



## SILICON PRAIRIE

### *How High Tech Is Redefining Texas' Economy*

**T**HE HISTORY OF Texas lies in cattle and oil. But increasingly, the future of the state is becoming linked with the ever-evolving high-tech industry. Texas is home to firms such as Dell Computer, Texas Instruments and Compaq Computer, among others. In addition to these homegrown high-tech companies, a number of out-of-state firms that produce high-tech equipment and services have already established themselves in Texas or are planning to do so. For instance, California-based Intel, the country's largest maker of computer chips, recently announced that it will build a \$1.3 billion plant in Fort Worth; Motorola, based in Schaumburg, Illinois, is Austin's largest private employer; and Nortel, based in Toronto, employs 6,500 workers in Richardson. Why is Texas so attractive to high-tech firms? What does the expansion of high tech mean for the state's economy and future growth?

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### *The High-Tech Wave Is a National Trend*

Nationally, high tech has become an important segment of the economy, employing 9.1 million workers.<sup>1</sup> In 1994, the production of computers and electronic and telecommunications equipment

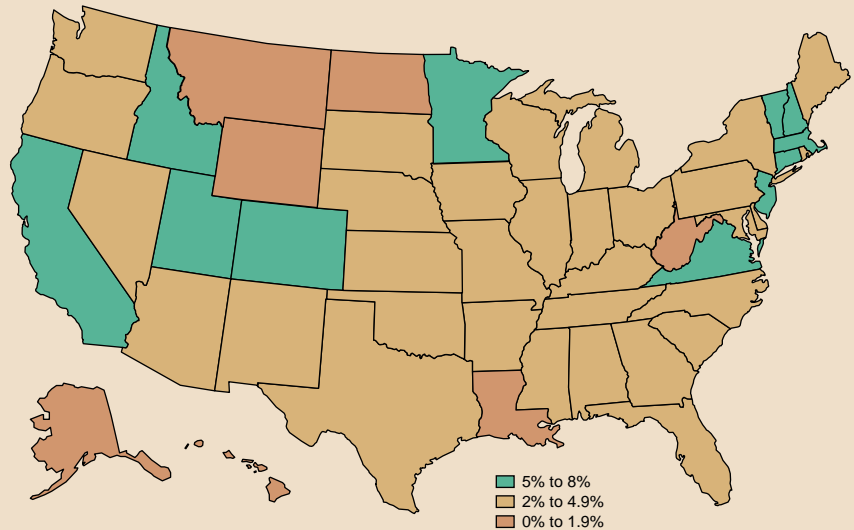
accounted for roughly 6.2 percent of the country's total output (measured in gross domestic product), up from 4.8 percent in 1990. By comparison, motor vehicle output accounted for only 1.1 percent of U.S. output in 1994. Moreover, during the current expansion, the high-tech sector has increasingly contributed to the growth of the national economy. For instance, business spending on computers contributed roughly 36 percent to growth in gross domestic product last year. By comparison, contributions from the housing and automobile industries, traditional drivers of the economy, were -1 and 9 percent, respectively. The high-tech sector is expected to continue expanding into the next century. In-Stat, a company that provides information to the electronics industry, forecasts 5.6 percent growth in worldwide semiconductor sales this year and 31 percent growth by 2001. The forecast is based on expectations of strong growth in demand from end-use markets, including consumer products, communications products and computers.

## Texas Has Been a Major Player (And Beneficiary) In the High-Tech Boom

Historically, Texas has been known for its cowboys, oil barons and real estate tycoons. But in recent years, the state's image has changed. Texas is now regarded as home to computer wizards and technical engineers. Although Texas still has more oil and gas rigs and farmland than any other state, it now ranks second (behind California) in computer- and telecommunications-related high-tech employment, with roughly 290,000 workers.<sup>2</sup>

While increasing rapidly, the high-tech industry in Texas is still only slightly larger in the state than it is nationwide. Chart 1 shows this by ranking U.S. states in terms of the share of high-tech employment to total state employment. However, Texas has benefited significantly from the high-tech expansion at the expense of some of its northern counterparts. Of the five

