

BY ROSS DEVOL

**Technological innovation** is powering the Great American Prosperity Machine, sustaining America's preeminence in industries ranging from pharmaceuticals to entertainment to software – or at least that it has been the assumption in recent years. Now, economists are not only finding the evidence that technology really is translating into higher productivity, but also discovering how it is driving success in local economies.

Perhaps the best indicator of the new focus on regionalism's ascendance is that policy makers from Jerusalem to Kuala Lumpur are busy trying to clone Silicon Valley. Geographic clustering is becoming central to the creation and understanding of what economists call "comparative advantage" in trade in an Information Age economy.

Since the late 1980's, there has been a resurgence of interest in the "new economic geography," which provides the foundation for analyzing specialized economic activity within regions. Clustering results from businesses and workers seeking out others engaged in related activities. Increasing returns to scale – as in, "the more that's made, the cheaper it is to make" – lead to competitive advantages. The usual suspects underlying these increasing returns include access to specialized labor skills, supplier networks and technology spillovers.

Such externalities play a particularly important role in the case of high-tech industries. The initial presence of one research

facility may lead to others being established nearby and, ultimately, to the clustering of businesses. Countering the centripetal effects are many forces – land and water scarcity, traffic congestion, air pollution – that favor economic dispersion. As economic activity concentrates, rents are bid up, eroding the advantage of the region. With mounting barriers to the entry of new companies, a new competing cluster may form somewhere else. The intricate ebb and flow goes on.

#### **CLUSTERING IN HIGH-TECH INDUSTRIES**

Of course, the relative importance of the various "push-pull" factors that influence clustering vary by industry and epoch. Historical accidents as random as Oppenheimer's love of the Los Alamos mountains or the pull of a local Congressman sometimes provide a critical advantage.

Many of the factors that attract high-tech companies are the same ones that attract traditional industries: taxes, wage rates, rents, energy costs and the like. Others seem more important to high-tech companies, notably access to a trained workforce, proximity to

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research facilities, a network of suppliers, local venture capital and so forth. Mature high-tech manufacturers place a higher value on the traditional cost-of-doing business measures than service companies.

**TECHNOLOGY’S IMPORTANCE IN METRO GROWTH PATTERNS**

Success in creating a high-tech cluster is now the distinguishing determinant of metropolitan vitality. The regional studies group at The Milken Institute measured the statistical links between high-tech and local economic growth using data covering 315 metropolitan areas. We chose to focus on the 1990’s because this is the period in which high-tech’s muscle in the national economy became so obvious.

In our statistical model, we “explain” the relative-output growth index of a locality by 1) the relative growth of high-tech output, and 2) an index of concentration of high-tech activity in 1990. As the graph suggests, two-thirds of the total-output growth differences among metros could be explained by these two factors alone.

The dynamics of high-tech clustering follow a fairly predictable pattern. As clusters develop, a supplier network is formed. The demand for locally produced professional services with specialized knowledge – for example, legal services – expands. These highly compensated occupations further stimulate local economies. Another important channel through which high-tech industries promote growth locally is the in-migration of knowl-

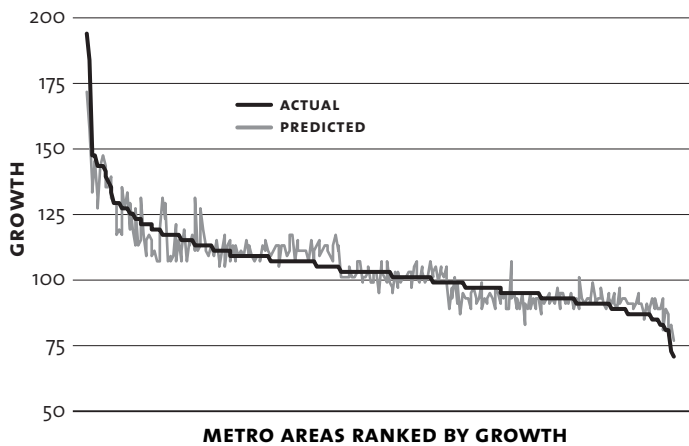
edge workers and their families. These effects can lead to a virtuous circle of positive feedbacks, with advantage leading to greater advantage.

