BACKGROUND REPORT ON SILICON VALLEY

prepared for the
U.S. Commission on Civil Rights

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OVERVIEW

At a time when basic industries in the United States are in decline, officials and planners throughout the country are looking to high technology electronics as the source of future economic activity, employment, and tax revenue. The outlook of the Tennessee Governor's Task Force on high technology is representative: "Most of the new jobs that will be developed in the 1980s and 1990s will be in the high technology industries. High technology is the wave of the future."[1]

Santa Clara County, California, which has experienced rapid economic expansion in the last two decades, is seen as a model. The area is universally known as Silicon Valley, because so many companies there manufacture silicon-based semiconductors. Governors, mayors, and Chambers of Commerce flock to Silicon Valley to evaluate the area's success and entice the region's high technology companies. They have designated their areas Silicon Valley East, Silicon Beach, Silicon Desert, Silicon Mountain, etc.

Silicon Valley still hosts the greatest concentration of high technology business. More important, it remains unrivaled as a breeding ground for small, innovative enterprises.

What is High Technology?

High technology industry can be defined in many ways. Conceptually, it refers to economic sectors dependent primarily

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[1] "Technology Corridor," Governor's Task Force Report, State of Tennessee, June, 1982, p. iv.

on scientific and technical innovation. Within the field of electronics, it includes computers and computer peripheral equipment (magnetic storage, terminals, printers, etc.); semiconductor components; and industrial, production, and optical instruments. It includes telecommunications equipment, ranging from satellites to switchboards, but it does not include consumer-oriented communications devices such as radios and televisions. Outside of electronics, it includes aerospace and the infant industries of photovoltaics (energy from sunlight) and biotechnology, but most studies ignore those last two fields because few people are employed in production in those industries.

The two most sought after high technology industries are semiconductors and computers; they are seen as the keys unlocking a wide spectrum of economic activity. Computers and other data processing equipment are the tools of all high technology research and production. Semiconductors - particularly integrated circuits ("chips") - are the universal building blocks.

In fact, computers and semiconductors are evolving into a single industry. IBM, the computer giant, is the world's largest producer of chips, which it assembles into its own computers. Intel, the most innovative semiconductor-maker, is now building specialized data processing systems. Motorola, a top marketer of semiconductors, just purchased Four Phase Systems, a small but growing manufacturer of computers.

Although Japanese companies are becoming increasingly competitive, U.S.-based computer and chip manufacturers dominate the

world market. Though the U.S. military was the original major customer for integrated circuits, buying some 70% of output in 1965, the Pentagon share had fallen to 7% in 1978.[2] Today chips are found in virtually every type of industrial product, including cameras, cars, cash registers, and computers. Computer-makers buy about one third of the chips produced today. Other major customers are consumer electronics manufacturers, industrial equipment builders, telecommunications companies, and auto manufacturers.[3]

The semiconductor industry itself consists of several, overlapping segments. Best known are the forty-odd "merchant" producers, such as Texas Instruments, Motorola, National Semiconductor, and Intel, which sell semiconductors on the open market. The small merchant firms that built the semiconductor market have grown and merged with larger companies. Ten multinational corporations produce 81% of the open-market chips in the U.S.,[4] and a smaller number of large firms comprise the Japanese competition.

"Custom circuit" makers form a subset of the merchant producers. These companies produce chips based upon designs supplied by outside companies. Though many of the leading merchant firms do custom work, a number of smaller companies specialize in custom chips.

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[2] Leonard Weisberg, in Industrial Technology hearings, Senate Committee on Commerce, Science, and Transportation, October 30, 1978, pp. 74-75.

[3] Technical Ventures, Inc. (now VLSI Research), San Francisco Sunday Chronicle & Examiner, July 26, 1981.

[4] Mel Eklund and William Strauss, Status '82: A Report on Integrated Circuit Industry, Integrated Circuit Engineering, pp. 5,40.

Second, there are about twenty "captive" producers. These are large users of chips, such as IBM, Western Electric (AT&T) and Delco (GM), which produce chips for intra-company use.

Third, there are literally hundreds of suppliers and subcontractors serving every aspect of the industry. These range from major corporations like Perkin-Elmer and Fairchild/Schlumberger to mom-and-pop operations in Silicon Valley. This group includes a large number of subcontractors that carry out one step of semiconductor production, such as design or assembly.

Computers and related equipment, such as word processors, are also used throughout the economy. The most significant trend is the move from large, centralized "mainframe" computers to medium-sized "minicomputers" and desk-top "microcomputers." Mainframes constituted 83% of the market in 1975 and 60% in 1980, and they are expected to drop to a mere 36% in 1985.[5]

In computers, the smaller the system the greater the opportunity is for small and new companies to compete. For instance, there are more than 100 manufacturers of microcomputers in the U.S., and the industry is still growing. As small companies enter the market, they are much more likely than IBM to go to outside suppliers for peripheral equipment like video terminals and disk drives. Thus, there are a growing number of firms specializing in peripherals for small systems.

Chips and computers both rely on software, or programming, to function. Each new application requires new software, adapted to a variety of hardware (computers). Consequently, software

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5 "Moving Away From Mainframes," Business Week, February 15, 1982, pp. 78-80.

production - usually considered a service - is one of the most rapidly growing sectors of high technology. Today there are about a half million programmers, including systems analysts, in the U.S., and growth in all sectors is creating a need for 25,000 more each year.[6]

In the early years of the computer business, most programmers worked for large hardware houses, large corporate users, and a handful of independent software houses. Two factors have since stimulated the growth of small software outfits. First, under anti-trust pressure from the Federal government, IBM agreed to "unbundle" its products in 1969. Previously, software was marketed along with computer systems, and there was no way for outside vendors to compete. Second, the increased computing power of chips reduced the price of computers, and particularly with the spread of microcomputers, computers became accessible to anyone with an income.

Since programming requires little capital once machine access is assured, it is not difficult to set up independent software businesses - high school students in Silicon Valley have done exactly that.[7] There are reportedly more than 10,000 software consultants in the San Francisco Bay Area.[8]

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[6] Through 1990, according to the Federal Bureau of Labor Statistics, cited in "Jobs for Programmers Begin to Disappear," Business Week, August 16, 1982. Daniel Hiltz, "The Growing DP Job Market, Datamation, April, 1981, p 219. Business Week points out that industry is seeking experienced, not entry-level programmers.

[7] Kathy Holub, "The Whiz Kids," San Jose Mercury News, August 1982

[8] San Francisco Chronicle, October 18, 1981

In addition, there are 4,000 to 4,500 independent software houses nationwide.[9] Though these ventures may subcontract, like the independent consultants, most market their own products. It is in the field of marketing, not programming, that software houses require substantial capital. It is not surprising, therefore, that the software industry still includes independent houses and chip and computer manufacturers that employ hundreds of programmers.

Small independents have established their most successful niche in the microcomputer industry. Early micro builders did not have the resources to meet the demand for software, so they spurred the development of a cottage industry linked by informal networks, such as phone-linked computer bulletin boards. When IBM, which historically developed software in house, introduced its first personal computer in 1981, it decided to rely almost exclusively on the independents for programs. Since IBM, with its reputation and sales force, is already a major force in microcomputers, that decision has given added impetus to the independent software industry.[10]

By definition high-technology companies employ a large number of scientists or engineers, but they also employ a large number of relatively unskilled production workers. The manufacture of computers, instruments, and telecommunications equipment relies heavily on the manual insertion of components such as

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[9] New York Times, January 8, 1981

[10] John Markoff, "Cottage Industry Blossoms around IBM Micro," InfoWorld, December 14, 1981, p. 10; R. Colin Johnson, "IBM Elects to Buy Software Outside," Electronics, August 25, 1981, pp. 51-54

chips into printed circuit boards. Semiconductor assembly, the bonding of fine wires to chips of silicon embedded with microscopic circuit patterns, requires only good eyesight, reasonable dexterity, and a lot of patience. Even wafer fabrication, the chemical and photographic process of embedding those circuits, relies on semiskilled production employees.

Table 1. U.S. High Technology Mass Production Workforce, 1980[11]

Officials & Managers	11%
Professionals	17%
Technicians	11%
Sales Workers	1%
Office & Clerical Workers	12%
Craft Workers	10%
Operatives	32%
Laborers	4%
Service Workers	2%

[11] Based on EEO1 Surveys covering 1,572,757 employees in Standard Industrial Classifications 357 (computers/office machines), 366 (communications equipment), 367 (semiconductors and other components), and 381-383 (instruments). "1980 EEO1 Summary Report of Selected Establishments from the Technical Services Division, OSP, Equal Employment Opportunity Commission"

National Growth

Though growth in all high technology industries depends upon the state of the U.S. economy, most projections call for continued expansion. The Bureau of Labor Statistics, for instance, projects substantial growth:

Table 2. National High Tech Employment Forecasts[12]

	1979 Actual	1990 Low	1990 High
Computers & Peripherals	350,000	552,000	614,000
Telephone & Telegraph	169,000	201,000	231,000
Radio & Communications	357,000	424,000	433,000
Components	525,000	666,000	669,000
Other Electrical	180,000	174,000	211,000
Scientific Instruments	218,000	252,000	296,000

In deciding where to establish labs and factories, corporate officials generally survey the workforce in various localities, the availability of land, the reliability of infrastructure - power, transportation, etc. - and the proximity to suppliers, subcontractors, and customers. High tech companies are particularly interested in areas which have, or can attract highly educated professionals and, in the case of production, which have a cheap, unskilled workforce as well.

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[12] Valerie Personick, "The Outlook for Industry Output and Employment through 1990," Monthly Labor Review, August, 1981, p. 35. These categories represent a major portion of U.S. high-tech mass production, but there are other industrial classifications which include high tech and non-high tech as well. The "1990 Low" trend assumes that the total U.S. workforce will rise from 104.1 million in 1979 to 122.0 million in 1990. The "1990 High" trend (identified as high-trend version I in the BLS figures) assumes that the workforce will grow to 130.7 million.

High tech ventures, therefore, cluster near major centers of scientific training and research, such as Stanford University and the Harvard-MIT complex. Established companies seeking satellite sites evaluate the cost of living, proximity of educational institutions, and quality of life, including climate and availability of adult recreational facilities. Though research and development operations have the greatest need to be near centers of learning, many companies have built factories in small university communities, such as Corvallis, Oregon, to keep professionals in touch with academic life. New companies generally set up shop in areas pioneered by larger companies, where they can utilize a support structure of consultants, suppliers, and subcontractors as well as hire away topnotch personnel from the established firms.

Companies seek out cheap production labor when evaluating new production sites, choosing locations where the workforce is growing and labor unorganized. Thus, of twenty sites identified by Business Week as the home of new high-tech plants in 1980, thirteen were in the West and three were in the South.[13] The only organized semiconductor plants in the country are at captive producers like Western Electric.

In fact, high tech companies have pursued cheap labor around the globe. Every sizable merchant semiconductor firm has one or more assembly (bonding) plants in East Asian countries, including Thailand, Indonesia, Singapore, Malaysia, the Philippines, Hong Kong, Taiwan, and South Korea. Labor costs in the Philippines,

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13 "More Elbowroom for the Electronics Industry," Business Week, March 10, 1980, pp. 94-100.

the greatest growth area, are about one tenth of non-union labor costs in the U.S. Equipment manufacturers ship out a portion of their printed circuit assembly to Asia and Mexico as well.[14] Companies which officially follow non-discriminatory hiring policies in the U.S. routinely specify that they want young, single women as assemblers at their "offshore" plants.

Other factors, such as the availability of electrical power, sewage treatment, and air transportation also influence company site decisions. Companies favor localities with low local tax rates, but not at the expense of education, vocational training, or infrastructure.

Centers of Growth

High technology plants are scattered across the country. In addition to Silicon Valley and Massachusetts' Route 128, there are thriving aerospace centers in Los Angeles County and Long Island. Many areas, such as Dallas, Colorado Springs, North Carolina's Research Triangle, and Roseville, California (near Sacramento) have attracted divisions of major firms, but most have a limited amount of entrepreneurial activity. State governments including Maryland, Hawaii, New Mexico, and now Tennessee have set up programs to recruit high technology firms. In fact, in virtually every region of the U.S. there is a move to attract high technology companies.

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[14] See Lenny Siegel, "Delicate Bonds," Pacific Research, First Quarter, 1980; Semiconductor International, February, 1982; Electronics, April 21,1982

The Boston area rivals Silicon Valley as the oldest high-technology center in the U.S. Though MIT helped create a research-oriented industrial park called Technology Square in 1950, the development of high tech companies along Route 128 was not planned. University scientists established firms on their own and attracted engineers from the local campuses. For instance, two MIT engineers left campus research posts in 1957 to form the Digital Equipment Corporation (DEC). Today DEC is the world's leading manufacturer of minicomputers and one of the state's largest employers.

North Carolina's less developed high tech industrial area is, on the other hand, the product of conscious planning. In 1958 the state government and the private sector combined forces to create a research park and research institute at a site equidistant from universities in Durham, Raleigh, and Chapel Hill. Considering those three institutions the corners of a triangle, they named the park and institute Research Triangle. Though it took many years for the Park to succeed, today it hosts thirty-one companies employing over 20,000 people.[15] In May, 1982, Governor Jim Hunt led groundbreaking ceremonies at the research park for the non-profit Microelectronics Center of North Carolina, backed by a $24 million state appropriation to attract high technology firms to the state.

The Dallas-Fort Worth metropolitan area is a center of high technology electronics because it is home to Texas Instruments

[15] The Tennessee Governor's Task Force Report, pp. 9-10, summarizes the North Carolina approach, which the task force adopted as a model.

(TI), the largest merchant supplier of semiconductors. TI is based in Dallas because it began as an oil exploration firm. The other major semiconductor operation based in the Dallas area, Mostek, is a TI spin-off. Electronics is the largest manufacturing employer in the Dallas-Fort Worth area.[16]

High technology centers in Arizona, New Mexico, and Texas tell of their low cost of living. Colorado Springs brags of its natural beauty. Silicon Valley is perhaps the most successful, but its success has brought "overcrowding", a housing shortage, and other problems which are leading many established Valley firms to expand elsewhere.

[16] Wesley Iversen, "Companies Plug in to Texas," Electronics, January 31, 1980, p. 69

SILICON VALLEY

A Community of Technical Scholars

Silicon Valley, the belt of industrial development along the southern edge of the San Francisco Bay, is not only the nation's largest concentration of high technology industry, with 200,000 in its high-tech workforce. But it is the most dynamic, called by Fortune "California's Great Breeding Ground for Industry."[17]

Though Stanford University and a horde of entrepreneurs have been the lead players in the development of the Valley's high tech industry, Federal policy has played an important role in both the formation and structuring of the industry. The Valley's architect was Frederick Terman, Jr., Stanford's Provost and Dean of Engineering. Terman envisioned a "Community of Technical Scholars" around the sprawling, Palo Alto campus of the private university, and he used the resources at his disposal to build it.

During the thirties Terman helped Stanford graduates form at least two local electronics firms, including Hewlett-Packard, but his real achievements began after World War II. Returning to Stanford after a stint at Harvard's Radio Research Laboratory, Terman recruited several promising engineers to build the university's electrical engineering department into one of the best in the nation.

