GLOBAL ELECTRONICS

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AUTO AUTOMATION

Automobile manufacturers have been using robots and other forms of isolated automation technology for some time. However, their goal of integrating manufacturing under the control or coordination of one computer system has been held up by the incompatibility of the various pieces of equipment. Manufacturers of that equipment, anxious to hold on to their own markets and unwilling to revise their systems, were not moving toward standard forms of communications.

To speed up its move into computer integrated manufacturing, General Motors created its own Manufacturing Automation Protocol, and over the initial objections of computer companies — such as Digital Equipment and Hewlett-Packard — it enlisted the support of other major American manufacturers, including Deere, Boeing, and Eastman Kodak. Today MAP is the standard for factory integration, accepted by major computer makers, production equipment manufacturers, and aerospace firms, as well as Ford and Chrysler. (See **Fortune**, October 28, 1985)

The standardization of factory data links should not only speed up the automation of American factories, but it is likely to help manufacturers of chips and computer systems regain their footing. First to the gate among chip-designers is a small Silicon Valley start-up called Industrial Networking, Inc. (INI), which has successfully demonstrated a MAP chip to GM. INI was formed by computer network-maker Ungermann-Bass, and General Electric provided \$6 million in financing as well.

Other, more established Silicon Valley firms are starting to rake in car factory automation contracts. Hewlett-Packard is selling large quantities of automatic test equipment to GM. Measurex has agreed with Ford Motor to develop a computer integrated manufacturing system for its Body and Assembly Operations.

AEROSPACE PAY

The U.S. General Accounting Office has published the results of a survey of compensation levels at 12 large aerospace companies. In general, managerial, clerical and technical, and production workers did better in aerospace than other manufacturing industries, but engineers and other professionals scored below their counterparts in other industries.

In 1982, the 12 firms employed over 177,000 people and had sales over \$18.5 billion. More than 78% of their business was for the government. They manufacture a range of products, including aircraft, engines, missiles, spacecraft, and associated electronics equipment.

Executives at the aerospace firms earned salaries and bonuses consistently above their counterparts in durable goods manufacturing, as surveyed by the American Management Association (AMA). In 1982, the greatest difference occurred among senior engineering executives, who in aerospace received an average of 171% of the applicable AMA average. Senior aerospace marketing executives earned only 105% of the AMA marketing average.

Comparing the salaries of professionals, the GAO found that the average aerospace professional salary fell from 102% of the Bureau of Labor Statistics national average in 1978 to 96% in 1983. Pay for engineers, the largest group of aerospace professionals, also fell from 102% to 96% of the applicable average in the same period.

Aerospace clerical and technical workers earned 109% of the BLS average in 1983, with secretaries, who make up a large proportion of that group, also making 109% of their counterparts. Aerospace industry factory workers as a whole earned 107% of the applicable average, while tool and die workers made 102% of their counterparts. Janitors scored well in aerospace, earning 118% of their counterparts in 1983.

The data presented by the GAO appears to genuinely show where large aerospace companies fit into the pay structure of American industry, but it is possible that smaller aerospace companies and subcontractors fit into an entirely different pattern. ("Compensation By 12 Aerospace Contractors," GAO/NSIAD-85-1, October 12, 1985)

THE BOOK IS HERE

Finally, our shipment of **The High Cost of High Tech: The Dark Side of the Chip**, has arrived. Written by **Global Electronics** editor Lenny Siegel and John Markoff, technology writer for the **San Francisco Examiner**, the book should be found soon in most major bookstores.

The book may also be ordered from PSC at its retail price, US \$16.50 plus shipping and taxes. The sales tax, for purchasers within California, is \$1.07, except for Santa Clara County, where the tax is \$1.17. Postage and handling, at book rate, is \$1.25 within the U.S. and US \$1.50 abroad. Checks and money orders should be made out to the Pacific Studies Center.

JAPAN

In the high-stakes, politically charged race to dominate the global semiconductor market, most detailed observations about the fairness of current trade policies are made by officials and executives with an axe to grind. **Competitive Edge: The Semiconductor Industry in the U.S. and Japan** (edited by Daniel Okimoto, Takuo Saguno, and Franklin Weinstein, Stanford University Press, 1984), produced by a team of American and Japanese scholars at Stanford University, is a welcome exception.

