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HOW SILICON IS MY VALLEY?

For nearly two decades, California's Santa Clara Valley has been recognized worldwide for its concentration of semiconductor firms and leadership in chip design technology. Hence the popular name, "Silicon Valley," is accurate.

However, the semiconductor industry itself accounts for a fraction of high-tech employment in the Valley. In 1985, chipmakers employed 45,500 in Santa Clara County, out of a total of 254,600 in electronics, weaponry, and aerospace. (Silicon Valley actually includes sections of Alameda County, San Mateo County, and Santa Cruz County, but figures on those areas are difficult to determine because they are within separate statistical areas.)

Santa Clara County 1985
High-Tech Employment

Computers	54,900
Semiconductors	45,500
Other electronics components	35,800
Weapons/aerospace (incl. ground vehicles)	32,200
Instruments	31,800
Communications equipment	25,200
Wholesale computers	8,200
Research and development	8,100
Wholesale electronics	6,600
Software development	6,300
TOTAL	254,600

More important, state employment experts anticipate that 1995 semiconductor employment will be 43,200. Though this is below the 1985 total, it lies above the preliminary mid-recession figure for 1986, 40,900. At the same time, computer manufacturing industry employment is projected to rise from 51,000 in 1986 to 74,100 in 1995.

The leveling of chip industry employment does not mean a victory for Japan, Inc. Silicon Valley will remain the world center of semiconductor technology. Semiconductor employment is stagnant around the world. Although the market for chips will continue to grow, despite periodic slowdowns, employment growth is restrained by both the automation of the production process and the increasing complexity of each device. The former process, automation, is easy to understand: fewer people produce more chips.

The second concept, however, is unique to chips. Every few years the semiconductor industry builds a product with twice the speed or memory of the last generation, and offers it in roughly the same size package for about the same price. In many applications, this just means that customers need fewer chips to accomplish the same function. This differs for personal computers, for example, where increasing complexity means that individuals get more powerful machines, not half a computer each. Thus, the technological dynamism of the chip industry places a drag on the growth of its market.

The outlook for semi-skilled semiconductor production employment, as well as other low-paying manufacturing jobs, is also expected to be bleak, but the demand for engineers and programmers should grow rapidly. Within the county's semiconductor industry, production employment is projected to fall from 46% in 1985 to 35% in 1995.

Employment by Electronics Occupation
Santa Clara County (thousands)

Type of Work	1985	1995 (proj.)
Electrical/electronics engineers	19.2	29.9
Electronics technicians	16.2	23.5
Electronics assemblers	13.5	10.1
Precision electronics assemblers	9.3	10.2
Semiconductor processors	8.8	5.0
Computer programmers	8.3	19.0
Electronics inspectors/testers	7.4	5.5
Precision inspectors/testers	6.3	7.6
Electronics repairers, industrial	1.0	3.2

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The experts who anticipate a decline in low-level production employment do not foresee a drop in manufacturing output. Rather, they expect that production will be increasingly automated. In addition, some firms will continue the trend of shifting production to other areas while maintaining headquarters and labs in the Valley.

There's no doubt that production employment is decreasing as a share of high-tech employment in Silicon Valley. Software is becoming increasing important in throughout the industry. In 1985, only 29.3% of the computer (manufacturing) industry workforce was directly engaged in production. This is not surprising, since most Valley-based computer companies develop the bulk of their software here. The experts say the share will fall to 25% by 1995. Similarly, independent software development employment (listed as a service in employment statistics) is supposed to triple from 6.3 thousand in 1985 to 18.9 thousand in 1995.

However, the contention that the number of semi-skilled production jobs will drop is debatable. Companies that manufacture electronic equipment and systems are constantly introducing new products, and entrepreneurs are still forming new companies to build and sell new products. These new product lines tend to employ large numbers of production workers locally. When product lines and/or companies mature, production is automated or moved, holding down employment. But by then, even newer companies and products are ready to be built. And there is no sign that Silicon Valley is running out of new technologies or products to feed that growth.

Similarly, the assumption that mid-level jobs, such as the technician category, will grow at the expense of semi-skilled work is questionable. Automation can displace semi-skilled workers, but it also routinizes the work of skilled workers so it can be turned over to employees with less training. For example, it takes less knowledge of electronics to plug a device into an automated test instrument than to use a meter to test the device function by function.

Still, it is particularly difficult to measure how automation affects electronics industry skill levels, because employers are not likely to reclassify technicians as machine operators. That is, it is possible that employment statistics will show consistent growth in technician employment, but that may merely represent job title inflation.

The relative decline of semiconductor industry employment and particularly semiconductor production employment in Silicon Valley does not mean, however, that semiconductor technology is any less critical to the Valley's future. Most of the other high-tech industries in Silicon Valley depend heavily upon chips. In fact, an increasing proportion of the design of computer systems and other electronic devices is built into silicon. That is, designers who once figured out ways to link chips and other electronic components on printed circuit boards are now figuring out where to place gates on one or a handful of chips.

Since the development of the microprocessor and memory chips in the early 1970's, Silicon Valley has seen the formation of new computer firms such as Apple, Sun Microsystems, and Tandem. Meanwhile, computer firms based elsewhere, notably Boston—such as DEC and Data General—and Japan—Fujitsu and NEC, for example—have set up research labs or chip fabrication facilities in Silicon Valley.

In 1987, Sun Microsystems, a producer of computers, not chips, received national recognition for the introduction of a new product, based upon reduced instruction set computer (RISC) technology. Sun's RISC product was not a computer, however, but a chip.

As long as the physics of silicon and other substrates allows designers to squeeze more functions onto a minuscule flake, Silicon Valley is likely to remain the world's center of semiconductor technology, and semiconductor technology, despite the long-term slowdown in chip industry

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hiring, remains central to the Valley.