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[17] Gene Bylinsky, "California's Great Breeding Ground for Industry," Fortune, June, 1974, pp. 128 ff.

Under Terman's leadership, Stanford attracted research funds from the Pentagon, further strengthening its high technology departments. Military electronics procurement enabled Stanford scientists to establish new local firms, such as Watkins-Johnson and Applied Technology, now a division of Itek.

Beginning 1951, Stanford leased land to the electronics corporations that had spun off from its departments, formally inaugurating the campus-like Stanford Industrial Park in 1954. Park companies, such as Hewlett-Packard, Varian, Applied Tech, and Watkins-Johnson developed a symbiotic relationship with Stanford. The companies hired university faculty as consultants and university graduates as employees. They sent their employees to continuing education programs at Stanford, eventually building a specialized instructional network with the Engineering school. Stanford not only earns rent from the land, but industrial park companies have historically made substantial contributions to the Stanford programs of their preference.

Local firms had little trouble keeping Stanford graduates in the area or attracting other professionals from across the country. Silicon Valley has a pleasant climate, suburban lifestyle, and an intellectual spirit kept alive by Stanford, the Jesuit-run University of Santa Clara, and the state-run San Jose State University. It is within driving distance of cosmopolitan San Francisco, the North Bay wine country, the Sierras, and beach towns like Carmel and Santa Cruz.

As the Stanford complex grew, it attracted electronics giants from across the country, such as Sylvania (now part of

GT&E) and Philco (now Ford Aerospace). When Lockheed set up a laboratory in the Stanford Industrial Park in 1956, it found the area so much to its liking that it established its new Missiles and Space division in nearby Sunnyvale the following year. Lockheed is presently the largest private employer in the Valley, with over 21,000 employees at its Sunnyvale plant alone.[18]

Demonstrations against the Vietnam War caused the reduction of campus war research in the late 1960's, but Silicon Valley still remains a center for high-technology military contracting. In fiscal year 1980 the Valley took in $2.7 billion in Pentagon contracts. Though Lockheed, which builds the Trident missile, is the largest local military contractor, electronics accounts for nearly half of the local prime contracts.[19] When unrecorded subcontracts are considered, the Valley's share of the military budget is even higher.[20]

Semiconductor Family Tree

While Terman was returning to Stanford, Palo Alto native and Stanford graduate William Shockley was leading a research team at the Bell Telephone Laboratories, then in New York City. Utilizing

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[18] For a more detailed description of the growth of the Stanford complex, see The Promised Land, Grass Roots, 1970.

[19] Carol Manahan, "The Santa Clara Valley," Plowshare Press, January-February, 1982, p. 5

[20] Based on 1979 data, the California Governor's Office of Economic Policy, Planning and Research, concluded that California receives substantially more in subcontracts from out-of-state prime contractors than it loses in out-of-state subcontracts from California prime contractors. ("The Effect of Increased Military Spending in California," May 19, 1982). Since Silicon Valley firms supply electronic devices and equipment to military prime contractors, it is likely that Pentagon statistics understate the local dependence on military spending.

solid-state physics research funded by the U.S. government during World War II, Shockley's team developed the first transistor in December, 1947.[21]

Bell Labs licensed its transistor patents, as well as its other inventions, to a number of manufacturers. In fact, the phone company's research arm actively disseminated the technology. Electronics suggests that Bell Labs considered this the best way to encourage further development, for eventual use by AT&T.[22] Brookings scholar John Tilton, however, links the spread of transistor technology to anti-trust proceedings brought by the U.S. Justice Department against AT&T in 1949. Justice wanted to separate Bell Labs (as well as manufacturing branch Western Electric) from AT&T's operating companies, and it eventually won a liberal licensing requirement in its 1956 consent decree.[23]

Bell not only made the technology directly available, but by doing so it freed Shockley and others, such as Gordon Teal - a Bell Labs alumnus who set up Texas Instruments' semiconductor operation - to spread the technology. It also established a practice - the widespread licensing of new technology - which is followed by semiconductor firms to this day. It is ironic that the world's largest corporation, AT&T, sparked the growth of an industry noted for small, innovative ventures. But as a Bell labs official noted, "Without Bell Labs, there would be no Silicon

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[21] "The Solid State Era," Electronics, April 17, 1980, pp. 215, ff.

[22] ibid., p. 236.

[23] John Tilton, International Diffusion of Technology: The Case of Semiconductors, Brookings Institution, 1971, pp. 76-77.

Valley."[24]

Shockley returned to Palo Alto in 1955, with the backing of Beckman Instruments, to form Shockley Transistor Corp., but the company accomplished little. Disappointed in Shockley's management, eight young employees contacted Fairchild Camera and Instruments, then based on the East Coast, and established Fairchild's semiconductor division in nearby Mountain View. Fairchild became an industry leader, while the Nobel-prize winning Shockley went into eugenics.

The "traitorous eight," as Shockley called them, not only established a new company. They set a pattern. Nearly all the semiconductor producers in Silicon Valley, including National Semiconductor, Intel, Signetics, and Advanced Micro Devices, can trace their ancestry to Fairchild.[25]

From the formation of Fairchild Semiconductor, scientists, engineers, and managers in Silicon Valley have set up their own companies when their employers were unable to satisfy their creative or financial needs. The Fairchild eight were the first of a new breed of technological entrepreneurs, who struggle to avoid outside control over their business activities, be it from government, unions, or multinational industrial corporations and banks.

Around the valley, a venture capital industry grew up to finance such spin-offs. While Fairchild founders Robert Noyce and

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[24] Vice-president for research Arno Penzias, quoted in "Bell Labs: The Threatened Star of U.S. Research," Business Week, July 5, 1982, p. 47

[25] Don Hoefler, "Silicon Valley - U.S.A.," Electronics News, January 11, January 18, and January 25, 1971

Gordon Moore went to venture capitalist Arthur Rock for funds to start Intel in 1968, another founder, Eugene Kleiner, became a venture capitalist. These and other financiers, specializing in risky high-tech ventures, not only funded semiconductor firms, but firms such as Apple Computer, Atari, and laser-maker Spectra-Physics.

Gradually, a network of support industries and consultants developed. Scientist and engineers with attractive ideas not only could find financial backing, but they could initiate operations with little more than a rented roof and a telephone. Silicon Valley provided lawyers, accountants, graphics specialists, and personnel consultants specializing in high tech. Subcontractors hired out to do assembly.

The spin-off phenomenon spread into less glamorous segments of the industry. Just as engineers spun off their own semiconductor and computer firms, graphics artists, assembly supervisors, and public relations employees set up their own firms. Since these support industries did not require sums of money on the order provided by venture capitalists - a minimum of $250,000 in 1981 - they turned to personal financing - mortgages, family investments, etc. for seed money.

During the 1970's, the semiconductor industry matured. Its capital requirements increased. While Monolithic Memories needed only $2.5 million to start up in 1969, a similar firm would have cost more than ten times as much to start up ten years later.[26] The only new chip-maker to emerge in that period, Zilog, was backed by oil giant Exxon.

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[26] Company founder Zeev Drori, testifying at Senate Industrial Technology hearings, p. 45.

Unable to raise capital directly, many chip-makers reluctantly agreed to purchases by multinational electronics and equipment firms. Philips, the Dutch electronics giant, bought Signetics in 1975. French oilfield instrument-maker Schlumberger bought Fairchild in 1979. GE bought Intersil in 1980. Gould, a U.S. electronics and instrument producer, failed in its early attempts to buy a semiconductor firm before settling on American Microsystems in late 1981.

Silicon Valley's leaders bemoaned the decline of entrepreneurial innovation, and they blamed the increase in the capital gains tax passed by Congress in 1969. Since venture capitalists make most of their money in capital gains, they argued that the Federal government had dried up their sources of capital. In addition, they noted that high capital gains taxes made it difficult to use stock options to attract managers and engineers to new firms.

Electronics entrepreneurs argued that without venture capital, the industry would be stifled. The industry would come more under the control of less innovative, large multinational corporations. It is clear that the merger method of financing was less desirable to Silicon Valley's high tech geniuses, who value the income and freedom that comes with running one's own firm. But it can also be argued that the resources of big firms have enabled companies to engage in long-term development projects - such as Bell Labs' transistor and laser research - not supported by small firms committed to making money fast.

Led by the American Electronics Assocation (AEA), the industry won. Congress reduced the capital gains rate from 49% to 28% in 1978, releasing a flood of venture capital.[27] Nationally, investors have poured $1.6 billion into high tech ventures since 1979.[28]

Venture capitalists funded about a dozen new semiconductor firms in the past three years. Most of these firms were spin-offs from established companies like Fairchild (LSI Logic), National (Linear Technology), and Intel (Seeq), but at this point they are not major competitors. These new chip-makers have avoided the problem of raising the $50 million minimum necessary to organize an integrated semiconductor firm - that is, one conducting design, wafer fabrication, and assembly - by subcontracting out to their larger competitors for production. Should they successfully market their early products, they will either attempt to raise funds through stock sales or by selling out to major electronics firms that are seeking access to semiconductor technology.

A majority of the 1980's start-ups have occurred in other fields, such as computers, peripherals, software, biotechnology,[29] and other fields requiring less capital than semiconductor production. The San Jose Mercury reported that more than seventy firms in Silicon Valley and adjacent

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[27] "Time is Ripe for Entrepreneurs," p. 93; Steiger amendment to the Revenue Act of 1978 (Public Law 95-600).

[28] "A Chill Grips High-Tech Venture Money," Business Week, August 23, 1982, p. 91

[29] There are so many research-oriented biotechnology start-ups in Silicon Valley, taking advantage of pioneer gene-splicing work done at both Stanford and the University of California, that some have started calling the area "Siliclone Valley."

communities had received about $165 million in venture capital in the first half of 1982. Most of those firms were recent start-ups.[30]

For several years, established Silicon Valley firms have been setting up satellite factories in other parts of the U.S., in areas where housing is cheaper, the roads less congested, and labor equally cheap. But the new start-ups would not think of leaving Silicon Valley, with its experienced workforce of professionals and production workers and its network of consultants, subcontractors, financiers, and support industries.

A Variety of Communities

Silicon Valley is usually identified with Santa Clara County, since the bulk of the area's high technology industry is situated in the northern reaches of that County. However, the southern section of the County, including Gilroy, the "Garlic capital of the world," is still primarily agricultural. And some of the earliest high technology firms in the area, including the Stanford Research Institute, Ampex, and Varian's Eimac division, are located just to the north in the southern portion of San Mateo County.

Unincorporated East Palo Alto and the eastern section of Menlo Park, just across the County line from Palo Alto and Stanford, form the only predominantly black community in Silicon Valley, but they are frequently ignored in studies of the Valley because they are outside the County. Like other documents, this

[30] Evelyn Richards, San Jose Mercury, August 30, 1982, pp. 1D,3D.

background report will often present data of Santa Clara County alone, because that is the way data are collected. But when applicable, it analyzes the situation in southern San Mateo County as well.[31]

Silicon Valley has grown rapidly since World War II, and its population has experienced a rapid rise in income. The population of Santa Clara County jumped from 291,000 in 1950 to 1,295,000 in 1980. The County is reportedly home to more than 3,000 millionaires.[32]

In shifting from an agriculturally oriented community to the world's leading high technology center, the minority population increased. Chicanos and others of Latin descent made up 12.2% of the population in 1950 and 17.5% in 1980. The small black population rose from 0.6% to 3.4%. The Asian population rose from 2.6% to 7.7%. 1980 census figures distinguishing between Asian ethnic groups are not yet available, but it is clear that Filipinos and Indochinese represent the greatest increase. There are an estimated 20,000 to 35,000 Vietnamese in Santa Clara County.[33]

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[31] Santa Clara County is not only a County, but a Standard Metropolitan Statistical Area (SMSA). San Mateo County, which extends all the way from San Francisco to Palo Alto, and even further down the coast, is part of the SMSA that includes San Francisco and Oakland.

[32] Valley Living (Sun Newspapers), April 1-2, 1980, p. A-1.

[33] Mark Johnson and Joanne Grant, "A Troubled Past, an Uncertain Future," San Jose Mercury News, April 5, 1981, p. 1A

Table 3. Santa Clara County Race/Ethnic Population Trends[34]

	Total	White	Black	Asian	Other	(Hispanic)
1950	290,547	280,429	1,718	7,464	936	(35,306)
1960	642,315	621,625	4,187	15,159	1,344	(77,755)
1970	1,064,714	1,003,898	18,090	31,189	11,537	(186,525)
1980	1,295,071	1,017,855	43,715	99,935	133,566	(226,611)

More importantly, geographical and economic differences also grew with the Valley. Wealthy, educated whites clustered in the Palo Alto area and the foothills of both counties. Less affluent residents, including most minorities, concentrated in flatlands communities like East Palo Alto and Mountain View and in San Jose.

[34] U.S. Census of Population; "1980 San Francisco Bay Region Population by Race and Spanish Origin: Changes in the City Populations, 1980-1980," Census Data Bulletin No. 3, Association of Bay Area Governments, July, 1981, Appendix, p. 7; John Frederick Keller, "The Production Workers in Electronics: Industrialization and Labor Development in California's Santa Clara Valley," Ph.D. Dissertation, University of Michigan, 1981, p. 31. Note that the definition of Hispanic has changed with the various censuses. Hispanics may be of any race, which perhaps explains the large increase in the 1980 "Other" category. "Other" also includes Asians unspecified in the census questionnaire, such as Laotians and Cambodians.

Table 4. Population and Minorities by Community[35]

	Population	Minorities
Santa Clara County		
Campbell	27,067	15.6%
Cupertino	34,414	13.1%
Gilroy	21,641	49.7%
Los Altos	25,769	7.9%
Los Altos Hills	7,421	8.6%
Los Gatos	26,593	7.6%
Milpitas	37,820	37.2%
Monte Sereno	3,434	8.6%
Morgan Hill	17,060	29.4%
Mountain View	58,655	26.8%
Palo Alto	55,225	13.6%
San Jose	629,456	35.8%
Santa Clara	87,746	26.2%
Saratoga	29,261	8.1%
Sunnyvale	106,618	25.3%
unincorporated	128,441	
South San Mateo County		
Atherton	7,797	8.0%
Belmont	24,505	14.1%
Menlo Park	25,369	23.9%
Redwood City	54,951	22.9%
San Carlos	24,710	9.9%
unincorporated		
East Palo Alto	18,191	80.7%
North Fair Oaks	10,308	50.2%

Santa Clara County consists of 15 cities and scattered unincorporated areas, including much of Stanford University. High-tech industrial activity is concentrated in the North County cities of Palo Alto (including the Stanford Industrial Park), Mountain View, Cupertino, Sunnyvale, and Santa Clara. Though IBM, with more than 12,000 employees today, has been in south San Jose since 1956, the main belt of industrial activity has spread into north San Jose only in the past few years. Within southern San Mateo County, there are major high tech firms in Menlo Park, Redwood City, San Carlos, and Belmont.

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[35] U.S. Census of Population; Santa Clara County and San Mateo County Planning Departments

Local government policy dealing with high tech is decided in many places. Each community has its own priorities, and its own insistence on local control, so sub-regional government is politically infeasible. In 1979, a County-backed task force proposed fundamental revisions in local government, providing for more centralized planning authority, but the the municipalities rejected the suggestion.[36] Present inter-city organizations, such as the Inter-Governmental Council, provide a forum but have no power.