**Chart 1**  
**High-Tech Employment Shares, 1995**



states with the highest number of high-tech jobs in 1995 (California, New York, Texas, Illinois and New Jersey), Texas and Illinois have seen increases in high-tech employment during the 1990s, while high-tech jobs have declined in California, New York and New Jersey. High-tech employment has grown more than twice as fast in Texas as it has in the nation during the 1990s.<sup>3</sup>

## High-Tech Growth— But Also Vulnerability

Much of the expansion of Texas' high-tech sector is due to growth in four specific industries: computers, telecommunications equipment and services, computer chips (or semiconductors) and computer-related services.<sup>4</sup> As Chart 2 shows, each of these industries has a larger presence (in terms of total employment) in Texas than in the nation as a whole. While many states would be hurt by a downturn in any one of these four industries, Texas could be affected slightly more because of the prominence of these industries in the state's economy.

For example, Texas has a large share of semiconductor employment. Semiconductor firms account for 12 percent of the state's high-tech employment,

compared with 5 percent nationally. Last year, a downturn in the semiconductor industry had a noticeable impact on the Texas economy. The downturn was primarily due to a global oversupply of dynamic random access memory chips (DRAM)—which account for about 33 percent of the total semiconductor market. The oversupply resulted from slower personal computer demand and the stockpiling of memory chips, as firms expected a huge memory upgrade to Windows 95 that never materialized. In addition, a vast amount of new DRAM fabrication capacity came on-line. As a result, from November 1995 to June 1996, the average DRAM sales price fell 60.2 percent and unit shipments fell 7.6 percent, according to In-Stat.

Texas firms responded to the semiconductor industry downturn with layoffs, hiring freezes and plant construction slowdowns. This put a damper on the state's economic growth last year, with high-tech manufacturing employment growing only 3 percent, following 7.8 percent growth in 1995.<sup>5</sup> Nevertheless, high-tech manufacturing still expanded at a faster pace than non-high-tech manufacturing industries. Had other high-tech sectors suffered a downturn as well, Texas could have fared much worse. But growth in computers, computer services and telecommunications helped keep over-

all high-tech growth positive in Texas in 1996.

This year, the semiconductor industry has turned around and firms are hiring again. Furthermore, the industry will soon play an even larger role in the state's economy. For example, Samsung will begin staffing its \$1.3 billion facility later this year, and Intel expects to eventually employ as many as 5,000 employees at its future plant in Fort Worth, which is slated to start construction this summer.

### What's So Special About Texas?

Texas owes its high-tech presence to many factors, one of which is the state's pioneering history in high tech. Texas Instruments has been around since the 1950s, and Electronic Data Systems (EDS) was among the first firms to offer data processing services. In addition, the state's defense giants made innovations in communications technology that are now being used in the private sector, and NASA's presence in Houston spurred the creation of many high-tech companies that provide the space center with services and equipment. Further, Texas has long been a leader in the research- and development-intensive oil and gas, chemicals and petroleum refining industries.

More recently, Texas has gained new players in its high-tech sector. Some of the larger firms with operations or headquarters in Texas include Compaq Computer, Cyrix, DSC Communications, Ericsson, Nokia, MCI, Samsung, PrimeCo and Applied Materials. But in

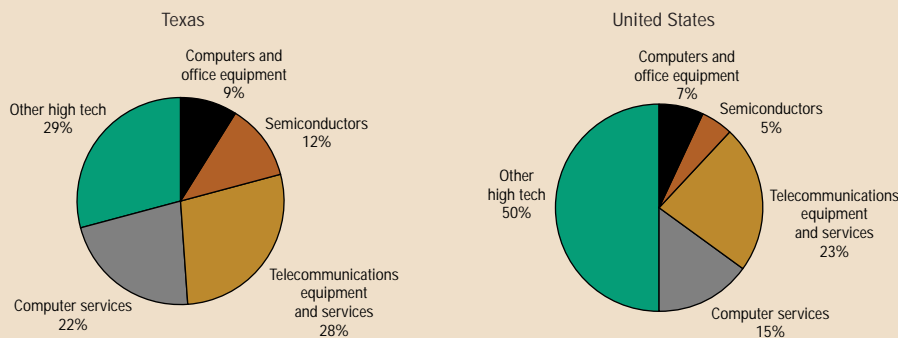
addition to these high-tech giants, scores of smaller companies have also expanded in Texas or made the state their home. Why are high-tech companies so taken with the Lone Star State?

