions conflict with the typical innovative firm's craving after flexibility. The commercialization of a new technology frequently involves rapid shifts in product and process configurations, producing concomitant needs for rapid shifts in occupational structures and the technical and social division of labor. Markets are uncertain, creating sudden price shifts; shifting prices create a desire on the part of firms for short-term flexibility with regard to wages.

The ability of innovative firms to participate in the creation of a new regime of accumulation, a new stable path for economic expansion based on a new type of technology, and/or a new organization of production, depends critically on the ability of those firms to effect sometimes sweeping changes in the stable social, cultural, and political life of the regional economy. Such changes are seldom easy, never costless, and not always possible. Employers may try to bypass local workplace traditions by turning to immigrant workers or first-time female entrants into the regional labor force (Massey 1984; Baran 1986). More often in the case of brand-new industries, managers will choose to construct new communities of firms and workers on fresh terrain (Scott and Storper 1987; Clark 1981, 1989; Storper and Walker 1983, 1989).

Aspects of local culture and history (now a different culture, a different history) play a large part in the choice of that fresh terrain. Much of the literature on high technology location factors mentions a series of attributes typically collected under the rubric "quality of life" (Premus 1982; Armington, Harris, and Odle 1983; Markusen, Hall, and Glasmeier 1986). As Scott and Storper point out, quality of life is not an abstract, trans-historical condition; it is a socially constructed category. The "ideal" quality-of-life standard now being constructed around new high-tech agglomerations in the United States typically involves people with no long history of industrial experience (no traditions of social regulation connected to the old accumulation regime); it also happens to comprise a set of social, cultural, and political attributes critical to the flexible accumulation strategies of high-tech producers.

Scott and Storper catalogue these quality-of-life attributes as "forms of community characterized by conservative political inclinations, low-density and highly privatized forms of family life, and abundant recreational resources." They point out that such communities are frequently associated with another quality, popularly referred to as "good business climate." This typically translates to "favorable local tax arrangements for producers and an absence of significant labor union activity." Importantly, the very spatial structure of such communities imposes barriers to the resurgence of the type of working class political movements that arose from the dense, highly urbanized clusters of workers characteristic of the old manufacturing belt. Moreover, the new Asian and Latin American immigrants so characteristic of Sunbelt cities have often arrived illegally or are, in any case, uncomfortable with English and therefore politically marginal. Sunbelt cities are also typically fragmented into numerous municipalities, reducing any chance for the replication of "big city political machines dominated by working class and ethnic groups" (Scott and Storper 1987).

Diffusion of Innovation within a Regional Economy

We have now seen how particular aspects of local culture and history influence the extent to which innovations will be likely to occur in a regional economy. We still need to understand, however, how these characteristics of regions impact the pace and pattern of diffusion. After all, Texas Instruments began semiconductor production in Dallas, and Motorola began in Phoenix, at about the same time Schockley Laboratories was first established in Santa Clara County. Yet neither of those cities developed the capacity for rapid and widespread diffusion of technological innovation so characteristic of the Silicon Valley and so central to the agglomeration economies that sustain innovation and growth throughout that regional economy.

The extent to which innovations will occur in a regional economy stems from the degree of match or mismatch between that region's own "regulatory" mechanisms and new production processes associated with the development of new technologies. The pace and pattern of innovation diffusion likewise stem from the degree of compatibility between local capacities to generate technological information and local channels of information exchange. Some channels prevent information from reaching persons in a position to act on it, while others facilitate the requisite communication. Local social routines and the informal social networks that facilitate technology transfer and information exchange reflect regional identities and solidarities that can be described as aspects of local culture. Like other aspects of local culture, they are consequences of local history, built up through a process of learning and mutual adjustment over time.