The study reviews the history, technological resources, financing strategies, and trade success of the semiconductor industry in both countries. At times, the report bends over backwards to avoid taking sides, leaving the reader without useful conclusions, but it does point out that most of the issues tossed around in the press are much more complex than they first appear.

Okimoto's analysis of the Japanese political economy, particularly the rise and continuing influence of Japan's Ministry of International Trade and Industry, is exceptionally valuable. Okimoto points out that the Japan Liberal Democratic Party has been able to rule Japan continuously since the U.S. occupation by directly placating a variety of electoral constituencies.

Insulated from the political winds such as those that influence U.S. tax, trade, monetary, and fiscal policy, MITI has established itself as the guiding hand of Japanese industry. MITI's greatest impact upon Japanese high-tech industry, therefore, has not been its organization of research projects like VLSI (very large scale integrated circuits) or "Fifth Generation" computing, but strategic leadership.

Corporate executives are confident that the Diet (Japanese parliament) will not reverse MITI's plans. They trust that the agency will not favor one firm or industrial group over another. And they can directly influence policies as they are developed. Therefore, powerful companies consistently follow MITI's lead.

INDIA

Citibank is setting up a software production center at the Santa Cruz Electronics Export Processing Zone in Bombay, for export to its worldwide operations. Another U.S. denizen of the Zone, disk-drive maker Tandon, will be the largest of nine foreign manufacturers to set up shop in the Madras Export Processing Zone, in Tamil Nadu.

Meanwhile, an Indian firm, Megabyte Consultancy Services and its affiliate, Megaware Computers, will produce microcomputers in Silvasa, Goa. Megabyte, the first private sector company in India to build computers from scratch, not imported kits, has signed a technology sharing agreement with Tradecom International of the Netherlands. Megabyte plans to export half its output.

TOSHIBA - H.P.

Hewlett-Packard's continuing technology-sharing relationship with Toshiba received a boost in the arm this September. The Japanese company announced that Dr. Yoshio Nishi, who led Toshiba's successful effort to develop the world's first megabit memory chip, would spend three years in H-P's integrated circuit lab in Palo Alto, California.

Toshiba spokesman Tsuyoshi Kawanishi told the **San Jose Mercury News** (September 24, 1985), "Although H-P is our rival to some extent in memory manufacturing, it's also one of our big customers."

Nishi compared American and Japanese researchers, suggesting that the latter worked better in groups. He added, "The Americans say we Japanese are workaholics and spend our weekends in the laboratory. But the Americans spend their weekends sitting in front of computer terminals, too. The only difference is they stay at home and we don't."

While in Silicon Valley, Nishi will lecture at Stanford University. He said that his academic work will help repay what he learned as a research associate at Stanford and what Toshiba has learned through its affiliation with the engineering school.

Nishi will be accompanied by his wife and two children, none of whom speak English fluently. Nishi reported that H-P assured him that his children could get a good education in Palo Alto, implying that Silicon Valley's quality of life is as important in attracting Japanese researchers as it is in bringing Americans to the area.

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edited by Lenny Siegel
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HYUNDAI SHUTDOWN

Hyundai, one of four major South Korean industrial groups that recently moved into chip production in a big way, has closed its two-year-old Silicon Valley wafer fabrication plant and laid off 100 workers. Production has been shifted to its larger, lower cost South Korean facility. The San Jose **Business Journal** (October 7, 1985) reports that Hyundai suffered a major blow to its image, for it originally promised its U.S. employees permanent jobs.

Hyundai's problems are symptomatic of the industry-wide slump in standard integrated circuits, but it may indicate much more. Hyundai, as well as the Daewoo, Samsung, and Gold Star groups, entered the high-end of the semiconductor market race as part of South Korea's policy of upgrading its role in the international high-tech division of labor.

Instead of focusing on the fabrication of semiconductors — for example, linear integrated circuits — that could be purchased within Korea for assembly into consumer electronics devices, all four South Korean chip-making ventures entered the cutthroat global competition in RAM (random access memory) circuits.

RAM profits, however, are generally low, particularly for chip-makers, such as the Koreans, that enter the market late in any particular generation of products. Some semiconductor firms profit little from RAM production, but they use high-volume RAM manufacturing to perfect production technology. They earn their money on other, less competitive product lines, but the Koreans cannot easily supply a wide range of products.