There are many reasons that high-tech firms, as well as other types of businesses, find Texas an attractive place for relocation, expansion or start up. These factors include the state's central location and proximity to Mexico, easy access to commuter and cargo transportation, a relatively low cost of living and relatively low real estate prices, access to colleges and universities, and the state's business climate.

High-tech firms have also been attracted to Texas because other high-tech firms are already doing business there. Industry concentration, or clustering, benefits firms in several ways. Clustering creates a pooled labor market for workers with industry-specific skills. Both firms and workers benefit from a pooled labor market—the firm finds workers with special skills and the worker benefits from increased job availability and opportunity. Clustering also benefits firms by increasing the availability of industry suppliers and services, which may make an industry more efficient. Finally, because information flows more easily locally than over longer distances, industry clusters generate technological spillovers—or benefits that result from knowledge sharing between nearby firms.<sup>6</sup> A good example of an industrial cluster at work is the Richardson–Plano “telecom corridor,” which is home to more than 400 high-tech firms, including some of the world's largest telecommuni-

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**Chart 2**  
**Components of High-Tech Employment, 1995**



## Table 1 Survey Results

Factor in location decision	Average score*
Trained/educated workforce	1.33
Business environment	1.73
Cost of living	1.87
Close proximity to colleges or universities	1.93
Proximity to centers of transportation	2.03
Tax incentives	2.13
Location of suppliers or customers	2.27
Climate	2.93

\* Scores are based on the following categories: (1) very important, (2) moderately important, (3) somewhat important, and (4) not important.

cation and electronic equipment manufacturers, as well as many start-up companies that provide computer services and equipment to the industry.

The availability of skilled labor in Texas is also an important factor in high-tech firms' location decisions and one of the reasons high-tech firms have clustered in certain areas of the state. In an informal survey of several high-tech companies with operations in Texas, the skilled labor pool was ranked (on average) as the most important factor in the firms' decisions to operate there (*Table 1*). Because high-tech companies are expanding in Texas, technically skilled workers from other regions are attracted to the state, thereby expanding the state's skilled labor pool. In addition, high-tech companies are attracted to Texas because technical schools are available to train electronic technicians, and universities provide graduate programs in engineering. Synergies between high-tech companies and universities have also fostered growth in the industry and the skilled labor pool. For example, the Austin Technology Incubator at the University of Texas in Austin has helped small start-up companies gain their footing. Rochelle Communications Inc. and Metrowerks Inc. are two nationally recognized graduates of the Austin Technology Incubator.

To continue as a major player in the high-tech expansion, Texas must strive to increase its skilled labor force, either through migration or education. Many high-tech companies have joined forces with technical schools to offer a number of two- and four-year degrees

in high-tech fields.<sup>7</sup> In addition, employee satisfaction is becoming an important standard for high-tech companies that hope to attract and retain highly skilled workers. For example, Nortel in Richardson allows workers to telecommute from home and has a department that monitors employee and customer satisfaction.

As *Table 1* indicates, other factors that rank near the top in high-tech firms' location decisions include the state's business climate and a relatively low cost of living. A state's business

climate includes tax burdens—a category where Texas ranks relatively low. In addition, utilities, home prices, and office and apartment rents are relatively lower in Texas than in other parts of the country, making workers and companies better off here than in more expensive states. For instance, a house that costs \$500,000 in Palo Alto, California, could be found in Austin for \$150,000.<sup>8</sup>

There was no consensus among survey respondents on specific factors restraining high-tech expansion in Texas, but concerns were voiced about tight labor markets for skilled workers and rising real estate prices. Furthermore, several surveyed firms were concerned about proposed changes to the state's tax structure.<sup>9</sup> (See the box entitled "Venture Capital in Texas.")

