

## **BEHIND THE CURVE: JAPAN'S PC INDUSTRY**

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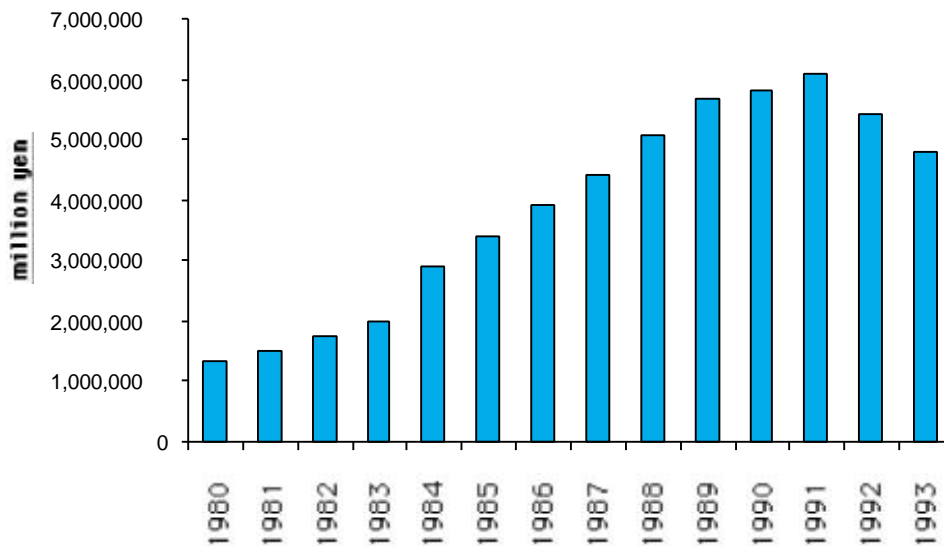
The Japanese are "going to run away with the world computer market. It's going to be another TV industry." Clyde V. Prestowitz, *Business Week*, Oct. 23, 1989.

By the late 1980s, Japan's electronic giants had vanquished most of their American competitors in consumer electronics, and many in the U.S. feared that America's computer industry would meet the same fate. Japan's computer makers had caught up with IBM in mainframe computer performance and were gaining market share worldwide. U.S. companies still led the personal computer (PC) industry, but they were dependent on Japanese suppliers for many components, including dynamic random access memory (DRAM) chips, laser printer engines and flat-panel displays for portable PCs. In 1989, Japan surpassed the U.S. in computer hardware output, and ran a large trade surplus with the U.S. in computers. American pessimists were conceding the computer hardware market to Japan, and argued that Japan would eventually challenge U.S. leadership in software as well.

Only six years later, the situation has changed remarkably. American companies have regained their leadership in computer hardware and remain the unquestioned leaders in software. The shift toward networked computing, exemplified by the explosive growth of the Internet, has put Japan at a further disadvantage as Japan is several years behind the U.S. in networking and Internet adoption. Japanese companies still lead the world in production of computer components, but their leadership is being challenged by aggressive competitors in Korea and Taiwan. Meanwhile, U.S. companies have made major inroads into the Japanese PC market, holding a market share of about 30% in 1994. Japan's computer makers appear to be on the defensive, unable to respond effectively to the lightning-fast changes in the computer market of the 1990s.

Before analyzing the reasons for the decline of Japan's computer industry, it is worth noting that the Japanese were not the only ones who have foundered in the PC era. U.S. companies such as Data General, Wang, Unisys, and Prime have disappeared or remain only a shell of their former selves. Even mighty IBM lost billions of dollars, laid off hundreds of thousands of workers, and is still weak in the PC business that it helped create. The problem for Japan is that its decline in computers has been systematic. The handful of large companies who control most of Japan's computer industry have all faced serious downturns in the 1990s, and there has been no new generation of companies to compensate for these losses. Total computer production dropped by over 20% in just two years (Figure 1).

