Landscapes of Knowledge and High Technology

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> *[T]his is a very special productivity, that of the minds of men and women. While they must be given the proper tools and facilities (which is relatively easy), they must also be put in an atmosphere that will be conducive to concentration and creativity.*
> *—U.S. economic development official speaking at a conference on "Research and the Community," 1961*[1]

> *The bottom line is that cities need a people climate even more than they need a business climate.*
> *—Richard Florida,* The Rise of the Creative Class, *2004*[2]

In pursuit of good jobs and a strong tax base, metropolitan regions across the U.S. have recently become fixated on building "knowledge-industry" clusters and attracting the white-collar professionals who work in and around them. Yet, as technology firms expand globally, both to capture new consumer markets and decrease labor costs, this competition has become increasingly international. Knowledge-industry workers, too, have become more mobile; and as they choose jobs for lifestyle as well as economic reasons, their perceived wants have become a major influence on regional economic priorities and urban initiatives.

Worldwide, the rise of the knowledge economy is having a profound aesthetic and spatial impact on cities. Occurring within a broader context of suburbanization, economic globalization, and urban gentrification, the knowledge economy is intensifying these trends and creating its own landscapes. Think "high-tech region," and the image that comes to mind resembles Boston's Route 128 or Northern California's Silicon Valley—suburban, low-rise, glass-clad buildings amid generous and heavily landscaped grounds. Historians and social commentators have even given this landscape a number of catchy labels, such as Robert Fishman's "technoburbs" and Joel Kotkin's "nerdistans."[3]

While seemingly easy to identify and categorize, twenty-first-century landscapes of knowledge are actually products of an incredibly complex bundle of social, political and economic conditions. These originated in a unique historical moment—the first two decades of the Cold War. The quest to replicate the economic success of Route 128 and Silicon Valley is decades old, and the failure of many cities and regions to do so partly reflects the impossibility of replicating the original historical events and regional assets that created them.

This essay provides a brief dissection of the forces that created the prototypical landscape of knowledge, and explores how successive waves of social and economic change have altered and reinterpreted this model while keeping its core characteristics intact. The discussion focuses on high-technology industries—since these typify the leading edge of the knowledge economy. High-technology firms are among the world's most dynamic and innovative, and they have had great influence on the service industries (real estate, finance, and law) that support them.

Landscapes of knowledge do not occur in isolation from larger social change. They are both *responses* to broader political and social transformations and *catalysts* for the rearrangement of urban space. Their story is central to the history of the contemporary city and suburb, showing how the twentieth-century political economy helped map out twenty-first-century urban space.

Historicizing the pursuit of the "creative class" and the coming of the "flat world" helps illuminate why some places have been more adept at building knowledge-based clusters, and why these activities so often cause urban de-densification and increased social and economic polarization.[4]

The Cold War and the Suburban Model

Why does high technology gravitate to suburbs? Ask a high-tech CEO, and she may cite the cost of land, company space needs, proximity to labor, nearness to compatible firms, and the quality of infrastructure. During the past half century, suburbs have generally done a better job of providing these desired amenities than cities. Yet the ability of suburbs to attract corporate facilities has also been conditioned by a broader political economy that influences land costs, residential options, and industrial mix.

This is true all over the world, but especially in the United States. For more than half a century, U.S. government policies have subsidized land and housing costs through tax breaks to landowners; they have paid for new road and utility infrastructure at the edge of metropolitan areas; and they have provided both direct and indirect incentives for industries to locate in suburban areas. Such incentives have been particularly significant in the case of the technology industry, a sector that came of age in the suburban era and relied heavily on federal spending during its early years.

Indeed, the global technology industry of today exists largely as a result of U.S. government policy in the 1950s and 60s. In the name of competing militarily and intellectually with the Soviet Union, unprecedented investments were made in university science and engineering programs, and the U.S. government became a major customer of firms with the technical expertise to develop sophisticated military machinery. In doing so, the federal govern-

ment arguably became the first (and largest) high-tech venture capitalist. Yet this public spending was geographically uneven. Some regions received many more federal grants than others, fostering the growth of technology clusters. The bulk of Cold War research and development contracts also went to Sunbelt regions experiencing rapid suburban growth.