The data presented here is from "The Future of Silicon Valley," State of California Employment Development Department, Employment Data and Research (P.O. Box 7774, San Francisco, CA, 94120), September, 1987.

TOXICS UPDATE

1. In November the Santa Clara County City Manager's Association convened a tripartite task force to resolve disputes over the nature of a proposed model ordinance to regulate the storage and handing of toxic gases, primarily by the electronics industry. The task force is made up of the city managers of Palo Alto, Sunnyvale, and Santa Clara; delegates from Intel, National Semiconductor, and Lockheed; and Ted Smith of the Silivon Valley Toxics Coalition, safety consultant Carolyn Scott, and Central Labor Council head Rick Sawyer. The negotiations, notes the **Silicon Valley Toxics News** (December, 1987) "mark the first time ever in Silicon Valley that the electronics industry has come to the negotiating table to attempt to resolve differences with labor."
2. Researchers from the School of Medicine at the University of California at Davis have found that the semiconductor industry reports only about 60% of work-related injuries and illnesses to federal occupational safetey and health authorities. Their report is based upon the 1984 records kept by firms at ten sites in six different states. Most unreported health problems were minor, such as acid burns on fingers, allergies to work gloves, blisters from work shoes, minor eye injuries, cuts, sprains, and bruises. (**San Jose Mercury News**, October 16, 1986)
3. The San Francisco Bay Regional Water Quality Board has referred twelve more sites in Silicon Valley to the Environmental Protection Agency for potential inclusion on the EPA's Superfund list. Most of the new sites are non-semiconductor high-tech firms. The **San Jose Mercury News** (August 22, 1987) reports that Silicon Valley "already has 19 Superfund sites, more than any other county in the country."

SCOTTISH FIRM BOUGHT

Scotland's Silicon Glen contains the greatest concentration of chip production in Europe, but most, if not all, plants are foreign-owned. When geographer Jeff Henderson studied the Scottish electronics industry in 1986, he found that there was only one Scottish-owned semiconductor producer. (See **Global Electronics**, September, 1987). Now there may be none.

In November, 1987 Integrated Power Semiconductor, a producer of smart power chips based in Livingston, went into receivership. California's Seagate Technology, which uses Integrated Power's chips in its hard disk drives, then bought the company for $7.75 million in cash. (**San Jose Business Journal,** November 30, 1987)

(We don't know yet whether Integrated Power Semiconductor was the company mentioned by Henderson, nor do we know whether any Scottish chip companies have been started in the last two years.)

SINGAPORE FAB

The government of Singapore has decided that the island nation, long an assembly and test center for U.S. semiconductor firms, is ready for wafer fabrication. Although Texas Instruments once planned to set up a wafer fab facility in Singapore, only Italy-based SGS now operates such a plant there.

Government-owned Singapore Technology Corp. has formed a partnership with Silicon Valley start-up Sierra Semiconductor and National Semiconductor. The new firm, Chartered Semiconductor Pte. Ltd., plans to manufacture application-specific integrated ciruits by January, 1989.

The roots of Chartered lie back in 1985, when Singapore Technology looked at 15 small U.S. semiconductor firms before deciding to work with Sierra. In mid-1986 Singapore Technology participated in Sierra's third round of venture capital financing and received an option to form a production partnership. Today it holds 5% of the company and has one seat on its board of directors. Since August, 1986, fifteen engineers from Singapore have been training at Sierra's San Jose facility.

Sierra is a privately-held firm specializing in chips that combine digital functions, analog functions, and erasable memory on one chip. It was formed in 1984 by a group from National Semiconductor led by Jim Diller, who headed National's operations in Southeast Asia and lived in Singapore from 1973 to 1975. Since its formation Sierra has worked closely with National and Diller reportedly has been a close friend of Ed Pausa, National's top exec for international

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manufacturing, for twenty years.

In November Singapore Technology announced that it had exercised its option. The government-run company will invest $40 million in state-of-the-art plant, in Singapore, expected to employ 260 people. It holds 74% percent of Chartered.

Sierra and National will contribute technology, and they promise to buy more than half of Chartered's initial output. Sierra owns 17% of the partnership, and National holds 9%. (**San Jose Business Journal**, November 30, 1987)

BRAZIL

Brazil appears to have backed off slightly in its latest showdown with the U.S. over high technology trade. In November, President Reagan announced trade sanctions against certain Brazilian exports to the U.S., and in early December Brazil eased its restrictions against software shipments from the U.S.

In 1984 Brazil enacted legislation designed to protect and promote its indigenous computer industry. The law limits imports and requires Brazilian ownership and control of minicomputer and microcomputer production. The ownership of companies making mainframe computers is not restricted, so IBM and Unisys, which have had subsidiaries in Brazil for decades, actually benefit from import restrictions.

Brazil refused to let Microsoft license its MS-DOS operating system (used by the IBM PC and its clones) in Brazil, so Microsoft complained to Uncle Sam. Following unproductive negotiations, President Reagan imposed a symbolic embargo against Brazilian computers—virtually none are exported to the U.S., anyhow—and announced plans to raise tariffs on imports such as planes, shoes, ceramics, and pesticides.

Brazil relentedon the software issue, but it still appears resolved to protect the domestic computer industry. Brazilian policy may give local companies and edge within Brazil. But protection cannot help them compete internationally, where U.S. and Far Eastern companies are maintaining a fast pace of hardware and software innovation. (**Los Angeles Times**, reprinted in the **San Jose Mercury News**, November 14 and December 5, 1987); Associated Press, printed in the **San Jose Mercury News**, November 28, 1987; and "Does Anyone Really Believe in Free Trade," **Forbes** magazine, reprinted in the **Congressional Record**, September 23, 1987).