## Indirect Effects of the High-Tech Boom

The high-tech expansion has had an indirect impact on the state's economy, by keeping other industries humming. Perhaps one of the best examples of

## Venture Capital in Texas

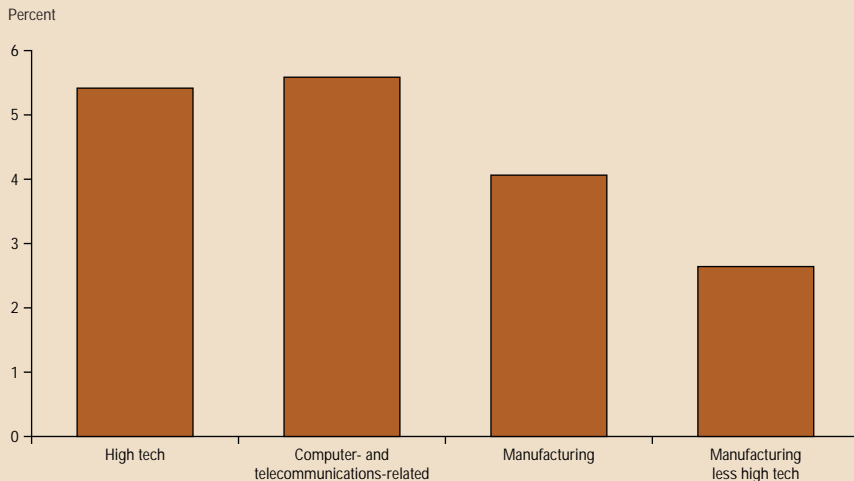
Venture capital is not cited as one of the major reasons companies locate in Texas, yet it is rising in importance. According to a Price Waterhouse survey, which divides the nation into regions, Texas ranked fifth in the amount of venture capital invested in 1996. Texas received 7 percent of the total venture capital invested last year, while Silicon Valley received 24.1 percent and New England 13.4 percent. Nevertheless, Texas' high-tech firms still benefited from growth in venture capital investment in the state. Between 1995 and 1996, the amount of venture capital invested in Texas grew 28.4 percent, slightly faster than the nation's 25.8 percent growth.<sup>1</sup> Of the 1996 venture capital deals in Texas, 57 percent of the deals and 42 percent of the dollars invested were in "high-tech" firms.<sup>2</sup>

In recent years, Texas, particularly Austin, has been successful in attracting more venture capital companies to locate offices in the state. Since 1992, nine venture capital companies have opened offices in Austin. In 1996, Silicon Valley Bank and Imperial Bank, which both act like venture capital companies in their lending practices to high-tech companies, opened offices in Austin. While these companies lend to all types of firms, their presence in Austin is primarily the result of the growing number of high-tech start-ups in the area.

<sup>1</sup> There is no direct comparison among regions because the regional definitions changed from 1995 to 1996 in the survey. "Topline Results Full Year 1996," *Price Waterhouse National Venture Capital Survey*, 1997.

<sup>2</sup> Price Waterhouse's definition of high tech differs from ours. The firm's includes: biotechnology, communications, computers and peripherals, electronics and instrumentation, environmental, medical instruments and devices, semiconductors and equipment, and software and information.

**Chart 3**  
**Texas Average Annual Wage Growth Per Employee, 1990–95**



the indirect effects is the impact on the state's construction and real estate industries.

Construction employment has risen strongly during the 1990s, as single-family home, apartment and even non-residential construction began to pick up. According to business contacts, much of the demand for properties has come from expanding high-tech firms and their employees. In addition, demand for office space began to increase, causing office vacancy rates to fall in several areas of the state, most notably in areas with a large concentration of high-tech industries. In Austin, for example, the office vacancy rate is at a 16-year low.<sup>10</sup> The construction industry has also benefited directly from high-tech plant expansions; about 3,000 construction workers will help build the Intel plant this summer.