Cold War funds flowed unevenly at the intra-metropolitan level as well—for both deliberate and indirect policy reasons. One seemingly unlikely catalyst was the Cold War civil defense campaign. In the doomsday scenarios of military planners, downtown business districts were seen as ground-zeroes for Soviet nuclear attack. In response, both Congress and the Truman and Eisenhower Administrations built a number of incentives into military contracts and tax policy to encourage defense-related industries to choose "safe" suburban locations. Such incentives may have been small, but they were significant to the often struggling firms that later seeded the high-tech industry. Whether new entrepreneurial start-ups or the research arms of established manufacturers, these enterprises usually lacked commercial markets for their products, and relied on government contracts to stay in business.

Top left: A Stanford official shows Lockheed executives plans for its prototypical research park. Courtesy of Stanford University Archives. **Top right:** The American idea of "campus" presumes that spacious, quasi-rural environments are conducive to intellectual discovery. Nassau Hall at Princeton. Library of Congress, Prints and Photographs Division, Historic American Buildings Survey, HABS NJ,11-PRINT,4B-1. **Bottom right:** Landscapes of knowledge are the product of publicly subsidized suburban freeways. Special Collections and University Archives, Georgia State University Library. **Bottom left:** New knowledge landscapes far from city centers required places for workers to eat and socialize, such as this cafeteria at Bell Laboratories' 1940s facility in New Jersey. Library of Congress, Prints and Photographs Division, Gottscho-Schleisner Collection, LC-G612-T-42361 DLC.

Early Knowledge Workers

The demographic profile of the early technology workforce also played a role in shaping early knowledge landscapes. The Cold War created tremendous demand for talented and experienced scientists and engineers, both at universities and private-sector manufacturing and research firms. Media attention during this period further bolstered the visibility of scientists and their activities.

As the prestige of knowledge workers rose, the public definition of "high-tech worker" also narrowed. Even if blue-collar, assembly-line jobs provided the bulk of employment in the sector (and still does), the public face of high technology was white-collar, professional and managerial—and more often than not, white and male. An image of the typical high-technology worker as a well-educated, affluent family man became solidified in the minds of politicians and business leaders. Such workers were desirable not only because they added to a region's tax base, but because they brought a glamorous space-age cachet.

Local governments, employers and institutions soon became preoccupied with establishing environments to appeal to this demographic. Exhaustive studies were made to assess what scientific professionals might want in a community. Good housing and schools were found to be important—as they were to other white-collar workers. But access to an intellectual community of like-minded scientific people was also important, and this usually meant proximity to an elite research university. This raised the importance of such institutions in economic development terms.

As University of California Chancellor Clark Kerr noted in 1961, "universities have become 'bait' to be dangled in front of industry, with drawing power greater than low taxes or cheap labor."[5]

The Early Research Park

At the time, mass suburbanization had already spurred development of low-density "industrial parks" in areas on the outskirts of major cities. These typically featured modern buildings, extensive landscaping, and plenty of parking. Capitalizing on this trend, the promoters of university-centered, knowledge-driven employment created a new and alluring variant: the research park. This took the restrictive architecture and planning of the suburban industrial park to a new level, creating an environment with the look and feel of a college campus.

The ultimate example of a Cold War-era research park—and the facility that became the most widely imitated high-tech real estate development over the ensuing five decades—was built in Palo Alto, California, in the early 1950s by Stanford University. Boston's Route 128 was another important early center of research park development; and large private-sector operations like Bell Laboratories in suburban New Jersey popularized the idea of the corporate campus. But the Stanford development was so often copied and reinterpreted by developers elsewhere that it became the true prototype for the landscape of knowledge. In blurring the lines between the residential and industrial environment, creating close associations with an institution of higher education, and focusing on technology industries, the Stanford Research Park became the model both for later suburban tech regions and for urban and foreign reconstitutions of the form.

The San Francisco Peninsula, where Stanford is located, was profoundly transformed during the mid-twentieth century by both Cold War spending and suburbanization. Once an area of orchards and grazing land, in the 1950s it fast became the site of affluent residential suburbs and major defense installations and contractors. The area had several important amenities; its benign climate and natural beauty attracted educated migrants from other parts of the country and the world. But elite, private Stanford University was also one of the institutions most favored by the Cold War defense complex. It won millions of dollars in government research grants, and vastly enlarged its science and engineering programs.