In addition, numerous elementary school, secondary school, unified (elementary and secondary), and community college districts, each with elected Board, serve Silicon Valley. The boundaries, in general, do not match city boundaries. The Los Altos elementary school district, for instance, serves a large chunk of Mountain View. There are ten separate elementary school districts based in San Jose. The County Board of Education exercises limited oversight.

Furthermore, the County has a number of special districts, providing hospital, fire, water, and other services to unincorporated areas or combinations of cities.

As part of the nine-county Bay Area, Silicon Valley is served by a number of regional agencies with specific authority, including the Air Quality Management District, the Bay Conservation and Development Commission, the Metropolitan Transportation Commission, and the Regional Water Quality Control Board. These agencies, in addition to State and Federal bodies, oversee

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36 "Living Within Our Limits," Report of the Santa Clara County Industry and Housing Management Task Force, November, 1979

environmental policy and infrastructure investment. In monitoring Federal funds for the region, they are joined by the region's council of governments, the Association of Bay Area Governments. Each agency is governed by a board consisting of state appointees and representatives of local governments from throughout the Bay Area. Solving Silicon Valley's problems thus requires the cooperation of agencies with diverse political interests, and despite its industrial success, Silicon Valley has its share of problems.

Problems Amid Promise

There is a tendency, across the country, to view high technology industry as a panacea. Newspapers describe Silicon Valley as a place where everyone drives a Porsche, ultra-clean factories look like modernistic college campuses, and social problems are remote. In fact, the rapid growth of Silicon Valley has created a number of problems along with the thousands of jobs. While reaping the benefits, residents are also paying the financial and quality-of-life costs of growth.

Silicon Valley suffers from uneven development. The spatial organization is unlike that of most U.S. urban centers, but it appears to be characteristic of regions of high technology growth. In mature urban centers like New York, San Francisco, and Baltimore, employment is concentrated in older, central areas. Commuters, in general, are well paid professionals. In Silicon Valley, however, employment is concentrated in suburbs - Palo Alto, Mountain View, Sunnyvale, and Santa Clara. Not

suffering from urban decay, these cities have attracted the engineers and other professionals of Silicon Valley, who wish to live near their workplaces. The bulk of the production workforce commutes from San Jose.

Since these communities have zoned land to provide many more jobs than places to live, employees commute great distances to work. This is particularly a problem for low paid production workers, who have trouble meeting the costs of commuting. Since many are the mothers of small children, the commute puts a strain on working families. Organized child care, particularly at rates affordable by industrial workers, is scarce.

The geographical imbalance between jobs and housing has made itself felt as a housing shortage. Employees, in general, want to live near their jobs, so the demand, particularly near employment centers, has driven up the cost of housing. Housing prices and rents are among the highest in the nation. Costs are highest in exclusive hillside communities, but industrial cities with a surplus of jobs over housing follow closely behind.

Moderate, low, and fixed income people, including many minorities, are being forced from northern Santa Clara County by the high cost of living. Condominium conversions cut deeply into northern Santa Clara County rental housing stock until stifled by stiff local regulations.[37]

The housing shortage in Silicon Valley became so critical by 1977 that even industrial leaders and County planners discovered

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[37] Mountain View voters enacted a tenant-backed initiative proposition to control conversions in 1979 after the City Council had approved the conversion of more than 1500 units in one year. Neighboring city councils then enacted controls of their own.

it.[38] By that time the "jobs-housing imbalance," as they labeled it, was not only having an impact on production workers. Companies were finding it difficult to recruit engineers from other parts of the country, since one could buy a mansion in Maine for the cost of a Santa Clara County condominium.

Since that report, both industry and government have conducted several more studies, but relatively little has been done to ameliorate the situation. Mountain View has increased the allowable density in a few areas. Sunnyvale has re-designated 121 acres of industrial land for residential development, but northern Santa Clara County industrial growth continues much faster than the housing stock's ability to accommodate it. Each city wants the others to provide housing. Industry, through the Santa Clara County Manufacturing Group,[39] endorses the principle of rezoning industrial land for housing, but individual companies are reluctant to give up their own expansion plans. New employees either commute greater distances or crowd into small houses and apartments near industrial parks.

There is a tendency, in Silicon Valley, to blame the imbalance of jobs and housing on the planning priorities of northern Santa Clara County cities, but in fact similar problems are likely to emerge in new centers of high technology industrial growth, unless communities plan carefully to avoid them.

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[38] "Housing: A Call to Action," A Report from the Santa Clara County Housing Task Force, October, 1977

[39] "The Manufacturing Group, formed in 1978, is an association of 67 companies [nearly all high technology] in Santa Clara County that employ more than half the county's manufacturing workforce. The Board of Directors consists of 18 chief executive officers . . .", The Monitor, League of Women Voters of the Bay Area, October, 1980

Companies, especially new and small ones, benefit from clustering. Only large firms like IBM or Hewlett-Packard can afford to establish facilities outside of major industrial parks, since they can supply support services internally. Since high tech companies attract well paid professionals from the national - and even international - employment market, there is a large segment of the workforce able to pay a premium for living close to their offices and plants. Unless planners provide for housing for the influx of engineers and for the poorly paid production workers, a housing shortage and/or geographical imbalance is likely.

Wealthy communities like Los Altos Hills can survive on the revenues generated by one-acre estates, but San Jose, home to half the county's residents, has ongoing financial problems. It must serve most of the area's poorer residents, but it does not have Palo Alto's industrial tax base.

Table 5. Assessed Valuation per Capita by City, Fiscal 1982[40]

Los Altos Hills	$49,674
Monte Sereno	$37,677
Palo Alto	$35,462
Los Altos	$33,949
Cupertino	$33,580
Saratoga	$33,032
Los Gatos	$31,545
Santa Clara	$31,335
Sunnyvale	$27,511
Mountain View	$26,845
Campbell	$25,445
Morgan Hill	$25,158
Milpitas	$22,460
San Jose	$20,801
Gilroy	$18,705

[40] Santa Clara County Assessor's Office

Cities also rely on sales tax, much of which is also generated directly by industrial activity. In 1979-80 , the Stanford Industrial Park alone contributed 16.5% of Palo Alto's sales tax revenue. In that year the local share of the sales tax represented 16.7% of the city's revenues.[41]

At the urging of San Jose interests, a County task force proposed in 1979 that cities share tax revenues, but that proposal never won any support in northern Santa Clara County. Less than two years after Proposition 13 drastically cut property tax revenues, communities were unwilling to give up any portion of their reduced budgets.

Tax disparities are even greater for East Palo Alto, an area bounded by industrial and commercial development in other jurisdictions. There is a strong local movement to incorporate East Palo Alto as a city, to provide improved basic services, but the biggest obstacle has been the absence of a tax base. With assessed valuation per capita of only $10,149,[42] the area is caught in a vicious circle. Without the funds to support a municipal police force, crime and vandalism have constricted commercial activity. Residents take their business across the freeway to Palo Alto, generating tax revenues for an already wealthy community.

For years high technology industry coasted on a reputation for cleanliness, but despite its landscaped low-rise campus-like factories it poses a number of environmental problems. Most visible is the congestion generated by commuting, which coupled

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[41] William Zaner, City Manager, "Selected Statistics - Stanford Lands within Palo Alto," Memorandum, City of Palo Alto, January 31, 1981

[42] San Mateo County Assessor's Office

with prevailing wind patterns (funneling from San Francisco into the V-shaped valley) gives Santa Clara County some of the worst air pollution in the Bay Area. Though local communities are primarily responsible for land use patterns, direct control over air pollution is exercised by the state and the regional district. The Air Quality Management District is now pushing, for the first time, regulations controlling hydrocarbon emissions from Silicon Valley plants.[43]

Less recognized, the electronics industry utilizes a range of toxic chemicals, generating occasional spills and hazardous wastes. In January, 1982, when officials disclosed that trichloroethane, an organic solvent, had seeped from a storage tank at Fairchild Semiconductor into a neighborhood's water supply in south San Jose, an outcry emerged. Residents linked an above-average incidence of birth defects to the spill, but that may never be conclusively determined.[44]

As a consequence, the county's Fire Chiefs' Association has created a task force, which is cooperating with industry to develop a model ordinance controlling the storage of hazardous materials. Once the task force reaches agreement, the code must be adopted by each industrial city. When the ordinances are passed, industry will face substantially higher handling costs, and cities will pay the cost of monitoring the ordinance, as well as preparing for emergencies.

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[43] Tom Harris, "Smog War Shifts to Chip Firms," San Jose Mercury, September 6, 1982, pp. 1B,2B

[44] See, for instance, Susan Yoachum, "Public Agencies Named in Claim Over Chemical Leak," San Jose Mercury, May 6, 1982

A Growing Infrastructure

Like any other growing industrial area, Silicon Valley needs an infrastructure that expands as fast as the high technology industry. Industry associations, such as the Manufacturing Group, put a great deal of effort into assuring that industry's needs are met. While roads, power, water, sewage, and other projects provide additional business and employment opportunities, they are costly. The cost of Silicon Valley's infrastructural growth is shared by industry, residents, and supporting agencies at the state and federal level. It may take decades to determine whether these public investments pay for themselves by generating sufficient growth and taxes.

Santa Clara city and Palo Alto are served by public power agencies, but utility ratepayers in other Silicon Valley cities are paying for the construction of PG&E's design-plagued Diablo Canyon nuclear plant. The Manufacturing Group, speaking for the industry, insists that industry needs Diablo's power to expand.[45] But many Californians sympathetic to the industry, including Governor Edmund Brown, Jr., oppose further construction of the plant, which is situated near an earthquake fault on the California coast. The Federal government's Nuclear Regulatory Commission will make the final decision.

County voters barely approved a $56 million water bond in 1977 to construct the local links to the San Felipe distribution system, under construction by the Federal Bureau of Reclamation at a cost of at least $286 million. Major local companies, such

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[45] James Mitchell, "Power: Will We Run Dry in '80 or '81?" San Jose Mercury, July 8, 1980, p. 1C

as GE, IBM, and Hewlett-Packard contributed to the pro-bond campaign. Residents in those communities supplied by the County's water district are paying for the system in their water bills.[46]

Sewage treatment facilities in Sunnyvale and San Jose-Santa Clara are stretched to capacity, prompting restrictions on growth. Silicon Valley industrialists are pressuring San Jose and the seven other communities that use its wastewater plant to fund a $144 million expansion.[47] Though industrial and residential rate-payers will pay for any expansion, in the long run sewage treatment programs in the area are dependent upon Federal and State monitoring and possible funding as well.

By far the biggest investments to be supported by tax dollars are public transit and roadway improvements to ease the Silicon Valley commute. Transportation agencies have estimated a need to spend $391 million in the County on ground transportation from 1980 to 1985.[48]

Such expansion requires the cooperation of cities, the state, and the Federal government. For instance, in 1981 the Santa Clara County Manufacturing Group convinced the California Department of Transportation to fund a $200,000 environmental impact statement so that the manufacturers could get local

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[46] Andrew Baldwin, Anne Bartz, and Tom McKenna, "The San Felipe Story," Forefront, 1977, No. 3; Tom Harris, "Huge Increases in Water Rates Seen by District," San Jose Mercury News, April 27, 1980, p. 1B

[47] Armando Acuna and Philip Trounstine, "S.J. Sewage Plant: Promises, Problems, and Lots of Money," "Pressure for Expansion Comes from All Sides," and "Treatment Plant Called the Key to Growth in the Valley," San Jose Mercury News, January 3, 1982, pp. 6A,7A

[48] "California's Large-Scale Facility Problem: A Review of the Situation in Santa Clara and San Diego Counties," California Planning Roundtable, October, 1981, p. 9

governments to apply for Federal funds to widen Highway 237, the major roadway bringing East Bay commuters - some 36,000 daily - into Silicon Valley.[49] Similarly, the $400 million Guadalupe Corridor light rail and expressway project will require funds from the county, the state, the federal government, and the cities of San Jose and Santa Clara if it ever emerges from the planning stages.[50]

Finally, the Manufacturing Group is attempting to persuade airlines to provide more service to San Jose's relatively small municipal airport.[51] Increased service would, of course, require airport expansion. The last expansion plan, proposed in 1978 and already partially implemented, projected spending $74 million over a 19-year period.[52]

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[49] Mark Nelson, "Industrial Group Sways CalTrans to Move on 237," Peninsula Times-Tribune, May 15, 1981

[50] Frank Sweeney, "Federal Grant Boosts County's Light-Rail Line," San Jose Mercury, September 9, 1982, pp. 1B, 3B

[51] Dave Farrell, "Business Travelers Air Gripes," Peninsula Times-Tribune, August 21, 1982, pp. B1,B4

[52] Frank Sweeney, "$74 million Long-Range Plan Unveiled for S.J. Airport," San Jose Mercury," November 7, 1978

THE WORKFORCE

In 1979 185,000 people worked in Santa Clara County's high technology industry. At least eleven thousand more worked in southern San Mateo County.[53] Wells Fargo Bank projects that the number of persons employed in high technology manufacturing in Santa Clara County will rise from 170,000 in 1981 to 227,000 by 1990.[54]

Overall, the number of minorities in the high technology workforce roughly corresponds to their share of the Silicon Valley population. 10.6% of the employees are Hispanic, chiefly Chicano, compared to 17.5% of the population. 10.9% are Asian, including Japanese-Americans, Chinese-Americans, and immigrants from the Philippines, Indochina, Hong Kong, and South Korea. This corresponds to a 7.7% share of the population (excluding Laotians and Cambodians not specifically enumerated in the census). And blacks make up 4.9% of Silicon Valley's high tech workforce, slightly above their 3.4% share of the population. 39.1% of the workers are women.

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[53] Marcie Axelrad, "Profile of the Electronics Industry Workforce in the Santa Clara Valley," Project on Health and Safety in Electronics, July, 1979, p. 20

[54] "Santa Clara County: Growth Prospects to 1990," Wells Fargo Bank, April, 1982, p. 16

Table 6. High Technology Employment in Santa Clara County, 1979[55]

Manufacturing		159,000
Drugs (including biotechnology)	1,500	
Office machines & computers	40,000	
Radio & TV receiving equipment	900	
Communication equipment	11,500	
Electronic components & accessories (includes semiconductors)	59,100	
Other electrical	5,800	
Guided missiles, space vehicles, parts	17,700	
Instruments & related parts	22,500	
Services		21,700
Computers & data processing	8,200	
Research & development laboratories	10,800	
Commercial testing laboratories	1,100	
Medical laboratories	500	
Non-commercial educational, scientific, & research organizations	1,100	
Wholesale trade		5,100
Electrical apparatus & equipment	1,600	
Electrical appliances, TV, & radio	200	
Electronic parts & equipment	2,800	
Drugs, drug proprietaries	300	
Chemicals & allied products	200	
TOTAL		185,800

Employment Patterns

The workforce is sharply divided along ethnic, sexual, and educational lines. In general, white males hold the positions with the highest incomes and greatest power. Non-white men (including Hispanics) and white women fall in the middle of the high tech hierarchy. And minority women stand at the bottom of the occupational structure.

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[55] San Jose office, California state Employment Development Department. EDD has been able to include certain classifications, such as drugs and radio & TV receiving equipment, in its local high tech category, although nationwide those classifications are not necessarily high-tech, because of its familiarity with Silicon Valley companies.