**Figure 1. Japan's computer hardware production, 1984-1993**



Source: JECC, *Konpyuuta Notoo* 1994

Many people blame the downturn on the bursting of Japan's bubble economy and the ensuing recession that depressed demand for computers. However, the real problems ran deeper. By the late 1980s, when the Japanese computer makers (JCMs) appeared ready to "run away with the world computer market," they were actually in a very vulnerable position. They were still highly dependent on mainframe computer production and their vertically integrated production structures were poorly suited to the fast-changing, decentralized PC industry. The domestic recession and global price wars of the 1990s just served to expose those weaknesses.

### **Chasing IBM: The mainframe era**

Japan got into the computer business in the 1960s, at the high point of IBM's market dominance. By 1971, IBM had a 62% share of the world market. IBM's dominance of global markets was a source of consternation in a number of countries who did not want to be shut out of a leading high-tech industry such as computers. Several European governments supported "national champions" such as ICL and Bull as competitors to IBM, with disappointing results. None of these national champions was able to compete with IBM outside of their protected home markets, and European computer makers were unable to maintain IBM's pace of technological innovation.

Japan was a different story, however. By 1980, the JCMs were able to produce mainframe computers that matched IBM machines in performance. Japanese companies controlled 72.5% of the domestic market by 1980 and Fujitsu had passed IBM in market share in Japan. With Fujitsu's purchase of Britain's ICL and the U.S. company, Amdahl, they appeared to be poised to penetrate the European and U.S. markets.

How was Japan able to successfully challenge IBM while others failed? Credit the combined forces of private sector initiative and government industrial policy. The Ministry of International Trade and Industry (MITI) limited IBM's operations in Japan and forced IBM to transfer technology to the JCMs. Protectionism bought time for the JCMs to catch up, but was limited in time. MITI also encouraged competition among several domestic companies and allowed IBM to compete with some restrictions. Both MITI and NTT supported research and development consortia among the JCMs in computer, semiconductor and communications technologies.

While the JCMs were able to compete with IBM in hardware, they remained dependent on IBM software standards, a fact that was brought home when Hitachi and Mitsubishi were caught stealing IBM technology in 1982. That same year, MITI launched the Fifth Generation Computer System project, hoping to leapfrog IBM technologically and establish a new generation of computers based on Japanese standards.

### **The PC Revolution**

Even as MITI and the JCMs intensified their efforts to beat IBM in the high-end of the computer market, a revolution was brewing in the garages and workshops of Silicon Valley in the form of the personal computer. The first wave of commercial PCs was led by Apple Computer, but it was IBM that introduced the PC to the business market and established the technological standards around which the PC industry would evolve. Ironically, the PC revolution that IBM helped foment would eventually cost the company its industry leadership and lead to billions of dollars in losses. The Japanese companies that were chasing IBM followed it off the same cliff.

Why did both IBM and the JCMs meet such a fate? The explanation lies partly in the new industry structure which IBM unwittingly created. By publishing the interface standards for the IBM PC, IBM opened the door to companies such as Compaq, Dell and others to produce IBM-compatible PCs. Those PCs could be easily assembled from off-the-shelf components and would run all of the software written for the IBM PC. The new industry structure that emerged was based on horizontal specialization. Many independent companies compete in each segment of the market (for instance, PC systems, disk drives, monitors, and application software), and buy and sell their products through market transactions.

Initially, this appeared to be a boon for the Japanese industry, which flourished as a supplier of components for the PC, including chips, monitors, laser printer engines, floppy disk drives and flat-panel displays. However, Japanese suppliers soon faced aggressive competition in most components and peripherals from Taiwan, Singapore, Hong Kong and Korea, as U.S. companies developed supply and production networks throughout Asia. Korea is challenging Japan's dominance in memory chips, with Samsung now the number one producer in the world. Taiwan's nimble small and medium-sized enterprises (SMEs) exploited niche markets and eventually became world leaders in a number of components and peripherals, as well as in notebook computers. And U.S. disk drive companies moved production to Singapore and gained the lead in the hard disk drive market.