Stanford also had an asset that few other universities possessed—nearly 9,000 acres of mostly undeveloped land. In the early 1950s, Stanford's administrators decided to parlay its new research clout into a lucrative connection with the technology industry by building a research park adjacent to its campus. The park set a very high bar for tenant selection, and mandated exacting architectural and planning standards. The aim was to create a space that echoed the look and feel of Stanford's campus. In establishing such standards for an industrial area, the school violated nearly every cardinal rule of economic development. But in the new Cold War environment the rules of the game had changed. Those businesses that leased land in the park gained access to Stanford faculty and laboratory facilities through specially created cooperative programs. And they gained well-designed facilities in a prime location carrying the Stanford name.

Stanford immediately gained worldwide attention for its development, and delegations arrived from such older industrial centers as New York, Paris and Tokyo to glean its secrets. In their enthusiasm to develop high-tech

centers of their own, however, imitators often focused on the park's aesthetics without recognizing its tremendous political, economic and demographic advantages. The degree to which wealth and suburban location functioned as advantages becomes clear when one compares Stanford's case to later efforts by other institutions located in economically declining city neighborhoods.

A good number of American research universities had urban campuses. And in the 1960s, 70s and 80s they embarked upon science-focused economic development efforts to "save" their surrounding neighborhoods from economic deterioration and racial change. Yet the unadulterated research park form—with its uniform architecture, low density, and functional exclusivity—proved ill-suited to urban neighborhoods. And in an age of rising urban crime, declining tax bases, and increased social and racial diversity, even the most aesthetically pleasing development could not lure knowledge firms and workers back to the city in great numbers.

In the meantime, suburban high-tech districts boomed, and benefited from a broadening of funding sources. After 1970, a slowing of federal spending and a growing commercial market for high-tech products made private capital an increasingly important sponsor of knowledge work. Public spending continued to matter a great deal, but the most visible involvement began to come from state and local governments.

In North Carolina, for example, a vigorous state-directed effort to draw research facilities to an under-industrialized rural area near Duke University and the flagship state university at Chapel Hill resulted in the Research Triangle Park. In Texas, state leaders played an instrumental role in wooing two large semiconductor research projects to Austin, seeding a high-tech economy around the University of Texas that eventually led to another prominent American knowledge landscape by the end of the twentieth century.

The headquarters of Microsoft Corporation in Redmond, WA, is located in a suburban campus about 15 miles from downtown Seattle. Like those of many other knowledge-economy firms, Microsoft's facility consists of lowrise, modern buildings set amid landscaped green space, with employee amenities like sports fields and jogging trails. Photo by author.

The Research Park 2.0: Urban and International Reinterpretations

The American city would have to "come back" before high technology could return to it. After several decades in which the American middle class—knowledge workers included—left the city for the suburbs, changing demographics and new urban amenities began to draw a significant subset of these workers back in the 1990s. And just as high-technology industries had been at the forefront of industrial suburbanization in the post-World War II era, they now became the "pioneer" tenants in newly transformed urban neighborhoods.

One factor in this shift was the end of the Cold War. This allowed the technology industry to choose locations guided more by the preferences of talented employees than by the predilections of the Defense Department. In the 1990s and 2000s the character and diversity of urban neighborhoods were also a powerful draw for educated professionals.

After several decades of failed attempts to create landscapes of knowledge in cities like Philadelphia, New York, and Chicago, high-tech districts began to sprout in downtown neighborhoods during these years. Internet and media companies, not needing large spaces to house server rooms or research laboratories, gravitated to urban districts like Manhattan's "Silicon Alley" and San Francisco's South of Market.

The return of technology work to the city did not involve a wholesale abandonment of the suburban research park ideal, however. Instead, it reinterpreted its forms, keeping basic principles intact. Like their Cold War predecessors, urban technology facilities and districts were designed with the preferences of knowledge workers in mind. In many instances their development was also fueled by intensive public subsidy—in this case, local and national urban development policies that offered significant tax breaks for rehabilitating buildings, constructing urban infill, and bringing jobs back to older urban areas.

These were also districts with distinct geographic identities, separate and different from the urban landscapes that preceded or abutted them. And in many instances, the arrival of high-tech industries accelerated gentrification and the displacement of the traditional working class—despite the fact that it was the heterogeneity and "funk" of urban districts like San Francisco's Mission District and Seattle's Belltown that drew the new high-tech workers in the first place.