Since most Silicon Valley companies were formed as spin-offs of other firms by scientific and engineering professionals, who are predominantly white males, most top managers are white men as well. Although some women occupy management positions in personnel, marketing, and public relations, only a handful of women sit on Silicon Valley boards of directors. The San Jose Mercury reports, "In fact, area firms seem more reluctant to add women board members than many major firms nationwide." Minorities appear even less represented in top management positions, although there are a few companies that are or have been headed by foreign professionals who immigrated from countries such as Korea and Mexico.[56]

Not surprisingly, high tech executives are well paid. Nationally, the salaries of chief executives at second-tier (not quite the largest) electronics firms range from $125,000 to $375,000 annually. Chief engineers earn $72,000 to $80,000. Sales managers bring in $65,000 to $85,000.[57] Silicon Valley firms of that size probably are at the high end of the range, given the high cost of living in the Valley.

Professional positions - primarily engineers, programmers, and physical scientists - also tend to be held by white men, but there are more women and minorities in these positions than in management. Notably, Asians - chiefly Japanese-Americans and Chinese-Americans, are found in this category. This corresponds to the high percentage of Asians with professional training nationwide.

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[56] Bruce Entin, "Few Women Nail Down Spots in Boardrooms," San Jose Mercury, September 6, 1982.

[57] J. Dean Meyer, "Outlook for High Technology," The Executive, February, 1982, p. C3

Table 7. Women and Minorities Nationally in Science and Engineering[58]

	Women	Blacks	Asians
Share of working engineers	1.6%	.8%	2.1%
Share of working computer specialists	17.3%	.6%	3.0%
Share of working physical scientists	7.4%	1.5%	2.6%

High tech professionals and managers are in high demand. Silicon Valley companies, especially new ventures, offer high salaries, fringe benefits, and stock options to entice qualified personnel from other firms. Stock options are a key tool of start-ups, which don't have enough ready cash to attract top people. Instead, they allow key employees to buy stock at founding prices. If the company succeeds, these employees make a fortune in capital gains.

In 1980, the average annual earned income, for all electronics engineers in the U.S., was $36,659.[59] Industry offers to electrical engineers receiving their bachelor's degrees in July, 1981, averaged $22,572.[60] New Ph.D.'s were offered an

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[58] "Women and Minorities in Science and Engineering" National Science Foundation, January, 1982, pp. 49,50 (1978 figures). This survey includes all engineers, not just those in high technology. According to the NSF (p. 15), "Statistical information on the participation of Hispanics in science and engineering is limited because of small sample sizes and high levels of nonresponse to questions related to Hispanic status." NSF also reports (p. 15) "Although . . . over 2 percent of all professional and related workers were Hispanic in 1979, Hispanics make up less than 1 percent of all doctoral scientists and engineers."

[59] Ray Connolly, "EE Shortage Divides Industry, IEEE," Electronics, November 30, 1981, p. 43

[60] Philip Abelson, "Industrial Recruiting on Campus," Science, September 25, 1981, p. 3

average of $33,516.[61] Salaries of computer scientists and other professionals were comparable.

Skilled employees such as machine-tool operators and technicians with experience earn $260 to $440 per week in Silicon Valley.[62] These categories are predominantly male. But if one excludes Lockheed from survey data - counting only mass production - women actually account for 44% of the craft worker classification in Silicon Valley, compared to 25% nationally in the same industries. Workers in these categories rarely advance into professional positions.

Clerical workers, as in the rest of the economy, are predominantly women. Since many educated minority women in Silicon Valley speak native languages other than English, most clerical workers are white. Because the industry is expanding, many clerical workers have found that the industry provides opportunities for advancement into professional positions not requiring advanced science and engineering degrees. Many companies, in fact, supply on-the-job training or give time off for outside training to permit such advancement. Thus, a number of women who began as receptionists and secretaries now work at professional positions in public relations, personnel, and marketing. Experienced clerk-typists and entry-level secretaries earn $900 to $1000 per month, while experienced secretaries earn $1,000 to $1,500.[63]

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[61] Eleanor Babco, "Science and Engineering Graduates Offered Record High Salaries," Science, January 1, 1982, p. 49

[62] San Jose Labor Market Bulletin, Employment Development Department, State of California, First Quarter, 1981, p. 6

[63] San Jose Labor Market Bulletin, First Quarter, 1981, p. 5

Despite its image as a white-collar paradise, the biggest job category in Silicon Valley's mass production sectors consists of semi-skilled production workers, or operatives.[64] Operatives make up 24% of Santa Clara County's high technology mass production workforce.

Operatives are about two thirds women, including one third minority women. In general, minority women are willing to work for the low wages - $3.75 to $5.00 per hour at entry level, $5.00 to $7.00 with experience - offered in electronics, while minority men look for work in other, unionized sectors.[65] The largest minority among semi-skilled production workers is Hispanic women, primarily Chicanas who along with their uneducated white counterparts have little vertical mobility. Some operatives make it into technician or supervisory positions, but not many.

Asians who work in the high technology industry are presently predominantly Filipina and Indochinese women, many of whom - because of immigration and refugee policy - are well educated. Filipina production workers are often women who were qualified, in the Philippines, for careers in nursing or teaching. In the U.S. many work in electronics while they study to qualify for licenses and credentials.[66]

Production workers - that is technicians, craft workers, operatives, and laborers - at many companies are pushed to work hard and fast, since electronics is still a highly competitive

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[64] When used, "laborer" (unskilled) is generally inaccurate. There are very few unskilled positions.

[65] Keller, p. 178

[66] James Beebe, "The Filipinos in Mountain View, California: A Census Type, Socio-Economic Survey," Filipino Association of Mountain View, March 1978, pp. 99-101

industry. A large proportion work with toxic chemicals as part of the production process, but industry representatives argue that workers are adequately protected. A 1981 state study generally took the industry's position,[67] but local labor groups attacked the study's methodology. Organizations such as the Santa Clara Center for Occupational Safety and Health charge that the industry is one of the nation's most hazardous, suggesting that without unions and the presumption of job security, most workers are afraid to report violations.

Perhaps the single most unifying characteristic of the Silicon Valley workforce is mobility. Top-level employees leave companies to start their own, or because competitors have offered major increases in pay and benefits. Production workers leave to find better working conditions and pay, or temporarily put more energy into raising their families. Overall the annual turnover rate among Bay Area electronics firms (primarily Silicon Valley) was 29% in 1981. Among production workers turnover was 37%. Those figures may seem high, but economic uncertainty brought mobility down to those levels from 35% and 50% respectively in 1979.[68]

Recruiting Patterns

The job market for management and professional employees is national, and in some cases, international. Companies recruit on college campuses across the country and advertise in national

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[67] Richard Wade, Project Director, Semiconductor Industry Study, Department of Industrial Relations, Division of Occupational Safety and Health, Task Force on the Electronics Industry, 1981

[68] Barbara Buell, "Electronics Employees Staying Put," Peninsula Times Tribune, July 2, 1981, based on figures from the American Electronics Assocation

trade journals. Headhunters - personnel consultants - scour the industry looking for professionals interested in moving on. Sometimes they make contacts via third parties, but frequently they just call employees blindly. Within Silicon Valley, firms post billboards along major freeways, place ads in the daily newspapers, and promise bonuses to existing employees who find qualified new hires.

A surprisingly large number of Silicon Valley professionals are foreign citizens, who often find that high tech work pays better, provides more access to modern technology, and offers more creative freedom than back home. "Up to 50 per cent of all engineering Ph.D. candidates at major U.S. universities are foreign nationals - and academic studies show that five-sixths of them remain in the U.S. after completing their degree work."[69]

In addition, some firms actively recruit foreign engineers, winning immigration approval when U.S. engineers fail to respond at the salaries offered. A San Jose-based headhunting firm, Omni Personnel Services, has found electronics engineers in Poland and the Philippines. This practice has led groups within the Institute of Electrical and Electronics Engineers, the field's leading professional association, to advocate tighter immigration policies.[70]

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[69] Jack Robertson, "DOD, Universities Clash over VHSIC Research Controls," Electronics News, December 14, 1981. This is a major source of tension between the Pentagon and the universities, since the military wants to restrict foreigner access to research funded through its Very High Speed Integrated Circuit program. Since so many graduate students could be forced out of research programs, many university officials consider this approach an affront to academic freedom.

[70] Robert Feldman, "Foreign Group of EE's Booked for U.S. Jobs," Electronic Engineering Times, November 9, 1981. p. 1

While industry and some government agencies have been warning about a growing shortage of engineers, members of the IEEE say they are skeptical. These views can be expected, since an engineer surplus would benefit employers by driving down salaries while a shortage would benefit engineers by forcing pay higher.[71]

Skilled, clerical, and semi-skilled employees are recruited locally, through newspapers, film ads at drive-ins, and employee reference. At times of expansion, major employers offer their workers incentives to find friends who want to join the workforce.[72] In addition, vocational training programs sometimes directly supply new hires to cooperating employers.

A number of firms of various sizes use temporary agencies to supply professional and production as well as clerical workers. There are about sixty such "job shops" in Silicon Valley. These agencies charge about 35% above direct labor cost to cover the costs of personnel management and delayed reimbursement.[73] Since workers are temporary, job shops offer fewer benefits than electronics employers.

Similar to the legal temporary agencies, there are an uncounted number of illegal subcontractors, who farm out printed circuit assembly to women at home with small children. Though this practice violates California's labor standards,

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[71] Evelyn Richards, "The Engineer Shortage: Myth or Reality?" San Jose Mercury, February 1, 1982

[72] See Keller, pp. 132-141, for a detailed description of Fairchild's recruitment practices for production workers.

[73] Michael Malone, "Electronics Firms Discover Uses for Contracted Help," San Jose Mercury, January 28, 1979; Bruce Entin, "Temporary Help Pays Off for Q Tech," San Jose Mercury, January 27, 1981, pp. 1D,5D

investigators have had a difficult time catching the subcontractors. The women, who are paid extremely low piece rates, are unwilling to talk, since they need the income and don't wish to pay taxes.[74] Many, in fact, are immigrants unaware of their rights or undocumented immigrants who in practice have no rights.

National Comparisons

The workforce stratification characteristic of Silicon Valley is found in high technology industry across the country, including major high tech centers like Boston, Dallas, and the Research Triangle. Though there are many minor variations, the chief difference between the high tech regions is that the ethnic make-up of the workforce in each area corresponds to the population breakdown.

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[74] Pete Carey and Michael Malone, "Black Market in Silicon Valley," San Jose Mercury News, August 31, 1980, p. 1; John Markoff, "California's Space-Age Sweatshops," Los Angeles Times (Pacific News Service), October 28, 1980

Table 8. High-Tech Employment by Race, Ethnicity, and Sex: Production and Services - Santa Clara County[75]

	Male	Female	White	Black	Span.	Asian	Indian
Total	61%	39%	73%	5%	11%	11%	1%
Managers (13%)	86%	14%	88%	2%	4%	5%	1%
Professionals (27%)	83%	17%	84%	2%	3%	10%	<1%
Technicians (14%)	75%	25%	72%	4%	10%	14%	<1%
Sales Workers (2%)	68%	32%	91%	2%	3%	3%	<1%
Clerical (15%)	20%	80%	77%	6%	10%	6%	1%
Craft Workers (7%)	62%	38%	67%	6%	15%	11%	1%
Operatives (20%)	32%	68%	50%	9%	23%	18%	1%
Laborers (1%)	43%	57%	45%	8%	32%	15%	1%
Service Workers (2%)	85%	15%	61%	14%	18%	7%	1%

[75] This and subsequent tables are based on "1980 EEO1 Summary Report of Selected Establishments from the Technical Services Division, OSP, Equal Employment Opportunity Commission." This table includes survey data on SIC codes 357, 366, 367, 376 (guided missiles), 381, 382, 383, 737 (computer services), and 739 (business services). Although the EEO1 business services category in Silicon Valley consists primarily of research and development labs, it also includes a number of non-high-tech firms.

Table 9. High-Tech Employment by Race, Ethnicity, and Sex: Mass Production Only - Santa Clara County[76]

	Male	Female	White	Black	Span.	Asian	Indian
Total	57%	43%	70%	5%	12%	12%	1%
Managers (14%)	85%	15%	88%	2%	4%	5%	<1%
Professionals (20%)	82%	19%	83%	2%	3%	12%	<1%
Technicians (15%)	75%	25%	71%	4%	10%	15%	<1%
Sales Workers (2%)	67%	33%	91%	2%	3%	3%	<1%
Clerical (15%)	19%	81%	77%	6%	10%	6%	<1%
Craft Workers (7%)	56%	44%	63%	6%	17%	14%	1%
Operatives (24%)	31%	69%	49%	9%	23%	19%	1%
Laborers (2%)	38%	61%	41%	8%	34%	17%	1%
Service Workers (1%)	86%	14%	49%	12%	26%	13%	1%

[76] This and subsequent tables covering mass production high tech industries include SIC codes 357, 366, 367, 381, 382, and 383. Due to reporting peculiarities, the Santa Clara County figures may include 2% from SIC 376 (guided missiles and space vehicles). Lockheed, the large 376 company in the area, actually files its EEO1 data under SIC 739 as a research and development firm.

Table 10. High-Tech Employment by Race, Ethnicity, and Sex: Mass Production Only - Greensboro-Raleigh-Durham, North Carolina

	Male	Female	White	Black	Span.	Asian	Indian
Total	55%	45%	84%	15%	<1%	1%	<1%
Managers (9%)	91%	9%	95%	4%	<1%	<1%	<1%
Professionals (19%)	89%	11%	94%	4%	1%	1%	<1%
Technicians (7%)	89%	11%	92%	6%	1%	1%	<1%
Sales Workers (<1%)	94%	6%	100%	-	-	-	-
Clerical (15%)	31%	69%	89%	10%	<1%	<1%	<1%
Craft Workers (6%)	83%	17%	88%	11%	<1%	1%	<1%
Operatives (40%)	28%	72%	72%	26%	<1%	<1%	<1%
Laborers (1%)	46%	53%	91%	9%	-	-	-
Service Workers (1%)	85%	15%	54%	42%	-	3%	1%

Table 11. High-Tech Employment by Race, Ethnicity, and Sex: Mass Production Only - Boston Area

	Male	Female	White	Black	Span.	Asian	Indian
Total	63%	36%	89%	6%	3%	1%	<1%
Managers (13%)	91%	9%	97%	1%	1%	1%	<1%
Professionals (19%)	85%	15%	95%	1%	1%	3%	<1%
Technicians (13%)	88%	12%	91%	5%	2%	2%	<1%
Sales Workers (2%)	82%	19%	97%	1%	1%	<1%	-
Clerical (14%)	22%	78%	93%	3%	1%	1%	2%
Craft Workers (10%)	62%	38%	72%	23%	4%	1%	<1%
Operatives (23%)	43%	57%	85%	7%	5%	2%	<1%
Laborers (4%)	29%	71%	86%	9%	3%	2%	<1%
Service Workers (2%)	95%	5%	85%	5%	8%	1%	<1%

Note: the 2% figure for American Indian clerical workers is probably a reporting error.