### **Controlling architectural standards**

While Japan has struggled with fierce competition in components and peripherals markets, most PCs are still full of Japanese parts. The real problem of the Japanese computer industry has been in PC systems and software. A brief shopping trip in a typical U.S. city will illustrate the problem. Stopping first at a consumer electronics store, the shopper will be surrounded by Japanese brand names such as Sony and Panasonic. Going next door to a computer store, that shopper will find a different set of brand names, such as Compaq, Apple, Packard-Bell and IBM, and probably some Toshiba notebooks and NEC monitors. In the software department, U.S. brand names fill the shelves, and Japanese products are virtually absent except in video games.

Why have Japanese companies been largely shut out of global markets for PCs and software, after dominating in consumer electronics? The simple answer is that they were unable to control the key architectural standards of the PC industry. These are the technology standards that all hardware and software makers must adhere to in developing their products. By contracting with Microsoft and Intel for its PC operating system and microprocessors, IBM relinquished control of the architectural standards of the PC industry. Over 80% of the PC market is based on the so-called Wintel standard of Windows operating systems and Intel x86 microprocessors. Other important standards are also controlled by U.S. companies, such as laser printer software (Hewlett-Packard and Adobe) and networking (Novell). The only significant alternatives to Windows are Apple Computer's Macintosh system, and IBM's own struggling OS/2.

Japanese companies, which set standards for VCRs, camcorders and video games have been unable to influence any of the critical standards for the PC. Even the NEC 9800 PC architecture, which had dominated the Japanese market is now losing share to Windows and Macintosh. Japan is now trying to influence global standards for computer networks through participation in international bodies, but it appears that the U.S.-based Internet protocol is becoming the de facto standard for the next generation of computing.

### **Japan's computer industry structure**

Japan's weakness in PCs stems from the vertically integrated production system that was the very source of its companies' strength in other industries, including mainframe computers. Vertical integration allowed the JCMs to match the internal capabilities of IBM to produce all of its key components. In PCs, however, vertical integration proved to be a disadvantage. The bureaucratic decision making and top-down management of the Japanese industry structure made it slow to respond to changes in technology and markets. Also, relying on domestic suppliers of components kept the JCMs from taking advantage of the dynamism of the decentralized global PC structure. For instance, if one of NEC's suppliers were slow to develop a necessary component, a new generation of PCs could be delayed. In the U.S., if Seagate was slow to bring a new generation of disk drive to the market, PC makers would gladly buy from Quantum or Conner. The intense competition at each level of the production chain gave the U.S. PC industry a dynamism that the Japanese industry did not match.

Japan also lacks the entrepreneurial startup companies that created much of the global PC industry. Speed and responsiveness to the market are critical in the PC industry, and size can be more of a liability than an asset. Japan's PC industry is dominated by giants such as NEC, Fujitsu and Toshiba, for whom the PCs is not the main business. The global industry is led by PC-era startups such as Apple, Compaq,

Microsoft, Taiwan's Acer, and Singapore's Creative Technologies. The larger companies that have done well in PC-related products, such as Hewlett-Packard, have done so by consciously decentralizing their management structures in order to achieve the flexibility of a smaller company. Even IBM has decentralized itself into several smaller operating units and undergone a radical downsizing. So far, the JCMs have shown little inclination to downsize or decentralize, partly because of the pressure to maintain jobs in Japan and not tamper with the social contract between workers, government and business that are the foundation of Japanese corporate culture. The JCMs have tried to reduce employment by cutting back on new hiring, but this just keeps older workers remain on the payroll, while fewer PC-literate young workers are brought in.

### **The Japanese Computer Market**

The Japanese PC market grew slowly in the 1980s, partly because of difficulties in dealing with the Japanese language. The thousands of ideograms that make up the Japanese written language make keyboard use difficult and require extra processing power. The early IBM-compatible PCs lacked the power to handle the Japanese language, and the MS-DOS operating system complicated matters with its reliance on keyboard commands. The JCMs each developed their own adaptations of DOS to handle Japanese characters, but these versions were not compatible with each other or with the English language version. Many users opted for dedicated word processing machines that could handle the Japanese language.