**HIGH-TECHNOLOGY SPATIAL CONCENTRATION**

A straightforward approach to measuring high-tech spatial concentration (see Charticle, page 12) seems the most appropriate. The dominance of Silicon Valley (San Jose

**METRO GROWTH EXPLAINED BY HIGH TECHNOLOGY 1990-98**

**AVERAGE METRO GROWTH = 100**



metro) as a high-tech industry center is well documented, but our composite index of 23.7 is more than three times the size of the second-ranked metro. As a “tech-pole,” the gravitational pull of the San Jose metro area is unparalleled. Silicon Valley created the personal-computer industry and is on the cutting edge of electronic networking.

Dallas’s position, second on the index, might be surprising, but with a diversified high-tech base. GTE’s global headquarters are

## INSTITUTE VIEW

in Dallas, while Nortel, Ericsson, Fujitsu and Alcatel have United States headquarters there. Austin is thought by many to be the center of Texas's electronic components industry, but Dallas produces 20 percent more and employs 4,200 more people.

Despite the loss of military-related high-tech companies in the early 1990's, Los Angeles ranks third on the index. The ranking is somewhat inflated, perhaps, by the inclusion of non-high-tech portions of motion picture production and services. Even if the entire entertainment industry were excluded, though, Los Angeles would rank seventh.

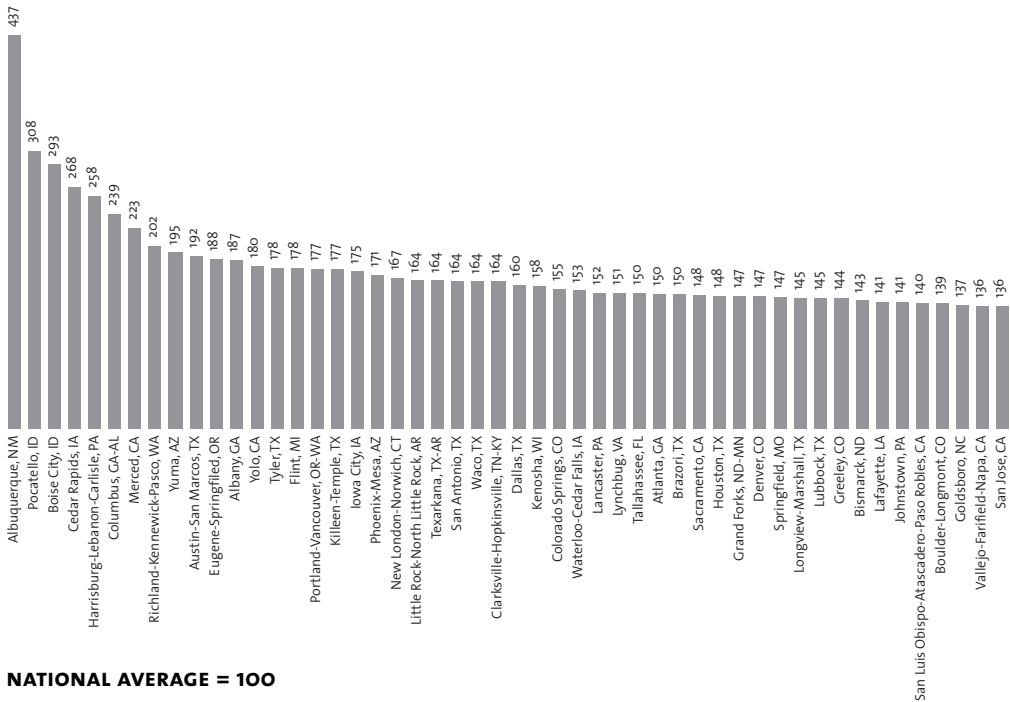
Boston places fourth on the list, with an above-average concentration in 11 high-tech industries. Although the joint impact of mili-

tary downsizing and heavy dependence on the lagging mainframe computer industry has been sizable, it is enjoying renewed vigor due to its Internet-related prowess.