Table 12. High-Tech Employment by Race, Ethnicity, and Sex: Mass Production Only - Dallas-Fort Worth

	Male	Female	White	Black	Span.	Asian	Indian
Total	57%	43%	78%	14%	5%	2%	<1%
Managers (10%)	92%	8%	95%	3%	1%	1%	<1%
Professionals (19%)	89%	11%	93%	3%	2%	2%	<1%
Technicians (16%)	74%	26%	85%	10%	4%	1%	<1%
Sales Workers (1%)	75%	25%	94%	3%	2%	1%	-
Clerical (13%)	20%	80%	85%	10%	4%	1%	1%
Craft Workers (9%)	77%	23%	80%	11%	7%	1%	1%
Operatives (30%)	24%	76%	58%	29%	7%	4%	1%
Laborers (1%)	60%	40%	59%	17%	23%	<1%	<1%
Service Workers (1%)	76%	24%	38%	48%	12%	1%	1%

Table 13. High-Tech Employment by Race, Ethnicity, and Sex: Mass Production Only - National

	Male	Female	White	Black	Span.	Asian	Indian
Total	58%	42%	81%	8%	6%	3%	<1%
Managers (11%)	89%	11%	94%	2%	2%	2%	<1%
Professionals (17%)	87%	13%	91%	3%	2%	4%	<1%
Technicians (11%)	82%	18%	86%	5%	4%	4%	<1%
Sales Workers (1%)	76%	24%	95%	3%	1%	1%	<1%
Clerical (12%)	22%	78%	87%	7%	4%	2%	1%
Craft Workers (10%)	75%	25%	83%	7%	7%	2%	<1%
Operatives (32%)	32%	68%	73%	13%	10%	4%	1%
Laborers (4%)	34%	67%	71%	11%	14%	3%	1%
Service Workers (2%)	72%	28%	75%	15%	8%	2%	<1%

Table 14. Race & Ethnicity by Region[77]

Population	White	Black	Asian	Other	Hispanic
United States (226,545,805)	83.5	11.7	1.6	3.1	6.4
Boston (2,763,357)	91.2	5.8	1.3	1.6	2.4
Dallas-Fort Worth (2,974,805)	79.8	14.0	0.8	5.3	8.3
Durham-Greensboro (1,358,058)	77.4	21.6	0.5	0.5	0.7
San Jose (1,295,071)	78.6	3.4	7.7	10.3	17.5

Structural Discrimination Problems

One possible explanation of Silicon Valley employment patterns is outright selective preference. Charges of such discrimination have come from a variety of sources. For example, on July 31, 1982, more than twenty workers alleged discrimination, as well as anti-union harassment at a public hearing conducted by the County Human Relations Commission. However, the Commission has not yet issued a report.

Discrimination in other sectors may also influence the Valley's job structure. For instance, a recent study pointed to widespread racial discrimination in a key employment center.[78]

Mothers of small children have a particularly difficult time advancing their careers in Silicon Valley. Since in most families

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[77] 1980 Census of Population, "Supplementary Report, Provisional Estimates of Social, Economic, and Housing Characteristics," and "Supplementary Report, Standard Consolidated Statistical Areas and Standard Metropolitan Statistical Areas." Note: Hispanics may be counted as White in the residential population count, done by the census, but are considered Non-White in EEO1 employment reports.

[78] Cinde Chorness, "Study Documents Housing Discrimination," Peninsula Times Tribune, June 25, 1982, p. B-1.

women have primary responsibility for children, it is difficult for working mothers to work long hours - a practice expected of professionals and managers. Working mothers also have trouble attending work-oriented social gatherings and training programs, particularly since good after-hours child care is hard to find.

Compounding the problem, most of northern Santa Clara County's apartments have had a policy of denying rentals to families with children. It is extremely difficult for women who cannot afford to buy homes at North County's high prices to find housing near work. This makes child care even more difficult. A 1982 California court decision banned discrimination against families with children, but "many families with children are discovering decent housing is as elusive as ever."[79]

Regardless of the law, it is likely that housing discrimination based on race and age will continue in Silicon Valley as long as there is a housing shortage.

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[79] Michael McCabe, "Shelter-Skelter," San Jose Mercury News, May 23, 1982, p. 1H. The decision was Marina Point Ltd. vs. Stephen Wolfson, California Supreme Court (30 Cal 3d 721), February 2, 1982

OPPCRTUNITIES FOR BUSINESS DEVELOPMENT

Since high-technology is one of the leading growth areas in the U.S. economy, it is viewed as a potential arena for new business development. Silicon Valley, as the cradle for hundreds of high-tech manufacturing and computer service firms, could be a model for business development nationwide. The experiences of women and minorities in establishing high technology businesses, as well as ventures supplying or supporting high tech corporations, provide lessons for public policy nationally as well as within Silicon Valley.

Silicon Valley has all the critical elements necessary for business development. It has a trained, experienced workforce. Venture capital is available to those who have a solid business plan and a good market. Suppliers, contractors, and customers are scattered throughout the area. Infrastructure, though needing expansion, is reliable.

It is not surprising that there are at least 800 manufacturing firms, at 1100 locations, with more than 10 employees in Silicon Valley. There are nearly 2,000 business sites for manufacturing and service companies with less than 10 employees.

However, as in the rest of the nation, there are few high-tech firms owned by minorities or women. Nationwide in 1977, women owned only 1.5% of the firms in high technology electronics. Minorities owned only 1.3%. The record was only slightly better in computer services, where women owned 5% of the establishments nationwide - including data entry firms as well as

software - and minorities owned 1.8%.[80]

A study of 250 high-technology companies that started up in Silicon Valley in the 1960's showed that high-tech ventures have a greater chance of success than other firms. While 50% of non-manufacturing firms fail in their first two years and 25% of manufacturing outfits go out of business in the same period, 24.4% of the sampled firms - some of which started as early as 1960 - were still in business in 1973. In 1976, the total of discontinued firms reached 29.2%, and the number merged with other businesses totalled 23.2%.

"Successful high-technology firms in this survey were founded by groups that left larger organizations and set up businesses which used the same technology and served the same markets."[81] The experiences of successful minority and women businesses in Silicon Valley appear to bear this out.

While in other industries, the major reported obstacles to minority and women business success are finding the financing and establishing contacts, in Silicon Valley those are to a certain extent developed automatically in the process of spinning off a business. A major obstacle to minority and female-owned business formation in Silicon Valley is barriers to advancement in established companies. That is, there are few women or Hispanic engineers, so there are few electronics firms that have been formed

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[80] 1977 Census of Manufacturers, Geographic Area Series; 1977 Census of Service Industries, Geographic Area Series; 1977 Census of Minority-Owned Business Enterprises; 1977 Census of Women-Owned Business Enterprises

[81] Arnold Cooper and Albert Bruno, "Success among High-Technology Firms," Business Horizons, April, 1977. There appears to be no comparable study of more recent start-ups.

by women or Hispanics. Since software design is the professional field most open to women and minorities at large companies, it is not surprising that there are a number of small programming firms run by women and minorities who formerly worked for industry leaders. In building anything larger, the chief problem faced by minority and female-owned businesses is their inability to attract sufficient capital.

Those workforce segments that are most open to women and minorities at large companies appear to have generated a number of support companies geared to high tech. A large number of personnel firms, such as job shops and headhunters, are run by women. Graphics outfits, including word processing and typesetting, are frequently owned by women. Some minority women have developed skills as production supervisors before setting up their own assembly subcontracting businesses.

Because small, start-up high-tech firms need these support services, Silicon Valley has created enormous opportunities. Other areas, such as Dallas or North Carolina, however, where employment is concentrated in a few firms, have not yet generated the number of small firms that characterize the Valley. Thus, opportunities for support firms in those environments are much more limited.

EDUCATION

At a time when industry is demanding greater numbers of technically and professionally trained personnel, the California school system is in apparent decline. Declining enrollment, local and state financing cuts, and federal budget cuts are all placing a strain on the ability of the schools to continue their historic levels of service. The current push by high tech industries to upgrade technical education could stimulate a new thrust of public and private support for the schools, or it could divert scarce resources into programs that serve a small portion of the state's students.

The School System

Though the State of California and the County Board of Education set priorities and standards for the state's schools, primary responsibility for budgeting, hiring and firing, school construction and closure, and most significant educational policies lies with local school boards. Within Santa Clara County there are 22 elementary school districts with 200 schools, 5 high school districts with 30 schools, and 6 unified districts encompassing a total of 112 elementary schools and and 20 high schools. In addition, the County is served by 4 community college (formerly junior college) districts with 2 campuses each. South San Mateo County is served by one high school district, five elementary school districts, and one campus of the three-school County-wide community college district.

Since California voters passed Proposition 13, the Jarvis-Gann property tax limitation initiative, in 1978, the structure of California school financing has been in flux. Direct state assistance to local school districts is now by far the most important source of school funds. In 1980-1981, state aid represented 63.5% of the aggregate budget of public school districts in Santa Clara County. Local funds, chiefly the property tax, represented 31.4%. Federal assistance accounted for 5.1%.[82]

A series of state supreme court decisions, including the famous Serrano v. Priest case,[83] and legislative acts have mandated that the state act to equalize the financial base of California's school districts. Thus, Palo Alto's unified district, with the same industrial tax base as the city of Palo Alto, provided 39.1% of its funds locally in 1980-81. Property-poor Milpitas, however, supplied only 25.9% of its unified district's revenues from local sources.[84]

State financial policy has moved the rich and poor districts toward equality, but differences remain. Palo Alto, with only 14.4% minority students, is easily the best funded unified district in the county, but in general there is no correlation between financial position and minority enrollment.

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[82] Data Book: 1981-1982, Santa Clara County School Districts, January, 1982, p. 50

[83] In Serrano vs. Priest (96 Cal. Rptr. 601, August 30, 1971), the California Supreme Court ruled that using local taxes, which provide unequal revenues to varied areas, to finance education violated the Fourteenth Amendment.

[84] Data Book: 1981-1982, p. 49

Table 15. 1981-82 District Budgets per Student and Minority Enrollment[85]

	Budget per Student	Minorities
Community College Districts		
Foothill-De Anza	$2,364	20.0%
Gavilan	$2,860	
San Jose	$3,069	
West Valley	$2,527	
High School Districts		
Campbell	$2,307	12.1%
East Side	$2,314	53.0%
Fremont	$2,091	16.3%
Los Gatos	$2,476	4.6%
Mtn. View-Los Altos	$2,159	20.0%
Unified Districts (includes elementary schools)		
Gilroy	$2,613	52.7%
Milpitas	$2,020	40.6%
Morgan Hill	$2,267	28.4%
Palo Alto	$3,214	14.4%
San Jose	$2,346	34.5%
Santa Clara	$2,338	57.7%

In general, test scores in districts with greater percentages of minorities are lower. In all districts arithmetic scores exceed reading scores.

85 ibid., projected general fund expenditures per average daily attendance; "Profiles of School District Performance, 1980-1981," California Assessment Program, California State Department of Education, 1981

Table 16. Test Scores and Minorities by District, 1980-81[86]

	Minorities	Reading	Arithmetic
High School Districts			
Campbell	12.1%	66.8	72.1
East Side	53.0%	61.4	67.5
Fremont	16.3%	70.1	76.9
Los Gatos	4.6%	72.5	77.8
Mtn. View-Los Altos	20.0%	68.8	75.3
Sequoia Union	28.3%	67.3	72.4
Unified School Districts			
Gilroy	52.7%	61.8	64.3
Milpitas	40.6%	64.1	68.7
Morgan Hill	28.4%	66.8	69.4
Palo Alto	14.4%	73.0	79.6
San Jose	34.5%	65.3	69.1
Santa Clara	57.7%	63.7	68.6

Though the school system does not keep statistics on drop-out rates, a 1982 survey correlated the school drop-out rate in California to ethnicity. Statewide, 23% to 30% of California's high school students drop out of school before age 18. Up to 55% percent of the Hispanics leave before age 18, compared to 15% to 40% of the blacks and 11% to 23% of the whites. Twice as many boys drop out as girls.[87]

High Tech Education

Silicon Valley high school districts have initiated a variety of programs to prepare students for careers in high technology. For instance, every high school in Santa Clara County has at least one programming class. In San Mateo County the number of microcomputers in high schools and middle schools rose from 102 in June, 1980 to 362 in December, 1981.

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[86] ibid., district mean test scores, grade 12

[87] Laurie Olden, Citizens Policy Center-Open Road, cited in "School Drop-Out Rate Is Rising, Reaches 23-30 Percent in State," Peninsula Times Tribune, (Associated Press), May 14, 1982

Most recently, the Fremont Union High School District and the Los Gatos Joint Union High School District have joined to create the Institute for Computer Technology, known as "Hi Tech Hi." The Institute will be based at the closed De Anza School site in Sunnyvale, with a satellite facility at Saratoga High School. The non-profit Board of Directors includes school district representatives and executives from three local high tech companies.

Local companies have promised $400,000 in donated equipment, and the state has allocated $100,000 to the program. Beginning late 1982, the Institute will train at least 150 part-time students in programming and electronics. The Institute is oriented toward vocational education, not college prep courses. A spokesman for the Institute's board of directors said, "Silicon Valley needs not just whiz kids - it needs people who know how to solder a circuit board."[88]

In establishing high tech courses, school districts universally seek funds outside their general budgets. "Most of these districts have had to raise money from outside sources (often federal grants) or use money from School Improvement Program funds, Mentally Gifted Minor programs or parent associations to buy the computers."[89]

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[88] Kathy Holub, "Executives Join Board of New High-Tech School," San Jose Mercury, September 9, 1982, p. 1B; Robert Rudy, "School Gets State Funding for Computer Training Courses," Peninsula Times Tribune, September 9, 1982, p. B-3.

[89] Elizabeth Useem, "Education and High Technology Industry: The Case of Silicon Valley," University of California, Santa Cruz, August, 1981, p. 7

Although industry and the state have recommended that the state universities train guidance counselors to encourage students, especially women and minorities, to take math, science, and computer courses,[90] financial shortfalls are forcing school districts to downgrade their counseling programs. For instance, the East Side Union High School District eliminated 26 counseling positions rather than cut its support for its basic curriculum.[91]

Silicon Valley's community colleges have active programs in high technology education. Foothill, for instance, is the only institution in the country to offer an A.S. (two-year) degree in semiconductor processing. West Valley College just installed an IBM 4331 computer to train business students and a Hewlett-Packard 1000 to train programmers.[92]

Although several colleges teach about one thousand students each in electronics and computers each year, they barely scratch the surface of industry's need for vocational training. The companies promote the programs by placing executives on advisory boards, encouraging skilled and professional employees to moonlight as part-time college instructors, and by donating equipment. Intel, for instance, donated $85,000 in equipment to Mission College when it was opened in 1979.