The mainframe makers (Fujitsu, Hitachi and NEC) originally saw the PC as a smart terminal for the mainframe rather than a standalone product, and were not inclined to develop a common operating system. NEC came to control over half of the fragmented PC market with its 9800 series by mobilizing its vast distribution channels and courting independent software vendors to write applications for the 9800. Foreign competitors were discouraged from entering the Japanese PC market by NEC's control of the key retail channels and the lack of Japanese-language software for their products. Fujitsu and Hitachi were unable to make a dent in NEC's market share and sold mostly to their mainframe customers, while Toshiba concentrated on supplying components and portable computers to the U.S. market.

Facing little competition, NEC maintained high prices which boosted its profits but slowed the spread of PCs in Japan. Other factors came into play as well, including the corporate culture of large Japanese companies, whose managers saw PCs as tools for secretaries, not managers. Also, the centralized management structures of those companies favored centralized computing systems over the decentralized client-server system developing in the U.S. By the early 1990s, the penetration of PCs in Japan was only about a third of the U.S. level, and networking of PCs was even less developed (Figure 2).

**Figure 2. Computer use in the United States and Japan, 1993.**

	United States	Japan
Computers in use	74,400,000	12,200,000
Computers/1000 workers	660	220
Percent of PCs connected to LANs	66	17

Sources: Juliussen and Juliussen (1994), *Computer Industry Almanac*; Fukuda, Takeo (1994). "Japan's emerging network services."

The lack of a large domestic user base, combined with the incompatibility of Japanese PCs with international standards, meant that Japanese companies could not use their home market as a base for developing products for international markets as they had done with consumer electronics. The low level of computer use also put Japan years behind other countries in gaining the productivity benefits associated with computerization.

The Japanese market is undergoing major changes in the 1990s. IBM introduced the bilingual DOS/V operating system in 1991, which made thousands of DOS-based applications available on a standard Japanese operating system. Meanwhile, Apple Computer began to make rapid gains with a user friendly Japanese version of its Macintosh system. Apple's market share in Japan grew from under 1% in 1990 to 15% in 1994. Then, in 1992, Compaq launched an all out price war by offering its PCs at half the price of equivalent NEC machines. Finally, perhaps the most important development was the introduction in 1993 of Microsoft's Windows 3.1J, a Japanese version of Windows that can run on both NEC and DOS/V. This effectively unified the software market and allowed developers to write programs for both platforms. It also meant that Windows programs written for international markets can run directly on most Japanese PCs. The combination of lower prices and a much broader base of software applications has caused a boom in PC sales in the past two years, with sales of PCs nearly doubling from 1993 to 1995.

NEC initially tried to stay above the price wars that Compaq launched, acting somewhat miffed that Compaq would bread the unwritten rule against price competition in Japan's computer market. But NEC's market share dropped from 52% in 1992 to 43% in 1994, and it has responded by cutting prices to maintain market share. Not only has NEC lost market, but the JCMs have lost share overall, as U.S. companies increased their market share from 13% to 30% in three years (Figure 3).

**Figure 3. Share of Japan's PC market by company**

Company	1988	1991	1994
NEC	51%	52%	43%
Fujitsu	14	8	9
Toshiba	10	9	4
Seiko Epson	10	9	5
IBM	7	7	10
Apple	<1	6	15
Compaq	<1	<1	4
Other	8	9	10
Total U.S. co's	8	13	30

Sources: IDC Japan; *Electronics Business Asia*, April, 1995.

### Software shortcomings

If Japanese companies have had a mixed record in PC hardware (strong in components, weak in systems), their record in PC software is dismal. Software is a faster

growing market worldwide than hardware, and the fastest growing segment is packaged software for PCs. Yet, Japanese products are virtually non-existent outside the Japanese market. Even the Japanese market is now dominated by operating systems controlled by U.S. companies, i.e., DOS/V, Windows and Macintosh.

