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THE DATAMATION 100

Datamation (June 15, 1986) issued its annual survey of the worldwide data processing industry. It provides valuable profiles on the top 100 suppliers of computers of all sizes, peripheral equipment, software, and other computer services. Those 100 firms hold an estimated 92% of the world (non-Communist) market. It also ranks the top 100 data processing companies in the U.S. Though numerous manufacturers of semiconductors appear on Datamation's lists, only their systems and software revenues were counted for the ranking.

Not surprisingly, IBM still dominates the field; with \$48.6 billion in data processing revenue it accounted for 32% of the \$150.8 billion 1985 global total. IBM's \$14.0 billion in mainframe sales represented a whopping 55% of that \$25.3 billion market. Despite strong showings from DEC (Digital Equipment) and Hewlett-Packard, IBM led the minicomputer market with \$3.5 billion in sales (21%). It dominated the microcomputer segment with sales of \$5.5 billion (36%) and peripherals with sales of \$12.7 billion (31%). Of the markets detailed by Datamation, only in computer services did IBM follow another leader, with only \$300 million in that \$8.6 billion market.

The largest Japanese data processing company, Fujitsu, ranked fifth on the top 100. With data processing revenues of \$4.3 billion it posed little threat to IBM. Even in Japan, IBM outsold Fujitsu last year.

Datamation ranks firms that hired the most (proportionately) and fired the most. Disk-drive maker Seagate upped its global workforce by 54.1% while supercomputer-builder Cray Research added 44.3%. Dataproducts, Datapoint, Computervision, and Apple all reduced their workforces by more than 20% in 1985.

FAIRCHILD'S TOXICS PROBLEMS

In April, the Silicon Valley city of Mountain View distributed to all its residents a summary of a proposal by Fairchild Semiconductor to limit the underground spread of toxic chemicals in one of the community's high-tech industrial areas, an area in which Fairchild and four other companies have reported chemical leaks. Fairchild proposed the construction of underground slurry walls, to control the toxic plumes as an interim measure, as well as pumping and excavation. At that time, the company and many public officials believed that contamination was limited to aquifers near the surface. The deep aquifer, which provides at least 15% of Mountain View's drinking water, was protected from pollution by a layer of clay.

A few days later Fairchild released news indicating

that the proposed clean-up is either too little or too late. Fairchild detected significant concentrations of trichloroethylene (TCE) - a chemical known to cause cancer in mice (at least) and other health problems - in the deep aquifer. Mountain View officials ordered that a nearby well, ostensibly closed earlier for maintenance, be shut indefinitely. How the chemicals penetrated the clay is unknown, but some officials suspect an abandoned, unsealed agricultural well, left over from the days when Santa Clara County was the "Valley of Heart's Delight."

It will be extremely difficult to clean up the deep aquifer, since extraction, in the absence of cautionary measures, could suck pollutants down through the clay. Initial responses by Fairchild and the Environmental Protection Agency, which assumed supervisory responsibility for the site last year, indicate that clean-up is a long way off.

Beginning 1982, Fairchild and four other companies reported toxic leaks in the Mountain View industrial park. Though Fairchild acted quickly to clean up another of its Silicon Valley pollution sites, in South San Jose, it proceeded slowly in Mountain View. The *San Jose Mercury News* cites Larry Kolb, assistant executive of the Regional Water Quality Control Board, "There were long delays occurring in the cleanup because the companies could not agree among themselves who should pay for the cleanup." In 1985, under pressure from the Silicon Valley Toxics Coalition and local governments, the water board ordered the companies to take action and invited the EPA to oversee their efforts.

The migration of toxic chemicals to the deep aquifer bodes ill for Silicon Valley as a whole. About half of the public water supply for Santa Clara County originates or is stored in that aquifer. Contamination could spur demands for the importation of additional water, always a controversial notion in California. Mountain View, for example, may attempt to increase its use of Hetch-Hetchy water. Already it takes 85% of its water from the city of San Francisco's Hetch-Hetchy aqueduct, which begins at the Tuolumne River in Yosemite National Park.

Meanwhile, Fairchild reached an out-of-court settlement with lawyers representing 530 residents of San Jose's Los Paseos neighborhood, site of the other spill. In that case, residents were actually drinking contaminated water, and studies confirmed that a cluster of birth defects had occurred in the area at about the same time. The residents' suit for damages had been expected to resolve legally their contention that Fairchild was indeed responsible for a host of health problems.

Fairchild agreed to pay millions of dollars, but it did not admit guilt. The terms of the agreements prevent both sides from disclosing details.

ELECTRONIC WARRIOR BLUES

Engineers working in military electronics may not be as satisfied as their status would indicate. The *Journal of Electronic Defense*, magazine of the electronic warfare fraternity, the Association of Old Crows, commissioned a survey of its readers last year. This June it published the results.