Complementing the community colleges are a number of private vocational training institutes. These organizations, with a

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[90] See "Winning Technologies: A New Industrial Strategy for California and the Nation," California Commission on Industrial Innovation, September 2, 1982, Table of Recommendations, p. 2, no. 20

[91] Cathy Castillo, "Beleaguered Schools Push State to Share Financial Burden," San Jose Mercury, August 17, 1982, p. 4B

[92] A. Robert DeHart, "Planning for the 80's," De Anza College, June, 1981, p. 31; Useem, pp. 12-18

reputation for placing students as technicians in Silicon Valley firms, charge for their courses. One such institute, an informal program established by Vietnamese engineers to train other Vietnamese as electronics technicians, charges only for books and supplies.[93]

The Bay Area's major colleges and universities also have significant training programs in high technology fields. Stanford, the private institution that created Silicon Valley, graduated 256 bachelors, 707 masters, and 130 Ph.D.'s in engineering in 1981. "Approximately 18% of the undergraduate student body is now majoring in engineering or pre-engineering."[94]

The Jesuit-run University of Santa Clara, also in the heart of Silicon Valley, enrolls 600 undergraduates, or 17% of its student body, in engineering and computer science programs. It also has 1,000 students in its part-time graduate programs. In 1981 it awarded 80 B.S. and 90 M.S. degrees in engineering and computer science.[95]

State-run San Jose State University has the largest engineering school in the Bay Area, enrolling about 4,000 students in engineering and computer science. In 1981 it granted 323 B.S. degrees in engineering, including 125 in electrical engineering. It awarded 84 masters in engineering, including 16 MSEE's.[96]

Bay Area universities host two major new research centers for microelectronics, both of which are backed by government and

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[93] Allison Engel, "Self-Help Is Refugees' Key to the American Dream," Pacific News Service, November 21, 1980
[94] Useem, p. 21
[95] Useem, p. 20
[96] Useem, p. 19

industry funds. Stanford's Center for Integrated Systems is funded by the Pentagon and at least ten high tech companies, including IBM, Hewlett-Packard, TI, Xerox, GE, and Fairchild.[97]

Silicon Valley executives played a key role in formulating and pushing through Governor Brown's proposal for a Microelectronics Innovation and Computer Research Operation (MICRO) at the University of California in Berkeley. Industry pioneer Robert Noyce of Intel, himself a Stanford fund-raiser, declined to provide support for the Stanford center. Instead, he is backing MICRO, "We were concerned about the fact we were getting relatively few graduates from Stanford . . . Many Stanford graduate students are on leave from other companies or are foreign students . . ."[98] In 1981 the state allocated $2.6 million in construction funds for MICRO and another $1 million in research funds to be matched by contributions from industry.

Proposals for Change

When, in September, 1982, the California Commission on Industrial Innovation released a series or recommendations for stimulating high technology growth in California, 32 of its 50 recommendations dealt specifically with education and vocational training. It advocated increasing science and math requirements in the high schools, higher university entrance requirements, and new curricula. Depending upon how such policies are implemented, they could encourage more women and minorities to study in

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[97] "Stanford Gathers in $7.5 Million for IC Research Center," Electronics, March 24, 1981, p. 48

[98] Evelyn Richards, "How Gov. Brown Is Helping to Sustain an Old Rivalry," Peninsula Times Tribune, January 9, 1981

technical fields, or they could deprive those without adequate scientific education from advancing within the educational system. But the two most significant issues in the growing discussion of high tech education are funding and math/science teacher retention at all levels of schooling.

The Brown Administration proposed, for 1982-83, that the state "invest" $38.8 million in high tech-related educational programs, but the legislature approved only $15 million.[99]

Though there are many proposals before Congress to expand professional and technical training in computers and engineering, their future in this time of budget constraint and cuts is not particularly optimistic. For example, the Federal budget for "Pell" grants and for guaranteed loans to college students was cut by $500 million and $450 million respectively in fiscal 1982, with even greater cuts proposed for fiscal 1983. Vocational programs were cut as well.[100]

One program which may survive the budget and tax battles in Congress is Representative Fortney Stark's proposal to increase the tax incentives for donating computers to public schools. Stark developed the legislation when Apple Computer, a major Silicon Valley manufacturer of microcomputers, announced its intention to contribute a machine to every school in the country if it could get a full tax break. The industry is not unanimously

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99 "State Activities to Encourage Technological Innovation: An Update," California Commission on Industrial Innovation, February, 1982, p. 54; "Investment in People: A California Agenda for Education and Training in the 1980's," Governor's Office, July, 1982

100 "Cutting Aid to Education," Coalition for a New Foreign and Military Policy, March, 1982

in favor of the "Apple bill," however. One electronics executive said, "Companies such as Hewlett-Packard have been in the business of donating computers for years, and they have found that you don't just pack up something like an Apple II and tell a school to pick it up at a UPS office. You have to visit the school and show them how to use it and answer questions. There was no way that Apple could do that at more than 100,000 places in one year."[101]

Michael Kirst, the Stanford Education Professor who prepared the California Commission on Industrial Innovation's background report on education, says that schools need new policies and an infusion of state, federal, and industry money. He warns, however, "Improved technical education can only be built on a solid base for the overall school program. It is impossible to provide 'literacy' in technical subjects without 'literacy' in language and other skills." Kirst says that California's schools need an additional $2.75 billion annually - much more than the state's contribution to new technical programs - to bring them up to standard.[102]

Secondary and post-secondary institutions in Silicon Valley, and throughout the state as well, report an acute shortage of qualified instructors in engineering, computing, and the sciences. "In each field the supply of new teachers has dropped by

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[101] Carl Cannon, "Apple's Gift to Schools Faces a Corps of Foes," San Jose Mercury News, July 18, 1982, p. 1A

[102] Mary Madison, "One Way to Solve the Crisis," Peninsula Times Tribune, September 2, 1982, p. B-3

[103] Michael Kirst, "Improving Math, Science and Technical Education," California Commission on Industrial Innovation (Draft), June, 1982, p. 9

60% over the last decade."[103] The situation at colleges and universities is similar: "Of the nation's some 20,000 engineering faculty jobs, 10% to 15% or 2,000 to 2,500 are presently unfilled. In fields such as solid-state electronics, computer engineering, and digital systems, NSF's Stephen Kahne places the shortage close to 50%."[104]

The reasons are simple. Individuals qualified to teach sciences and engineering can make much more money by working in private industry. "A young graduate can start at $5,000 more [in industry] than his old teachers."[105] A master's degree holder in industry, with five years experience, earns about $25,000, while a high school teacher with comparable education and experience makes only $17,300.[106]

Industry and educators are urging several policies to overcome the shortage, including increased teacher training, salary supplements, and institutionalizing "moonlighting," part-time teaching by industry professionals. While the need for more instructors is generally agreed upon, the solutions are costly and the proposal to pay extra money to science and math teachers in the public schools is particularly controversial.

Disparities in Education

If present trends continue, women and minorities will be left behind in the push to upgrade technical and scientific

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[104] Pat Hill Hubbard, "Plan for Action to Reduce Engineering Shortage . . . With Supporting Data," American Electronics Assocation, October, 1981, p. 18

[105] Trends: "The Vanishing Professor," Forbes, July 20, 1981, p. 8, cited in Hubbard, p. 19

[106] Kirst, p. 13

education. Except for an over representation of Asian-American men, most engineering and science graduates are still white males. Women and blacks appear to make up their largest shares in computer specialties, but they still represent a fraction of the graduates.

Table 17. U.S. Recent Graduates by Sex[107]

	Total	Male	Female
Physical Scientists	33,900	77%	23%
Math Scientists	24,600	59%	41%
Computer Specialists	16,000	73%	27%
Engineers	119,200	93%	7%

Table 18. U.S. 1979 Graduates by Race & Ethnicity[108]

	Total	White	Black	Span.	Asian	Ind.	Alien
Physical Scientists	22,861	90%	3%	1%	2%	<1%	3%
Math Scientists	11,740	87%	6%	2%	3%	<1%	3%
Computer Specialists	8,693	85%	6%	2%	3%	<1%	4%
Engineers	61,426	84%	3%	2%	3%	<1%	8%

[107] 1978,1979, and 1980 bachelor's degrees. Excludes full-time graduate students. "Women and Minorities in Engineering," p. 106

[108] Bachelor's degrees. Note that the categorization of non-resident aliens, regardless of race, reduces the percentage of whites, particularly in engineering. W. Vance Grant and Leo J. Elden, Digest of Education Statistics: 1981, National Center for Education Statistics, pp. 124-125

FEDERAL GOVERNMENT PROGRAMS AND POLICIES

Federal Laws Affecting the High Technology Industry

In the past four years, Congress has enacted two major revisions to the tax codes to include significant incentives for business investment. The Revenue Act of 1978 (Public Law 95-600) and the Economic Recovery Tax Act of 1981 (Public Law 97-34) changed provisions in the law relating to accelerated depreciation, investment tax credits, research and development expenses, and the capital gains tax to make more money available for business investment. In addition, the Economic Recovery Tax Act also changed the rules for employee stock options to make them a more attractive method of compensation for motivating employees. The Revenue Act of 1978 reduced maximum corporate tax rates, and both acts established new lower tax rates for small corporations.[109]

The high technology electronics industry, through its trade associations, such as the American Electronics Association and the Semiconductor Industry Association (SIA), were active in seeking these changes to the tax laws.[110]

Before 1981, businesses had to use a complicated depreciation system if they wanted to write off the cost of capital investments. Plants and machinery were assigned to depreciation

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109 "Congress Approves $18.7 Billion Tax Cut", 1978 Congressional Quarterly Almanac; "Congress Enacts President Reagan's Tax Plan, 1981 Congressional Quarterly Almanac

110 "Chip Makers Tell Uncle Sam What They Want," San Jose Mercury News, May 19, 1981; "Silicon Valley Optimistic on Tax Changes," Peninsula Times Tribune, September 2, 1980; "AEA Measure Would Restore Stock Options", Peninsula Times Tribune, August 6, 1979.

schedules according to their useful life, and businesses deducted the cost of their investment over this useful life, which could take up to 40 years for some buildings and up 28 years for some machinery.[111]

These arbitrary useful lives were often far in excess of the actual useful lives of things being depreciated. The overly long depreciation schedules were a disincentive to investment, because business could not recover the cost of an investment before having to invest in a replacement. This is especially true of firms in the high technology industry and for firms buying the industry's products, because changes in this industry are occurring more rapidly than in industry in general. The 1981 tax act simplified the depreciation schedules by creating an Accelerated Cost Recovery System (ACRS) in which businesses could write off an assets' value in 15 years or less. Under ACRS, equipment used in research and development and some machinery can be depreciated in three years and all other machinery and equipment can be depreciated in five years.[112] ACRS also would have allowed businesses in 1985 and 1986 to make greater deductions in the early years of an investment, but this provision was repealed when Congress passed a revenue-raising measure in August 1982.[113]

The 1978 tax act made permanent the 10% investment tax credit[114] that was first provided as a temporary measure in 1975-1976. Prior to that time the investment tax credit was only

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111 "Congress Enacts President Reagan's Tax Plan."
112 ibid.
113 "Congress Clears $98.3 Billion Tax Increase," Congressional Quarterly Weekly Report, August 21, 1982
114 "Congress Approves $18.7 Billion Tax Cut."

7% for most businesses.[115] The 1978 act also allowed businesses to use their investment tax credits to offset up to 90% of their regular tax liability. Formerly they could offset only 50%.[116] The 1982 revenue measure reduced the offset to 85%.[117]

The 1981 tax act gives businesses a 25% tax credit for research and development expenses that exceed the average annual amount spent for research and development during the preceding three years.[118] The AEA argued for the research and development tax credit in 1980, when the Senate Finance Committee adopted the AEA's draft language and its definition of research and development.[119]

The 1978 tax act reduced the maximum capital gains tax to 40% of the maximum (70%) tax rate on investment income, or an effective maximum tax rate of 28%. The 1981 act reduced the maximum investment income tax rate to 50%, the same as the maximum rate on earned income, and thereby reduced the maximum capital gains tax to 20%.[120]

A new incentive stock option was enacted in the 1981 act.[121] Under a normal stock option plan, an employee pays ordinary income tax on the difference between the option price and the value of the stock when he/she purchases it. Then, when he/she sells the stock, the employee must pay capital gains tax. The American

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115 "Tax Bill Cleared: A `Legislative Miracle,'" 1976 Congressional Quarterly Almanac.
116 "Congress Approves $18.7 Billion Tax Cut."
117 "Congress Clears $98.3 Billion Tax Increase"
118 "Congress Enacts President Reagan's Tax Plan."
119 "Silicon Valley Optimistic on Tax Changes," Peninsula Times Tribune, September 2, 1980.
120 "Congress Enacts President Reagan's Tax Plan."
121 ibid.

Electronics Association argued that this double taxation made stock options unattractive to the employees that high technology companies are trying to motivate with the options.[122] The incentive stock option enacted in 1981 eliminates the income tax imposed when the stock is purchased[123] and increases the attractiveness of the stock option as an incentive for motivating employees.

The maximum corporate tax rate was reduced from 48% to 46% by the 1978 act, and a graduated rate schedule was instituted for small corporations. Previously, corporations with taxable income above $50,000 a year were subject to the 48% rate. The 1978 act set a 17% tax rate for the first $25,000 in income, a 20% rate for income between $25,000 and $50,000, a 30% rate for income between $50,000 and $75,000 and a 40% rate for income between $75,000 and $100,000.[124] The 1981 tax rate reduces the tax rates for businesses earning less than $50,000 a year by 1% a year in 1982 and 1983, so that the tax rate in 1983 will be 15% on the first $25,000 of income and 18% on the next $25,000.[125]

In June 1982 Congress approved the Small Business Innovation Development Act (Public Law 97-219) to give small businesses a guaranteed share of the federal government's research budget. The bill requires federal agencies with research and development budgets of more than $100 million to spend a small percentage of their budgets for small businesses. The percentages range from 0.2% in the first year of the program to 1.25% in the fifth and

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122 "Silicon Valley Optimistic on Tax Changes"; "AEA Measure Would Restore Stock Options."
123 "Congress Enacts President Reagan's Tax Plan."
124 "Congress Approves $18.7 Billion Tax Cut."
125 "Congress Enacts President Reagan's Tax Plan."

subsequent years.[126]

The bill was supported by the Electronics Association of California (EAC)[127] and opposed by the American Electronics Association[128] and major universities.[129] EAC, which represents over 400 small and medium-sized businesses, cited studies that showed that small firms produce 24 times the number of major innovations that large firms produce per dollar of research and development expenses. EAC also noted that the ratio of innovations to sales is one-third greater in small high technology firms than it is in medium and large firms.[130] The AEA opposed the bill, even though 80% of its members are small businesses, because it believed that the bill is an affront to the free market system and would take badly needed research money away from universities.[131] Universities also claimed that they would lose research dollars to small firms, but the bill's sponsors argued that a mandatory quota system was needed to give small businesses a share of government research and development money, or else those firms would receive little or no funding.[132]

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126 Congressional Quarterly Weekly Report, June 26, 1982.
127 "Electronics Association of California Supports Innovation Bill," Congressional Record, March 3, 1982, p. E709.
128 "Why the AEA Opposes a Bill That Helps 80% of Its Members," San Jose Mercury, February 10, 1982.
129 Stanford University News Service, Press Release, April 20, 1982.
130 "Electronics Association of California Supports Innovation Bill."
131 "Why the AEA Opposes a Bill That Helps 80% of Its Members."
132 "Small Business Bills Upset the Universities," Science, November, 1981.