Aircraft is still a major industry in Seattle, but software's rapid growth has made computer and data processing services a vital part of the economy. Microsoft, of course, is the nucleus of the Seattle software cluster.

Thereafter, the rankings are full of surprises. On a composite ranking of high-tech services, Washington, D.C. places first in the country, and sixth overall in high-tech. Albuquerque's ranking derives from its success in attracting electronic component manufacturers. Chicago is an important center of communications equipment, courtesy of Motorola. The windy city also has an above

## METRO HIGH-TECH GROWTH THE TOP 50 1990-1999



average concentration in pharmaceuticals, and research and testing services. New York's ninth rank is in due in part to its major presence in telecom.

Atlanta is the undisputed high-tech capital of the Southeast, with a foothold in telecommunication services, computers and data processing services. Oakland's fourteenth position places it just behind Orange County, Calif., – a fact that may surprise those accustomed to thinking of it as an aging seaport and home to a struggling underclass. San Diego, with its diversified high-tech economy, ranks seventeenth. Raleigh-Durham-Chapel Hill, Denver, Austin, San Francisco, Houston and Boise round out the top 25.

#### **HIGH-TECHNOLOGY SPATIAL GROWTH**

Spatial concentration is important, but it does not guarantee continuing high-tech growth. And here, with smaller clusters in the midst of rapid expansion, the rankings are quite different. Albuquerque is at the top, recording a compound annual growth rate of 12.7 percent in high-tech output in the 1990's. Pocatello and Boise home to Hewlett-Packard's laser-jet printer division as well as to Micron Technologies, are second and third respectively. Cedar Rapids and Harrisburg, rapidly growing centers of electronic component manufacture, are fourth and fifth. Columbus, Ga., ranks sixth due to computer and data processing services. Merced, Calif., recorded strong growth in pharmaceuticals, albeit on a very small high-tech base. The Richland, Wash., metro area witnessed increases in engineering and architectural services. Austin, a center of computer and electronics production, ranked tenth.

Flint, Mich., ranks high in the 1990's due to strong growth in data processing services, while Portland, Ore., is becoming a center of semiconductor chip and wafer production.

Houston was built on energy, but its future will have a high-tech component.

#### **CONCENTRATION VS. DISPERSION: WHO'S WINNING?**

There is evidence that high-tech manufacturing is becoming less spatially concentrated, but that high-tech services exhibit strong agglomeration. And even though manufacturing is dispersing to peripheral regions, it remains geographically concentrated.

Most of the metros that led in high-tech concentration 20 years ago are now slipping. Cities experiencing the fastest growth in high-tech industries in the 1990's largely consist of small to medium-sized localities that have attracted high-tech manufacturing. Most of the metros (38 out of the top 50 in high-tech growth) are in the South or West, and they rank high on most measures of cost-of-doing business, cost of living and on that elusive concept, the quality-of-life. Their sustained success depends upon the degree to which they can contain congestion and production costs.

High-tech services are also growing the fastest in small to medium-sized metros that have developed a critical mass. In contrast to manufacturing, however, the overall concentration of high-tech services is rising. Services apparently benefit more from geographic proximity than manufacturing. Computer and data processing services are becoming more spatially concentrated – software and Internet-related activities especially so.

Despite the evidence of dispersion in high-tech manufacturing, it is remarkable how concentrated it remains. Agglomeration forces in manufacturing are very durable and can only be thwarted by high congestion-related costs. A combination of high costs and obsolete technology seems to be a prerequisite to decline. **M**