Of those surveyed, 38% said their work did not provide "stimulation and challenge." 19% had no opinion. Only 25% felt they were "compensated appropriately" for their work, and only 23% said they "have a flexible career path ahead." The magazine reports, "More than half did not like the management of their companies."

On the positive side, the engineers (72%) said they "can be involved in various projects" and 76% are secure in their jobs. Only 10% reported being unhappy with their jobs, but a whopping 41% expressed no opinion either way.

We have contended, for some time, that despite the rapid expansion of Pentagon funding for electronic warfare and other military electronics programs, military contractors may have difficulty hiring bright young engineers, not because of their doubts over U.S. foreign policy, but because the bureaucratic nature of the weapons industry stifles technical creativity. The *Journal of Electronic Defense* survey reinforces that analysis.

WEAPONS SOFTWARE

Air Force magazine (James W. Canan, "The Software Crisis," May, 1986) has identified a software crisis, afflicting both the military electronics industry - the subject of the article - and its civilian counterpart. Software is essential to modern weapons systems; it is a force multiplier; and "modifying software is now the main means of upgrading [military] systems to keep them on top of threats."

The crisis is that the current supply of programmers cannot generate enough code to meet the armed services requirements. Canan reports, "The military is currently developing as much new software as the 100,000,000 lines of code that it now has in use. The national shortfall of some 80,000 civilian and military software professionals is expected to swell to 1,000,000 by 1990, and only a few US universities offer advanced degrees in software engineering."

The shortage means that systems completion is often delayed, quality is generally spotty, and costs have uniformly jumped. He writes, "Software costs have skyrocketed so high that they dominate the costs of military electronics and are headed for runaway proportions."

Canan says that the civilian sector is experiencing a similar shortage, and its top-dollar offers to military employees and officers are drawing them into the

commercial world and exacerbating the military's problems.

To overcome the close the software gap, the Pentagon has initiated a three-pronged Software Initiative. First, it is financing the Software Engineering Institute at Carnegie-Mellon University, one goal of which is to increase the productivity of software engineers - that is, partially automate software coding. Secondly, it is funding private contractors through the Software Technology for Adaptable, Reliable Systems (STARS) program, to develop re-usable software. And third, it has adopted Ada as a standard, high-level programming language.

Even as these programs pick up steam, they must overcome "the individualism and the lack of discipline that are rampant - necessarily so, given the freehand nature of the software workplace - in the programming world."

Canan and the Pentagon appear to be bureaucratizing what is in fact a creative process. Measures such as lines per man/month fit military planning, but are anathema in the more productive world of commercial sector microcomputer software.

However, they are right to point that software production is labor intensive. For many years, weapons manufacturing has increased in labor intensity, so employment has stabilized and in many areas fallen while military spending has increased. The increasing share of the Pentagon dollar going to software means that employment - of white collar workers, not production employees - may again move upward. (Reprinted in *Congressional Record*, June 23, 1986, pp. S8195-8198)

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SEMICONDUCTOR LOCATIONS

Allen Scott and David Angel have completed another valuable report on the geography of high-tech industry. In "The U.S. Semiconductory Industry: A Locational Analysis" (Department of Geography, University of California - Los Angeles), Scott and Angel ask why the U.S. merchant semiconductor industry has concentrated in Silicon Valley. After reviewing a wide body of literature and conducting their own statistical analysis, they concluded that Silicon Valley is particularly oriented toward technological development and that the Valley is sustained by a large number of intra-regional, inter-company transactions. This matches their general analysis: "Industrial systems that are characterized by numerous external transactions will have a strong inducement to converge spatially around their own center of gravity."

Reviewing the historic roles of Stanford University, non-semiconductor electronics companies, and military installations in development of Silicon Valley, Scott and Angel argue, "The kinds of locational factors that have been commonly advanced to account for the early growth of the semiconductor industry in Silicon Valley did not constitute unique geographical advantages, but only a set of adjunct contingencies widely available in varying combinations elsewhere. Nevertheless, by the early 1960s, a process of vertical and horizontal disintegration had been initiated among Silicon Valley semiconductor firms so that many important agglomeration economies started to become available in the region, especially for integrated circuit producers."

They say that it is not obvious why such conditions emerged in Silicon Valley, rather than Phoenix and Dallas, the home bases of Motorola Semiconductor and Texas Instruments, the two merchant industry leaders.

Though we consider the UCLA paper a major contribution to the understanding of the growth and structure of the electronics industry, we disagree on some important points. First, it is unrealistic to study the development of the semiconductor industry without reviewing the simultaneous growth of other high-tech sectors, particularly the computer manufacturing industry. Indeed, as shown in the May, 1986 *Global Electronics*, electronic components employment has hovered near 35% of all Valley high-tech employment for the past 13 years. Scott and Angel found that the presence of consumers and suppliers for the semiconductor industry made agglomeration possible, but they de-emphasize the importance of those other firms as an integral part of that concentration.