Comprehensive Employment and Training Act

The federal government provides training and employment programs authorized by the Comprehensive Employment and Training Act (CETA) of 1978 for economically disadvantaged, unemployed, and underemployed individuals.[133]

CETA began in 1973 as a relatively small training program oriented toward skilled workers who had lost their jobs due to recession. The 1978 amendments to CETA shifted the program from serving skilled workers to serving poor people with long-term employment problems.[134] The 1981 budget reconciliation act (Public Law 97-35) eliminated CETA's public jobs program. The CETA law expires on September 30, 1982.[135]

The 1978 CETA amendments also increased the role of private business. Local Private Industry Councils (PICs) were created consisting of local people familiar with the area's needs, businesses, and people. The PICs are dominated by local business people, but also include representatives from labor unions, community organizations, and educational groups.[136]

The Santa Clara County Private Industry Council meets monthly to discuss job training issues and make recommendations to the Santa Clara County Board of Supervisors, which has legal responsibility for CETA programs in its role as CETA prime spon-

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133 U. S. Government Manual, 1982-1983

134 "The CETA Roller-Coaster," Congressional Quarterly Weekly Report, March 6, 1982

135 "New, Smaller Job Training Program Emerging to Help The Hard-Core Unemployed," Congressional Quarterly Weekly Report, March 6, 1982.

136 ibid.; U. S. Government Manual, 1982-1983.

sor for the county. In 1981-1982 almost $1,000,000 in classroom training programs were funded through the Santa Clara County PIC. These include 10 subgrantees that trained 640 persons in new skills, including nearly 200 electronics assemblers and technicians and 30 computer programmers.[137]

The Senate and House of Representatives have both approved bills that replace the CETA training program with a new program that increases the role of private businesses in planning job training programs. The two bills differ on whether to retain the current CETA structure for disbursing federal funds to local training programs and on whether to pay program participants.[138] Under CETA, federal funds are channeled through 475 prime sponsors (city, county, and state governments). These prime sponsors identify training needs in their areas and ways to meet those needs.[139] Under the Senate bill, control of the training programs is taken away from city and county governments and given to state governors. The House bill would retain local control over the local programs. In addition, the House bill pays trainees' living expenses, while the Senate bill does not.[140]

A Senate-House conference committee is currently meeting to resolve these differences. The conference committee is expected

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[137] Interview with Maggie Knabb, Santa Clara County CETA Administration, September 10, 1982.

[138] "House Passes Scaled-Down Job Training Measure, 356-52," Congressional Quarterly Weekly Report, August 7, 1982; "Senate Approves Job Training Bill, 95-0, Congressional Quarterly Weekly Report, July 3, 1982; "New Job Training Legislation Awaits Senate, House Action," Congressional Quarterly Weekly Report, June 12, 1982.

[139] U. S. Government Manual, 1982-1983.

[140] "New Job Training Legislation Awaits Senate, House Action," Congressional Quarterly Weekly Report, June 12, 1982

to report a bill that "will give PICs control over at least $3 billion a year in a five-year program - nearly the amount CETA has been spending on public service employment."[141]

Small Business Administration

A number of federal agency business development programs exist to assist small businesses, including minority- and women-owned small businesses. These include the regular programs of the Small Business Administration (SBA), the Minority Business Development Agency in the Department of Commerce, and the programs included in Public Law 95-507 that increase the opportunity for minority-owned small businesses to participate in federal contracts.

The SBA provides financial, investment, and management assistance to all small businesses, and also targets specific programs to aid minority- and women-owned businesses through its Minority Small Business Capital Ownership Development program and Women's Business Enterprise Division.[142]

The SBA's financial assistance to small businesses consists of direct loans and loan guarantees to help them finance plant construction, conversion, and expansion, and to help them acquire equipment, facilities, machinery, supplies, and materials. It gives investment assistance to small businesses by licensing, regulating, and providing financial assistance to small business investment companies (SBICs) and Minority Enterprise Small

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141 "Business Tackles Hard-Core Unemployment," Business Week, September 20, 1982.

142 U. S. Government Manual, 1982-1983

Business Investment Companies (MESBICs). The SBICs and MESBICs in turn provide venture capital to small businesses in the form of equity financing, long-term loan funds, and management services. The MESBICs target these services to minority-owned small businesses.[143]

Through its procurement programs, the SBA seeks to increase the number of federal contracts and subcontracts that go to small businesses. It sets aside certain government orders for competitive award to small businesses and it refers qualified small businesses to government prime contractors. The SBA's management assistance programs include courses and conferences cosponsored by the SBA, informational leaflets and booklets prepared by the SBA, and management workshops and courses conducted by the SBA for established and prospective businesspeople.[144]

The SBA's Minority Small Business Capital Ownership Development (MSB-COD) program provides a local contact for new local businesses that want to take advantage of the SBA's services and programs. The MSB-COD field offices help small businesses prepare loan applications and develop financial statements and other related material, such as projections of future business activity. Under Section 8(a) of the Small Business Act, the SBA contracts with government agencies having procurement powers, and then subcontracts the performance of these contracts to small businesses owned and controlled by socially and economically disadvantaged people.[145]

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143 ibid.; Budget Themes, 1982-1983
144 U. S. Government Manual, 1982-1983
145 Ibid.

The Women's Business Enterprise Division (WBED) of SBA seeks to increase the number and profitability of women-owned businesses and to increase the number of employees in those firms. It negotiates with other federal agencies to increase the number of federal prime contracts with women-owned businesses and it monitors other SBA programs to ensure that women are included in all programs administered by the SBA. WBED also assists the Interagency Committee on Women's Business Enterprise in its objective of monitoring the federal government's efforts to establish, preserve, and strengthen women-owned businesses. In addition, WBED develops national pilot programs to increase the number of women-owned businesses in selected industries, and it encourages the use of trade associations and management consultants to provide financial education and counseling that is oriented to the specific needs of women business owners.[146]

In 1981-1982, SBA's San Francisco District Office made $32,000,000 in direct and guaranteed loans to 250 firms in the 13 county area consisting of the San Francisco Bay Area and the coastal counties from the Oregon border to Monterey. This is a decrease from 1980-1981 when $60,000,000 in direct and guaranteed loans were made.[147] A direct loan was made to a woman-owned electronics company in 1978[148] and a number of SBA guaranteed loans have been made to electronics companies in Santa Clara County, but the available data does not indicate whether any of

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[146] ibid.

[147] Interview with Jack Mattimoe, SBA San Francisco Office, September 10,1982.

[148] Interview with Loretta Moen, Terminal House, Inc., September 15, 1982.

these firms are owned by minorities.[149]

Between 1974 and 1980 SBA's San Francisco office doubled the amount of its Section 8(a) contract awards each year. The amount continued to increase, though at a slower rate, in 1980-1981, when Section 8(a) awards totaled $142 million. As of September 9, 1982, there were 103 contracts awarded for 1981-1982 totaling $106.8 million. These contracts are for an area that includes most of northern California plus Nevada.[150] Available data does not indicate the dollar amount or number of these contract awards that went to high technology companies,[151] but Section 8(a) contracts have been awarded to some high technology companies in Santa Clara County, including ATAC, a computer programming firm, Thrift Data Service Inc., a key-punch firm, and Comsis Corp., a software company.[152]

The Minority Business Development Agency (MBDA) coordinates federal programs for minority business development. It provides special assistance to high technology businesses and to firms with growth potential. MBDA also assists minority firms in the commercialization of new technology. Together, these programs seek to improve conditions for minority-owned businesses so that they will have an equal opportunity to compete with other businesses.[153]

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149 "SBA Plans to Let Banks Take Over Loans," Northern California Electronics News, September 18, 1978.
150 Interview with Louise Guerrero, San Francisco SBA Office, September 10, 1982.
151 Interview with Louise Guerrero, San Francisco SBA Office, September 14, 1982.
152 Sharman Stein, "Minority Businessmen Unworried about Cutbacks," Peninsula Times Tribune, August 25, 1982.
153 Appendix to the Budget for Fiscal Year 1983; U. S. Government Manual, 1982-1983.

Public Law 95-507

In 1978, Congress enacted Public Law 95-507 to maximize the opportunity for small businesses and for small businesses controlled by socially and economically disadvantaged individuals to participate in federal contracts. Each successful bidder for a federal contract exceeding $500,000 ($1,000,000 for construction contracts) must submit a plan that includes percentage goals for the use of small businesses as subcontractors and for the use of small businesses owned by economically and socially disadvantaged persons. The contractor's plan must include a description of the efforts that will be made to give these small business concerns an equitable opportunity to compete for subcontracts, and the contractor must make assurances that subcontractors who receive subcontracts of more than $500,000 also adopt a similar subcontracting plan.[154]

The new law was also intended to supplement the minority set-aside plan authorized by Section 8(a) of the Small Business Act. Under Section 8(a), government agencies were allowed to choose which of its contracts would be awarded to the SBA to subcontract to socially and economically disadvantaged businesses.[155]

PL 95-507 established a pilot program to require a federal agency designated by the President to make all of its contracts

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154 Text, Public Law 95-507

155 "Minority-Owned Businesses," 1978 Congressional Quarterly Almanac; "Minority Set-Asides," 1980 Congressional Quarterly Almanac; "Minority Firm Program," 1981 Congressional Quarterly Almanac.

available to the SBA so that the SBA, rather than the agency, could choose which contracts to award to small minority businesses. The Department of the Army was chosen for the pilot program.[156]

The new pilot program developed its own problems. It was nearly a year after enactment of PL 95-507 before the first contract was signed with the Army. Only 29 contracts were set aside under the pilot program, and only 4 of these were awarded. Congress agreed to extend the program for one more year in 1980, but in 1981 it decided that a civilian agency, instead of the Army, should be chosen to participate in the program.[157]

Part of the problem was that the Army felt that it was already a strong supporter of the regular Section 8(a) program and that the pilot program merely added additional burdens on the Army.[158] The SBA argued that it did not have sufficient authority to ensure that the goals of the pilot program were met. One SBA regional administrator pointed out to Congress that the SBA was limited to advising the procuring contracting officer whether or not a subcontracting plan submitted by a successful prime contractor was in compliance with the requirements of PL 95-507. He cited a Defense Acquisition Regulation that prohibited the SBA from determining the amount of subcontracting required of a prime contractor or subcontractor, and he noted that decisions on subcontracting were made during the bidding process and, therefore, any finding of non-compliance with PL 95-507 by the SBA

156 ibid.
157 ibid.
158 Small Business and the Federal Procurement System, Hearings, Subcommittee on General Oversight, Committee on Small Business, House of Representatives, July 18, 23, and 25, 1981.

would be after the fact and ineffective.[159]

Sen. Lowell P. Weicker, Jr., chairman of the Senate Small Business Committee, criticized the SBA for mismanagement of the pilot program. Nevertheless, committees in both houses of Congress agreed to continue the pilot program provided it targeted a civilian agency of the government, rather than the Army.[160] The SBA planned 15 to 20 civilian projects in a reauthorized pilot program, and submitted information (see table) to Congress that showed that civilian agencies provided substantial opportunities for a pilot program in high technology contracts.[161]

Table 19. High Technology Opportunities in Non-Defense Federal Agencies

Fiscal Year 1980 (Dollars in Thousands)

Federal Agency	Procurement	High Tech
NASA	$4,461,444	$3,212,239
Department of Energy	8,051,491	1,992,481
Dept. of Health & Human Services	1,538,554	722,033
Department of Transportation	1,400,676	504,097
EPA	407,738	322,096
Department of Interior	1,795,442	277,147
Veterans' Administration	2,227,587	262,233
AID	243,241	200,134

159 Small and Minority Business in the Decade of the 80's (Part 1), Hearings, Committee on Small Business, House of Representatives, July 7 and 18, 1981.

160 "Minority Firm Program," 1981 Congressional Quarterly Almanac

161 "SBA (8a) Pilot Programs, Hearings, Committee on Small Business, House of Representatives, September 22, 1981

The Section 8(a) pilot program expired on September 30, 1981 when Congress did not complete action on then pending reauthorization legislation. Bills to reauthorize the pilot program are currently before both houses of Congress. The Senate bill designates that a civilian agency be used in the pilot program. The House bill lets the President choose which agency to use.[162]

Office of Federal Contract Compliance Programs

Federal civil rights enforcement activities are carried out by the Office of Federal Contract Compliance Programs (OFCCP) in the Employment Standards Administration of the Department of Labor and by the Equal Employment Opportunity Commission (EEOC).

The OFCCP coordinates the federal government's programs under Executive Orders 11246 and 11375 to make sure that contractors and subcontractors take affirmative action to hire and promote minorities and women.[163]

Reviews of potential federal contractors are made by OFCCP before contracts are awarded to reduce the need for later enforcement proceedings. OFCCP makes regular compliance review of federal contractors to ensure that they are implementing their affirmative action plans. OFCCP also investigates complaints made that federal contractors have discriminatory practices.[164]

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[162] Interview with Dana Stebbins, counsel, Committee on Small Business, House of Representatives, September 15, 1982; Interview with Bob Wilson, Counsel, Committee on Small Business, U. S. Senate, September 16, 1982.

[163] U. S. Government Manual, 1982-1983; Appendix to the Budget for Fiscal Year 1983.

[164] The Federal Civil Rights Enforcement Budget: Fiscal Year 1983, United States Commission on Civil Rights.

Equal Employment Opportunity Commission

The EEOC is responsible for enforcing federal laws that prohibit employment discrimination. It coordinates and minimizes conflict among the various federal agencies that administer laws relating to employment discrimination. The EEOC also tabulates, stores, and publishes data on the employment status of minorities and women.[165]

Before a complaint alleging discrimination is investigated by EEOC it must be deferred to the state's fair employment practices agency, if any agency with an enforceable fair employment practices law exists. In California, the deferral agency is the Department of Fair Employment and Housing (DFEH). EEOC and DFEH have a contract that sets a goal for the number of discrimination cases to be handled each year.[166]

From the late 1960s through June 30, 1982, 506 charges of alleged discrimination were filed with EEOC's San Francisco District Office by workers employed by electronics firms with facilities in Santa Clara County. The bases for these charges were mainly race discrimination against blacks (190 cases) and sex discrimination against women (182 cases). The principal issues involved firing of workers (236 cases), terms and conditions of employment (124 cases) and promotions (114 cases). Data is not available to indicate how many of these charges were sustained. Data is also not available to indicate the total number of charges filed against all firms in all industries with

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[165] U. S. Government Manual, 1982-1983; Appendix to the Budget for Fiscal Year 1983.

[166] United States Commission on Civil Rights, The Federal Civil Rights Enforcement Budget: Fiscal Year 1983.

facilities in Santa Clara County.[167]

Effects of Federal Budget Cuts

Early in President Carter's term CETA's public employment service program reached a peak of 750,000 job slots. By 1980, there were only 325,000 public CETA jobs, and the public service jobs program was eliminated at the end of September, 1981.[168] Attempts to find new jobs for those who lost their CETA jobs has met with limited success. Of 332,000 who lost CETA jobs in 1981, only 56% obtained a new job or training position, and of these, less than 54,000 (16% of those who lost jobs) were able to obtain positions in the private sector.[169] Funding for CETA and other training and employment programs is scheduled to drop under President Reagan's budget proposal from $5,245 million in fiscal year 1981 to $2,387 million in fiscal year 1987.[170]

President Reagan proposes to eliminate the SBA's direct loan program. These loans are currently allocated for general business assistance, aid to socially and economically disadvantaged business owners, aid to businesses owned by or employing handicapped individuals, and aid for energy conservation and development. SBA direct business loans totaled $292 million in fiscal year 1981 and $184 million in fiscal year 1982. Eliminating this

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[167] Letter from Jay Friedman, Systemic Unit, U. S. Equal Employment Opportunity Commission, San Francisco District Office, September 2, 1982; Interview with Jay Friedman, September 15, 1982.

