

on to other areas of employment. The rise of the service sector has been called the *post-industrial revolution*, a twentieth-century phenomenon as fundamental as the nineteenth-century shift from an agricultural to an industrial economy.

The national economy became post-industrial sometime around 1956, when for the first time more than half the nation's workers were employed in service industries. California reached this crossover point far earlier. By the 1920s, over half of all Californians in the workforce were employed in the service sector. The tertiary sector had grown to nearly 70 percent by 1970, far outdistancing the secondary sector, which accounted for only 27 percent of the labor force, and the primary sector, which had fallen to about 3 percent.

In spite of the predominance of the service industries, it would be premature to conclude that manufacturing was no longer an important part of the California economy. Indeed, California continued to lead the nation in employment in manufacturing and remained the number one industrial state, ranking first in almost every general manufacturing category.

High Technology

The key factor in the economic transformation of California has been technological innovation. Technology was the driving force of the post-industrial revolution, just as it had been for the earlier transformation of the nation from an agricultural to an industrial society.

Technology in California has been bolstered by successive waves of foreign-aid-style support from the federal government. The massive federal spending in the state during World War II continued after the war, and thus Washington helped finance the postwar economic expansion of California just as it did that of Japan and Germany. The influx of federal aid tended to concentrate in California the most sophisticated technologies as well as a high level of technical expertise.

In the decades since the end of World War II, the center of much of California's high-tech industry has been the Santa Clara Valley. Once known as the Valley of Heart's Delight (from the bucolic charms of its expansive fruit orchards), this 25-mile stretch of the San Francisco peninsula was rechristened in the early 1970s as Silicon Valley. Thirty years later it was the undisputed capital of the global New Economy. Los Angeles, Orange, and San Diego counties also emerged as major high-tech centers.

The person most responsible for the development of Silicon Valley was Frederick Terman, a professor of electrical engineering at Stanford University. Terman became disturbed that his students often had to leave the state in order to find jobs as engineers. He began to encourage his graduates to form their own companies near the university. Two of Terman's brightest young students, William Hewlett and David Packard, acted on his suggestion and formed an electronics company in a Palo Alto garage. From this humble beginning came one of the world's largest and most successful electronics firms. Terman also proposed that the university lease some of its vast real estate holdings to local industries. The proposal was accepted, and in 1951 Stanford Industrial (later Research) Park was created. The sleek, campuslike facilities of the park set a precedent for Silicon Valley industrial architecture.

Another important step in the evolution of California's high-tech industry was the formation of the Shockley Transistor Company in Palo Alto in 1956. Stanford professor William Shockley discovered the principle that made possible the transistor, a quantum leap forward in miniaturization. Transistors soon became the basis for a new generation of compact calculators, radios, televisions, and other electronic devices. The Shockley laboratories also experimented with the use of silicon as a semiconductor of electricity. When mixed with minute bits of other chemicals, silicon could transmit on-off electrical signals—the basis of all modern computers—at incredible speeds. In a process that would repeat itself many times in the years ahead, eight of Shockley's top engineers left the company in 1957 to form their own firm. The new company, Fairchild Semiconductor, became the valley's first viable semiconductor company.

The most significant technological breakthrough in the history of electronics was the introduction in 1959 of the integrated circuit, commonly known as "the chip." Made of silicon and measuring a mere quarter inch on a side, the earliest chips could hold more than a million electronic components. The microprocessor, or "computer on a chip," was a marvel of seemingly infinite capacity; the number of components that could be crammed onto a given area of silicon doubled every 18 to 24 months. This was the technical basis for the exponential increase in power and memory of an endless stream of upgraded computer products.

Demand for the latest marvels of California's technological wizardry was worldwide. High-tech products accounted for nearly half the state's total exports by the early twenty-first century.

California also emerged as the world's biotechnology capital. Biochemists at Stanford University in the early 1980s discovered key enzymes that allowed foreign genes to be spliced into other cells. This discovery paved the way for the first bioengineered drugs and gave birth to the biotech industry. Eventually, about a third of all genetic engineering companies were headquartered in California, far more than in any other state. The largest biotech cluster was in the San Francisco Bay area, followed by Los Angeles and Orange counties. Biotechnology achieved a major breakthrough in 2000 when geneticists completed a preliminary mapping of the human genome, the complex genetic code that influences every aspect of human development. Four years later California voters approved an initiative to create the largest stem cell research program in the country, expanding biotech jobs and offering hope that cures someday might be found for Parkinson's, Alzheimer's, and other diseases. The initiative campaign was boosted by the support of actors Michael J. Fox, a victim of Parkinson's, and the late Christopher Reeve, paralyzed from a riding accident.

The success of California's high-tech industry rested on a unique combination of factors. Foremost was the contribution of the state's colleges and universities. California's leading institutions of higher education—including Stanford University, the University of California, and the California Institute of Technology—established themselves as centers for the most advanced work in the natural sciences, mathematics, chemistry, physics, and engineering. The universities provided the ideas and the technical knowledge necessary for technological innovation.

A second factor in the rise of California high technology was the ready availability of capital. Not only was the federal government pumping billions of dollars