More important, historical analysis suggests that Stanford University did indeed shape the development of Silicon Valley, not merely as an educational and research resource, but by actively promoting the spin-off phenomenon. By the time key managers and scientists left Fairchild to form their own semiconductor companies, numerous precedents existed, primarily in the military electronics field. MIT played a similar role in the

development of Massachusetts' Route 128, although that area has historically had few merchant integrated circuit producers.

In areas where single major companies, such as TI, Motorola, and IBM - as opposed to educational institutions - pioneered high-tech growth, spin-offs and start-ups have been much less common. Of course, it is easy to see why successful companies would discourage spin-offs.

In fact, one can compare Dallas directly with Silicon Valley. TI's ascendance as the market leader in semiconductors appears to result directly from the hiring of Gordon Teal, who had developed crystal-pulling techniques at Bell Labs, to head its semiconductor operations. Under Teal's leadership, TI perfected the first silicon transistor. (Bell's was made of germanium.)

At about the same time, William Shockley, who headed Bell's transistor research team, established his own semiconductor firm in Silicon Valley. Though Shockley's firm never succeeded, the people he recruited were able, in the environment created by Stanford, to form Fairchild Semiconductor, which spun off most of the Valley's well known semiconductor firms.

Industry pioneer Robert Noyce has half-jokingly commented that Silicon Valley is where it is because Bill Shockley's mother lived in Palo Alto - that is probably the reason Shockley went to teach at Stanford and set up his company nearby, after leaving Bell Labs. Shockley may have helped spark the industry's growth, but Stanford had created conditions in its environs that were never matched in Dallas, despite Teal and TI's success.

Should Portland emerge as a major high-tech center in the next decade, this analysis will require some adjustment. Portland has no "great research university," but Tektronix, the largest electronics employer, has encouraged spin-offs. (Though companies in the Portland area, which is known for its cheap electrical power, process silicon, there is relatively little semiconductor production in the area. But high-tech as a whole may resume its rapid growth there whenever the industry overcomes its current recession.)

DISCRETES

While the integrated circuit segment of the semiconductor industry remains mired in a global slump, the discrete business - small transistors, power transistors, thyristors, diodes, rectifiers, and optoelectronics - is doing relatively well. "Gnostic Concepts [according to its June 16, 1986 press release] projects worldwide consumption of discrete semiconductors to rise from \$5.513 billion in 1985 to \$9.830 billion by 1990, at an average annual rate of 12.3 percent."

Gnostic Concepts reports that government and military electronics is the largest market for discrete semiconductors in the U.S. Its 25% share is substantially higher than the government/military share of integrated circuit sales.

ATARI LAWSUIT

More than three years after Atari shocked Silicon Valley and the world by laying off hundreds of workers without notice, Warner Communications, Atari's owner at the time, has reached a settlement with lawyers representing over 500 of those workers. Warner has agreed to pay workers \$1,118.92 each additional severance benefits, an amount equal to the average of four weeks pay, and it will cover the workers' legal costs.

On February 22, 1983 Atari told 537 workers that they were being laid off, effective immediately, and that production was being moved to the Far East. In the midst of an ultimately unsuccessful union drive by the Glaziers Union, Atari had repeatedly re-assured its employees that their jobs were secure.

Following the lay-offs, the Glaziers filed an Unfair Labor Practices charge with the National Labor Relations Board. In its defense, Atari supplied evidence showing that the decision to fire the workers was made well before the Glaziers started organizing, and the NLRB ruled against the union.

In August, 1983, attorneys from the Employment Law Center in San Francisco filed a class action suit on behalf of those Atari workers who were dismissed on February 22, 1983. The lawyers, using information that Atari supplied the NLRB, argued that the company had

falsely and deliberately promised job security to the workers, and they claimed that statutes require some reasonable prior notice of lay-offs.

In April, 1984, a California Superior Court judge rejected Atari's motions to dismiss the case, essentially upholding the legal theories upon which it was based. After a lengthy process of discovery (legal investigation) and then negotiations, attorneys representing both sides reached the settlement.

On June 3, 1986, the Employment Law Center announced the settlement and claimed victory. Though the case never went to trial - thus no formal legal precedent was set - workers' attorneys called the settlement a "powerful precedent."

In fact, the settlement represented a small but important step forward in efforts to judicially expand workers' right. The long delay in the award - plus the difficulty in winning it - illustrates that legislation is still needed to guarantee American workers significant advance notice or timely in-lieu severance payments.

Ironically, workers at Atari's plant in Limerick, Ireland demonstrated that organization and militancy can bring results, even when statutory benefits are not present. When Atari shut its Irish plant, workers occupied it, quickly winning added severance benefits.

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