Yet, even as new urban technology districts appeared during the boom years of the 1990s, the suburban model also persisted and flourished. A proliferation of new research parks and corporate campuses began to appear at the outer fringes of American cities. And as high-tech clusters began to emerge in Asia, Europe, and Latin America, the research park went global. Today, in the booming economies of India and China, firms signal their seriousness about joining the knowledge economy by building technology parks and corporate campuses located well outside central business districts. These frequently also bear little trace of local or national culture or building style, instead replicating market-tested American models.

The sandstone buildings and red-tile roofs of Stanford and its adjacent research park were inspired by the Spanish mission style in California. But the appearance of these architectural motifs in research parks elsewhere in the world today owes little to this original source—indicating instead an attempt to evoke the look and feel of Silicon Valley. Even the residential areas catering to these new knowledge workers—many of them foreigners or returning émigrés from the U.S.—pay homage to California's suburban subdivisions.

On the surface, the proliferation of low-density, suburban, economically segregated research parks and gated communities in developing nations seems a disturbing replication of the more unsustainable and socially polarizing aspects of the American metropolitan landscape. Yet, a slightly wider view reveals important differences between global landscapes of knowledge and their U.S. prototypes.

While sometimes imitating the architectural aesthetics of Silicon Valley, other nations have built research parks that are denser and contain greater functional diversity than many of their American counterparts. Real estate costs, of course, play a huge role: in land-scarce Asian and European metropolitan areas, an American-style research campus is often prohibitively expensive. But local cultural preference also appears to be important. In India and China, for example, U.S.-style residential areas can be much denser and more pedestrian-friendly, catering to a population used to multigenerational households, walkable neighborhoods, and shared community amenities.

Without American-style zoning, upscale knowledge-economy facilities may exist adjacent to working-class housing, small locally owned shops, or even squatter settlements. Research park buildings may look as if they have been transplanted directly from Cupertino or Redmond, but their

Above: Residential areas are also a hallmark of landscapes of knowledge, and incorporate the same architectural motifs regardless of location. A large golf course development in Guangdong Province, southern China, features single-family homes that retail for up to US $7 million. Photo by author.

adjoining parking lots have spaces for 50 cars rather than 500, as most employees take public transportation, bike, or walk.

Of course, rising incomes may quickly erase these differences. The largest foreign technology centers are already wrestling with traffic gridlock and skyrocketing real estate prices. But international landscapes of knowledge, for now, have managed (perhaps accidentally) to create a more sustainable and less isolated reinterpretation of the American model.

Knowledge Landscapes and Social Class

In the United States, success in building landscapes of knowledge has not necessarily come through providing a suburban location, but in creating a functionally and class-segregated one. This is not a particularly comfortable conclusion, but it is one that cannot be ignored. The way these landscapes are being mediated and reinterpreted in the "new" Silicon Valleys of other countries may, however, provide compelling alternatives.

History shows that the geography of the knowledge economy is hardly accidental, and that public policy choices and institutional actions have a great deal to do with how and where creative classes and knowledge firms flourish. These economic development efforts make a great effort to cater to what educated professionals want and need. It is important today that these workers understand how their needs are conditioned, and appreciate alterative ways their industry may grow in the future.

Notes

1. George A. Dudley, "Problems of a Physical Environment," remarks to New York State Symposium on "Research and the Community," Sterling Forest, New York, May 1, 1961.

2. Richard Florida, *The Rise of the Creative Class and How It's Transforming Work, Leisure, Community, and Everyday Life* (New York: Basic Books, 2004).

3. Robert Fishman, *Bourgeois Utopias: The Rise and Fall of Suburbia* (New York: Basic Books, 1987); Joel Kotkin, *The New Geography: How the Digital Revolution is Reshaping the American Landscape* (New York: Random House, 2000).

4. Richard Florida uses the term "creative class" as shorthand for the group of workers and residents cities and regions need to attract in the knowledge-economy era. The concept of the "flat world" has been popularized by Thomas Friedman's writings on economic globalization and outsourcing, most notably in *The World Is Flat: A Brief History of the Twenty-First Century* (New York: Farrar, Straus and Giroux, 2006).

5. Clark Kerr, *The Uses of the University* (Cambridge, MA: Harvard University Press, 2001), p. 89.