[168] "The CETA Roller Coaster," Congressional Quarterly Weekly Report, March 6, 1982

[169] "CETA Report," Congressional Quarterly Weekly Report, April 10, 1982

[170] Budget Themes, 1982-1983

program will do away with the 4,000 direct loans that SBA makes each year. Currently, SBA has over 38,000 direct loans outstanding.[171] Legislation pending before both houses of Congress would appropriate some funds for direct loans.[172]

Non-credit assistance to minority businesses will also be drastically reduced. Currently this assistance is provided through the Minority Business Development Agency and SBA's programs for establishing minority procurement goals for federal agencies and awarding non-competitive Section 8(a) contracts to minority firms. Budget levels for these programs are scheduled to drop from $279 million in fiscal year 1981 to $160 million in fiscal year 1983. Guaranteed loans will be used instead of direct loans to minority firms, and the SBA will focus its activities on providing management and technical assistance to minority firms.[173]

Funding for the Office of Federal Contract Compliance Programs (OFCCP) has dropped from $50,962,000 in fiscal year 1980 to $42,614,000 ($33,676,000 in 1980 dollars) as proposed for fiscal year 1983. These cuts will result in a one-third reduction in OFCCP authorized staffing, from 1,482 positions to 979 positions.[174]

Staff reductions have already prolonged and limited the number of compliance reviews conducted by OFCCP. In fiscal year

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171 Budget Themes, 1982-1983

172 Interview with Dana Stebbins, Counsel, Committee on Small Business, House of Representatives, September 15, 1982; Interview with Bob Wilson, Counsel, Committee on Small Business, U. S. Senate, September 16, 1982.

173 Budget Themes, 1982-1983

174 United States Commission on Civil Rights, The Federal Civil Rights Enforcement Budget: Fiscal Year 1983.

1981, OFCCP "investigated employment practices affecting fewer protected workers, negotiated fewer agreements to correct violations, and obtained less relief for victims of discrimination."[175]

OFCCP plans to eliminate its pre-award contractor reviews so that it can focus its limited staff on other activities. By using its staff resources on compliance reviews, OFCCP had let 5,000 complaints accumulate by the beginning of fiscal year 1982, and it has no comprehensive plan for reducing the complaint backlog.[176]

EEOC funding has increased since 1980, but not enough to keep up with inflation. In 1980 dollars, funding has declined from $124,562,000 in fiscal year 1980 to $114,536,000 proposed for fiscal year 1983. These real budget cuts have caused a corresponding decrease in staff from 3,777 authorized positions to 3,278 positions.[177]

The heaviest staff cuts have been in clerical and field office attorney positions, thus slowing the production of documents and work on legal cases. As in the case of OFCCP, the lack of staff has resulted in a complaint backlog. EEOC "expects to have 5,000 complaints filed in 1979 or earlier still awaiting processing" in fiscal year 1983.[178]

EEOC will cut back its labor force data processing that helps it identify cases of systemic discrimination. Without devoting resources to develop supporting data, it will be dif-

175 ibid.
176 ibid.
177 ibid.
178 ibid.

ficult for EEOC to demonstrate patterns and practices of discrimination. The budget cuts will also affect EEOC's ability to obtain relief for victims of discrimination by use of litigation, since EEOC will be unable to pay for litigation support services, such as expert witnesses, special studies, and data processing.[179]

[179] ibid.

STATE GOVERNMENT POLICIES AND PROGRAMS

The State of California has a variety of programs to assist the development of the high technology industry in the state. Among these are programs in the executive branch of government to provide a favorable atmosphere for the industry's growth, education programs to prepare students for careers in the industry, and training and retraining programs to help workers obtain jobs in the industry and upgrade their skills.

State Programs to Encourage High Technology Industry

California's programs to encourage technological innovation include the California Commission on Industrial Innovation (CCII), the Microelectronics Innovation & Computer Research Opportunities (MICRO) program discussed above, the Investment in People program, and the California Innovation Development Loan Program.

The 18-member Commission on Industrial Innovation was established to produce a consensus among business, education, and labor leaders on the programs needed to maintain California's economic strength through industrial innovation. CCII has three subcommittees to examine the issues of financing technical innovation, education and training, and improving human productivity. It has prepared a report to serve as a blueprint for industrial innovation in California, and it has the mandate to evaluate programs that were proposed in 1981 in the fields of

basic and applied research, microelectronics laboratories, and capital, and recommend reforms to the Governor and the Legislature.[180]

The Investment in People program is a set of programs and budget priorities designed to increase the skill of California's labor force. A total of $49 million was proposed by the Brown administration for the program in fiscal year 1982-1983, but the legislature appropriated only $25.7 million, including $9.7 million to upgrade math and science education in kindergarten through grade 12, $3.3 million to augment engineering, computer science, and related basic university education, $2 million for employment-based training through community colleges, and $10.7 million for job training and placement assistance.[181]

The Innovation Development Loan Program provides financing to promising small technology-based entrepreneurs for product development. The program was funded for $2 million in 1981.[182]

School Improvement Program

The School Improvement Program (SIP) was established in 1977 for the purpose of restructuring education from kindergarten through grade twelve to provide instruction to ensure that students achieve proficiency in basic skills. SIP replaced the Early Childhood Education (ECE) program that served children in

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[180] State Activities to Encourage Technological Innovation: An Update, California Commission on Industrial Innovation, February 1982.

[181] ibid.; "Investment in People 1982-83: A California Agenda for Education and Training in the 1980s," State of California Investment in People Program.

[182] State Activities to Encourage Technological Innovation: An Update, California Commission on Industrial Innovation, February 1982.

kindergarten through grade three only.[183]

Under SIP, a local school site council, consisting of the school's principal, and representatives of teachers, parents, community members, and high school students, plans, implements, and evaluates the programs offered at their school. SIP places an emphasis on students taking a greater responsibility for their own education. At the high school level, SIP schools must provide students with alternative learning opportunities, including working at jobs in the local community.[184]

SIP funding has been used for hiring thousands of instructional aides, providing teacher training in new techniques, and financing remedial math and reading laboratory equipment. The effectiveness of SIP is demonstrated by the fact that test scores in basic skills have risen consistently in elementary schools where SIP has been in operation.[185]

Mathematics, Engineering, Science Achievement Program

The Mathematics, Engineering, Science Achievement (MESA) program was begun at the University of California at Berkeley in 1970 for the purpose of increasing the number of historically under-represented minorities in engineering and other mathematics and science based fields. MESA began receiving state funding in 1977, conditioned upon receiving matching funds from private sources. The program currently is operating in 15 centers, 29 universities, and 100 high schools throughout the state, and

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[183] Governor's Budget, 1982-1983

[184] School Improvement Program, California State Department of Education, 1981.

[185] ibid.

involves about 3,000 students.[186]

MESA targets its programs to blacks, Mexican-Americans, American Indians, and Puerto Ricans. It provides tutoring, field trips, and math and science advisors for high school study groups. MESA also brings industry representatives to schools to help make students aware of different career opportunities. A summer enrichment program offers courses in problem solving, higher mathematics, English, and computer science.[187]

In 1982 MESA programs had 813 graduates, including 748 from the targeted minority groups (378 blacks, 352 Mexican-Americans, 12 American Indians, and 6 Puerto Ricans). This an increase from the previous year when 668 graduates were from minority groups. The largest increase occurred among Mexican-American graduates, who increased from 285 to 352. The percentage of mathematics-based college majors chosen by the graduates has increased over the years. In 1982, 76% of the graduates plan mathematics-based college careers, including 36% in engineering and 11.5% in computer science.[188]

Another measure of the effectiveness of the program is the response of industry, the State legislature, and local School Improvement Programs. Despite budget cuts in other state programs, MESA has continued to receive increased funding from the state. In 1981-1982 it received $467,000 from the University of California and California State University budgets. For 1982-1983 that amount has been increased to $480,000. In addition, the state has provided $880,000 through the Investment

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[186] Interview with Dr. Vinetta Jones-Sykes, Assistant Director for Programs, MESA, September 9, 1982.
[187] ibid.
[188] Ibid.

in People program to fund a new MESA program in universities.[189]

A private industry advisory board is working to raise $920,000 for MESA, consisting of a dollar for dollar match of the $480,000 high school budget and a one for two match of the $880,000 university budget. Meanwhile, more high schools are shifting part of their SIP funding into MESA programs.[190]

EQUALS Program

EQUALS is a teacher education program designed to help teachers increase girls' and women's participation in school mathematics courses. It was supported originally in 1977 by the U. S. Department of Education. Additional funding was received from the Carnegie Corporation of New York, and state funding has been used to replace cuts in federal funding. In 1981-1982, the state provided $75,000 to maintain EQUALS' $230,000 budget for delivery of teacher training, when the federal government cut its budget by $75,000. In 1982-1983, the state is providing the entire $230,000.[191]

EQUALS has provided in-service training to 1,500 California teachers, counselors, and administrators serving kindergarten through high school. Schools where EQUALS has been used have shown increases in women enrolled in mathematics courses,

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189 Interview with Prof. Bill Somerton, Director, MESA, September 9, 1982.

190 ibid.

191 Nancy Kreinberg, "1000 Teachers Later: Women, Mathematics, and the Components of Change," Public Affairs Report, Institute of Governmental Studies, University of California, Berkeley; Interview with Nancy Kreinberg, Director, Math and Science Education for Women, University of California, Berkeley, September 9, 1982.

increased interest among women in math-based careers, and more positive attitudes among women in high schools towards mathematics.[192]

Although MESA and EQUALS have been able to increase their state funding despite cuts in other state programs due to the effects of Proposition 13, the School Improvement Program's funding has not been able to keep up with inflation. SIP funding levels have an effect on MESA and EQUALS because teachers are not able to take part in those programs unless SIP or other school budget funds can provide money for substitute teachers and teacher release time. Constraints in school budgets also affect the ability of local schools to offer a wider variety of courses in mathematics. With less money available, advanced math classes may be dropped, even if there is sufficient interest among students. As SIP money is directed to MESA, it is unavailable for other uses.[193]

The following table shows the level of state funding for SIP since it began in 1977. This year's budget increase consists of a 5% cost-of-living increase.[194]

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[192] Nancy Kreinberg, "1000 Teachers Later: Women, Mathematics, and the Components of Change."

[193] Interviews with Nancy Kreinberg and Bill Somerton, September 9, 1982.

[194] Governor's Budget, 1983-1984

Table 20. School Improvement Program

Year	Budget
1977-1978	$118,390,000
1978-1979	124,874,000
1979-1980	135,457,000
1980-1981	152,557,000
1981-1982	162,757,000
1982-1983	170,892,000

California Worksite Education and Training Act

The California Worksite Education and Training Act (CWETA) was enacted by the legislature in 1979 and is designed to train unemployed persons at public community colleges for skilled jobs in industries with a shortage of skilled workers. Employers participate in designing CWETA training programs that include classroom-training and on-the-job training. Employers agree to hire those who complete the training and to promote those who successfully complete a training program to upgrade skills.[195] The 1982-1983 state budget provides $10 million for CWETA funding.[196]

Employers, local educators, and CETA prime sponsors take part in developing CWETA projects. In 1980, over 4,000 people were trained by more than 100 employers in 42 CWETA projects.

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[195] The California Worksite Education and Training Act: Report to the Legislature, December 1980, California Employment Development Department.

[196] "Investment in People 1982-1983: A California Agenda for Education and Training in the 1980s," State of California, Investment in People Program.

CWETA's initial programs trained nurses and workers in the electronics and aerospace industries. CWETA spent $5.5 million in 1980 for 16 electronics projects that trained over 1,500 people for entry-level jobs and upgraded the skills of over 1,000 workers at 49 electronics manufacturing and repair companies.[197]

CWETA's electronics projects in 1980 included programs at the College of San Mateo - a public community college - for eight electronics firms in San Mateo and Santa Clara Counties, at the Occupational Training Institute of the Foothill-De Anza Community College District for Advanced Micro Devices in Santa Clara County, and at several Santa Clara County schools for Applied Technology, Finnigan Corp., and Molectron Corp.[198]

The program at the College of San Mateo was for Ampex Corporation, Varian Associates, Hewlett-Packard, and five other companies. It used computer-aided, videotaped instruction and on-the-job training for electronics assemblers and electronics technicians. The project cost $2.5 million in 1980, or an average of $2,400 per person trained. Entry-level assemblers received 270 hours each of classroom instruction and on-the-job training. Those being upgraded to technician received 540 hours of each type of training.[199]

The Advanced Micro Devices program trained 40 persons as semiconductor operatives, and included two months of classroom instruction, followed by three months on-the-job training and

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197 The California Worksite Education and Training Act: Report to the Legislature, December 1980, California Employment Development Department.

198 ibid.

199 Ibid.

additional classroom instruction. It cost $2,500 per trainee. The other program in Santa Clara county trained assemblers and technicians at a cost of $3,000 per trainee.[200]

The Investment in People program's $2 million budget in 1982-83 for employment-based training through community colleges includes $1.35 million for high technology training programs modeled after the CWETA program. Individual community colleges will apply to the Chancellor's Office of the California Community Colleges for funds to establish such programs on their campuses. The Chancellor's Office intends to seek matching funds from the federal government, other state programs, and private industry.[201]

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200 ibid.

201 "Investment in People 1982-83: A California Agenda for Education and Training in the 1980s," State of California, Investment in People program.

PENDING LEGISLATIVE PROPOSALS AFFECTING THE INDUSTRY

On September 2, 1982 the California Commission on Industrial Innovation issued a report entitled, "A New Industrial Strategy for California and the Nation," in which CCII made 50 recommendations for federal and state legislation that are designed to (1) ensure that the nation's high technology industry retains its international lead, (2) modernize and increase productivity in basic industries, such as steel, autos, and textiles, and (3) correct what the commission sees as unfair competition in foreign trade.[202]

CCII's recommendations are a coordinated series of proposals affecting federal and state tax policy, research and development policy, credit and investment policy, trade policy, and education and job training policies. Among their recommendations are the elimination of trade barriers, the increase of research and development funding in universities and industry, a policy to guarantee every child computer literacy, and providing extensive job training in anticipation of displacement due to modernization.[203]

Legislation to give a major tax break to one part of the high technology industry was recently approved by the California Legislature and is awaiting action by the Governor. The bill provides a sales tax exemption and refund to computer software firms on the grounds that the sale of computer programs is a

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[202] Winning Technologies: A New Industrial Strategy for California and the Nation, California Commission on Industrial Innovation, September 2, 1982.

[203] ibid.

service and not a product. The state Board of Equalization had ruled that these firms had to pay sales tax because they were providing a product. One member of the Board of Equalization claims that the state could lose more than $35 million in taxes this year and $100 million next year, if the bill is signed into law. The author of the bill said that these claims are exaggerated, but did not offer an alternate estimate. To help get the bill passed, tax refunds were limited to $1.2 million in the bill.[204]

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[204] "Silicon Tax Cut Gets OK," Peninsula Times Tribune, August 31, 1982, p. B-1.