Service industries, such as retail trade, have also benefited indirectly from the high-tech expansion, mainly due to growth in personal income. On average, wages in the high-tech industry have been growing faster than those in other industries (*Chart 3*), and high-tech workers in Texas earn 36 percent more than workers in non-high-tech manufacturing.<sup>11</sup> A study by the North Texas Commission suggests that relatively higher wages in high-tech industries makes these industries extremely important to a region's economic activity. The study reports that

in 1995, the \$6.2 billion in payroll received by Dallas/Fort Worth communications industry workers generated an additional \$1.8 billion in indirect earnings, making the industry's contribution to regional personal income more important than the contribution of the slightly larger health care and tourism industries.<sup>12</sup>

## Summary

In recent years, Texas has become a state known not only for oil and gas production and cattle ranching, but also for its concentration of high-tech companies. The high-tech sector has been one of the fastest-growing segments of the Texas economy in the 1990s, and its growth has benefited the state's economy indirectly by keeping other industries humming. The state's unique advantages should help it remain a beneficiary of the high-tech expansion. Synergies created by an already strong base of high-tech companies and access to colleges, universities and transportation should continue to attract firms to the state. In addition, its low cost of doing business should continue to make the state attractive to all types of businesses, including high tech. Because Texas' skilled labor pool seems to be one of the state's most important resources, educational excellence should be an ongoing goal for Texas. An ex-

panding pool of skilled workers will help keep Texas an important player in the knowledge-based economy of the future.

— D'Ann M. Petersen  
 Michelle Burchfiel

## Notes

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- <sup>1</sup> Mandel, Michael J., "Just How Big Is High Tech?" *Business Week*, March 31, 1997, p. 68.
- <sup>2</sup> Computer- and telecommunications-related employment is comprised of SIC 357, 361, 365, 366, 367, 369, 481 and 737. Based on our definition of high tech (which includes computer- and telecommunications-related employment and pharmaceuticals and drugs; electrical industrial apparatus manufacturing; medical, measuring, and controlling instruments manufacturing; photographic equipment and supplies manufacturing; and research and development employment), Texas ranks third in the number of high-tech jobs, behind California and New York.
- <sup>3</sup> Our employment and wage data were provided by the Bureau of Labor Statistics. The data are establishment-based rather than occupation-based. Thus, the data exclude high-tech workers in non-high-tech industries, such as a computer programmer working at the Dallas Fed. Because of this classification of workers, our data underestimate the "total" number of high-tech jobs.
- <sup>4</sup> For more detailed information on the growth of these industries, see D'Ann Petersen and Michelle Thomas (Burchfiel), "From Crude Oil to Computer Chips: How Technology Is Changing the Texas Economy," Federal Reserve Bank of Dallas *Southwest Economy*, Issue 6, 1995.
- <sup>5</sup> For further discussion see Sheila Dolmas and Mine Yücel, "The Texas Economy: An Overview of '96 and Outlook for '97," Federal Reserve Bank of Dallas *Southwest Economy*, Issue 1, January/February 1997.
- <sup>6</sup> For a thorough explanation of why firms cluster in certain locations, see Paul Krugman (1991) *Geography and Trade*, (Cambridge, Mass.: MIT Press).
- <sup>7</sup> See the North Texas Commission's "The Communications/Information Industry in Dallas/Fort Worth," November 1996, for a review of educational programs related to the telecommunications industry in Dallas and Fort Worth.
- <sup>8</sup> "A Survey of Silicon Valley," *The Economist*, March 29, 1997.
- <sup>9</sup> For examples of how businesses and households would fare under a proposed tax plan, see Michael Totty's article, "Under Tax Plan, Homeowners Get a Break—But Business Takes a Hit," *Wall Street Journal*, March 19, 1997, p. T1.
- <sup>10</sup> Source: CB Commercial Real Estate Service.
- <sup>11</sup> Our data cover through the year 1995. This is the most recent data available at the level of detail used in our definition of high tech.
- <sup>12</sup> See "The Communications/Information Industry in Dallas/Fort Worth," North Texas Commission, November 1996.