Over time, then, the social routines and information channels that evolved from nascent entrepreneurial networks in California's Silicon Valley came to constitute what Florida and Kenney (1987) call full-fledged "social structures of innovation," technologically-dynamic, self-reinforcing, place-bound business cultures. Scott and Storper (1988) also acknowledge the roles played by social mechanisms and cultural norms in generating and spreading the effects of innovation in Silicon Valley. For Scott and Storper, technical innovation is a dynamic, often informal process dependent on the conjunction of diffusion *mechanisms* (for the maintenance and transfer of useful knowledge) and *circumstance* (the innumerable practical problems and questions that are constantly generated out of the transactional interaction between producers). In such contexts, innovation develops not as a purely atomistic phenomenon (entrepreneurship), but rather as a collectively-defined activity.

The diffusion of technological innovation depends in large part on informal networks built out of "communities of trust and the social

construction of unwritten business norms." Such networks evolve throughout the history of place-bound business communities, as entrepreneurs learn collectively about one another's habits and capabilities.² The end result of history (as interpreted through personal experience) is "the constitution of a place-bound business *culture* [emphasis added] in which practical forms of knowledge are socially reproduced and individual sensibilities about production processes, labor skills, materials, product design, markets, and so on are finely honed." Significantly, the process of diffusing much of this useful "local" knowledge may be socialized eventually in the form of educational services tailored to the needs of the adjacent production system.

Of course, the successful commercialization of a fast-diffusing technological innovation requires that workers become habituated to frequent changes in the nature of work and extreme job instability in both the upper and lower tiers of the local labor market. It is a cultural adaptation to this very instability, however, that helps to account for the rapid and widespread diffusion of technological innovations throughout the regional economy. Over time, both upper- and lower-tier workers evolve a set of network relations that provide information about labor market conditions; these networks take the form of "professional associations, kin and friendship ties, ethnic organizations, trade unions (where they exist) and so on." These networks then become important channels for the informal diffusion of (sometimes proprietary) know-how. Along with other communal processes involving schools and universities, neighborhood contacts, local media, etc., these networks contribute to the creation of regional identities and solidarities that, to some extent, blur class distinctions.

The Future Repeating the Past?

Like past arrangements of local institutions and social routines, the mode of regulation built up over the past two decades in the Silicon Valley may be expected, through its own evolution, to eventually undermine the conditions which have accounted, until recently, for the stability of the existing regime of accumulation. The electronics industry's demand for many different skills and human attributes among employees has led to the development of a highly heterogeneous local population, both in socio-economic terms and in cultural, ethnic, and racial terms as well. This population comes together in one place during the work day but tends to sort, via individual residential behavior and differential access within urban housing markets, into "a mosaic of distinctive neighborhoods and communities within which subtle and intricate processes of family life, child rearing, and social interaction take place" (Scott and Storper 1988). Over time, community life in the new agglomeration has begun to follow a significant logic of its own; this

logic has given rise to social conflicts regarding various objects of collective consumption (housing, highways, health care, education). These claims have already begun to feed back upon and restructure the further development of the production system, collapsing or relocating diffusion channels and diminishing innovative capacities throughout the region (Saxenian 1981, 1984).³

Whether municipal politics will become dominated by agents of the Silicon Valley's workforce or will continue to be dominated by growth coalitions of employers and selected, highly-skilled employees remains to be seen; this is the historically contingent object of current social and political conflict in the area. The analysis presented here suggests, however, that if the local mode of regulation cannot be reconciled to the changing requirements of accumulation based on the still-dominant technology of microelectronics, a reorganization of production will surely ensue. History suggests that such a reorganization may involve the relocation of innovative activity to yet another, relatively "green" regional economy.

NOTES

¹Geographic endowments and transport possibilities are, of course, important determinants of locational formation, but an influential tradition in spatial economics sees agglomeration economies as the driving force behind the clustering of an industry in one or a few locations (Arthur 1986). See, for example, the seminal work of Alfred Weber (1909).

²Trust and personal experience also play an important role in the re-contracting behavior of many business enterprises, as shown by Storper and Christopherson (1987) in their study of the motion picture industry in Los Angeles.

³AnnaLee Saxenian's (1981, 1984) work on the "urban contradictions" of the Silicon Valley is a striking empirical record of this process. Her more recent (1988) work suggests, however, that the creation of flexibly-specialized inter-firm networks has promoted an economic resurgence of the area during the 1980s.

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