Consequently, it is likely that South Korea's much touted entry in the high-tech sweepstakes will flounder. Given South Korea's dependence on growing export earnings to pay off its large external debt, a failure in high-tech could be the straw that breaks the economy's proverbial back.

Alternatively, South Korean electronics firms may survive primarily as subcontractors for U.S.-based firms. For many years, a few South Korean companies have assembled circuits for U.S. outfits, and even now some of the wafer fabricators do contract work for U.S. firms with a greater command of the technology. Gold Star, for instance, fabricates several layers on wafers for Silicon Valley's LSI Logic, but LSI's U.S. plant processes the final layers that contain its proprietary designs.

Subcontracting, of course, leaves locally based ventures entirely dependent upon decisions made in corporate headquarters across the Pacific, but as long as South Korea can promise cheap production costs, some of that work will come its way.

CHALLENGES TO EDUCATION

The high-technology electronics industry is dynamic, not only because employment (in the long run) is growing at a rapid pace, but because the nature of the high-tech workforce is changing. Writing for the UC Santa Cruz Silicon Valley Research Group, Richard Gordon and Linda Kimball assess the implications of high-tech employment trends for U.S. educational policy. ("High Technology, Employment & the Challenges to Education," July, 1985, available from SVRG, Stevenson College, UCSC, Santa Cruz, CA, 95064, for $10 - checks payable to UC Regents)

For example, Kimball and Gordon show that the production workforce has steadily declined as a proportion of the overall electronics workforce, from 60.0% in 1965 to 49.3% in 1984. This trend, combined with the growing importance of high-tech, has increased the economic importance of scientific and technical education.

However, they argue that traditional manufacturing and traditional skills are as important to the competitiveness of the U.S. economy as high-tech training and production. In fact, with workers being called upon to solve problems not anticipated by the designers and programmers of machines, broad, practical learning is increasing in value.

The need for a flexible, autonomous workforce directly contradicts the present hierarchical social organization of technology, and the conflict between these two forces will govern not only the future of workplace automation but the shape of the American educational system.

Furthermore, Kimball and Gordon provide data underscoring the racial, ethnic, and gender stratification of scientific education and employment, pointing out that the current inequality of high-tech educational opportunity is largely a refinement of older forms of inequality.

FRENCH INVESTMENT

While one group of French investors in the U.S. electronics industry is seeing their efforts turn sour, another is putting in new capital. Texet, a power-semiconductor manufacturer established in Allen, Texas, in 1983, has declared bankruptcy. Backed by French capital, it operated a plant in Ste. Michele-sur-Meurthe, in Eastern France. Reportedly, the French government has taken over that factory.

Meanwhile, Merlin Gerin, a French power-supply manufacturer, has invested $4.1 million in Telmos, a Silicon Valley producer of specialized chips. (**Electronics**, October 14, 1985)

SOUTH AFRICAN COMPUTERS

North American opponents of South Africa's *apartheid* policy have long criticized the eagerness of U.S.-based computer firms to supply that country. In 1978, the Carter Administration restricted the sales of U.S.-made machines to police and military agencies implementing *apartheid*, but sales to the commercial sector, as well as other arms of the South African government, have boomed.

The Church-backed **Corporate Examiner** (Vol. 14, No. 4, 1985) reports that American computer exports to South Africa more than tripled from $50 million in 1978 to $162.7 million in 1983. U.S. firms hold 47% of the South African computer market.

The **Corporate Examiner** profiles three of the largest computer firms in South Africa. With their operations dedicated to sales and service, not production, whites make up the major portion of their workforce. IBM has 1,793 employees (1,419 white) there; Burroughs has 563 (476); and Control data has 313 (242).

OFFSHORE LABOR COSTS

The Communications Workers of America has tabulated unpublished Bureau of Labor Statistics data on national wage rate in electronics, including telecommunications, production, as well as overall manufacturing wages:

Country	Electronics	All Manufacturing
United States	US$12.48	US$12.59
Japan	5.49	6.35
Singapore	2.25	2.43
Mexico	1.69	2.00
Hong Kong	1.47	1.60
Taiwan	1.25	1.46
South Korea	1.23	1.36

Pacific Studies Center
222B View Street
Mountain View, CA
94041 USA