There is no single reason for Japan's software shortcomings, but several factors are clearly involved. The software industry in Japan developed as an adjunct to the hardware industry in the mainframe era. Originally, the software industry consisted of spin-offs from hardware vendors and large users who were organized into "software factories" to develop custom mainframe software. This software factory approach discourages creativity with its top-down approach to development. The independent software vendors that have produce most PC software worldwide are very weak in Japan, where most small software companies serve as subcontractors to a few large vendors. Until very recently, most PC software companies have focused on developing applications for the NEC 9800. This limited the size of their potential market, and made it almost impossible to try to tap export markets.

The size of the market for packaged software in Japan is also limited by the lack of government protection for intellectual property rights and the common attitude that software should come free with the hardware. The Business Software Alliance estimates that pirated programs account for 80% of PC software used in Japan, compared to about 35% in the U.S. The prevalence of pirating encourages software companies to stay with custom programming rather than trying to develop innovative packaged software which can easily be copied. Finally, software is not valued as highly as hardware, either by users or by producers, and talented people are not likely to be attracted to careers in software.

### **Industrial policy**

MITI's efforts to help the JCMs move to the frontier of computer technology have been largely unsuccessful. The Fifth Generation and Supercomputer projects have failed to produce commercial products or achieve major leaps in technology. The poor performance of the R&D consortia is partly due to the JCMs' lack of enthusiasm for the projects. In the past, the companies took the lead in carrying out R&D projects aimed at catching up in clearly defined technologies.<sup>1</sup> The consortia of the 1980s had vague, long-term goals determined by government committees, and the companies refused to invest their own money.

The other problem with the R&D projects was their focus on catching up to IBM in large computer systems. This strategy had worked during the 1970s, but failed to acknowledge the changes taking place in the 1980s. Like the JCMs, MITI was late to recognize the importance of the PC revolution and understand that IBM was no longer the target that mattered.

### **Conclusions and a look at the future**

How did the Japanese computer makers stumble so badly at a time when they appeared on the verge of challenging the U.S. for world leadership. One answer is that

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<sup>1</sup> For example, the very large-scale integrated circuit (VLSI) project in the 1970s that helped Japan catch up in advanced semiconductor technologies.

they were slow to comprehend and adjust to the radical changes taking place in both markets and technology. The old strategy of "Beat IBM" was simple to comprehend, even if difficult to achieve, and the vertically integrated JCMs were well structured to compete with IBM. Like IBM, the JCMs were slow to comprehend and respond to the changes that took place in the 1980s, and faced the consequences in the 1990s.

Japanese companies now understand that they must change to regain their competitiveness, but find it difficult to make the kinds of adjustments that many U.S. companies have gone through. Indeed, rather than radically restructuring or downsizing, the JCMs are attempting a hybrid strategy of increasing offshore production while only marginally reducing employment at home. NEC, for instance, is now producing low-cost PCs in Hong Kong and plans to eventually use non-Japanese suppliers for up to 80% of their components.

In the domestic market, Fujitsu and Seiko-Epson have begun selling DOS-V machines, although NEC remains a holdout. Foreign companies' market share is likely to continue to increase, with new entrants such as Dell and Taiwan's Acer becoming aggressive competitors. In global markets, Toshiba has reclaimed its leadership in portable computers, and NEC has bought a 20% share of Packard Bell, the leader in the U.S. home PC market. It is not likely that Japanese companies will make major gains in brand name sales abroad, but they will continue to be major suppliers of many key components, particularly flat-panel displays, memory chips and CD-ROM players.

The longer term strategy of the Japanese computer industry appears to focus on multimedia rather than PCs. Japanese companies see new opportunities in the convergence of computing, communications and consumer electronics and hope to use their strength in multimedia hardware to take advantage. The government is likewise planning major investments in Japan's national information infrastructure (NII) to encourage the growth of domestic multimedia markets. Internet-mania is now catching on in Japan, but Japan's highly regulated telecommunications industry has been slow to provide access at reasonable rates. There is talk of deregulation, but the Ministry of Posts and Telecommunications seems bent on actually increasing its regulatory role.

The government and companies are both trying to influence global standards for multimedia. Japanese companies have done best when building products such as TVs, camcorders and VCRs that are based on stable technology standards. As standards for multimedia eventually emerge, Japanese companies will certainly be major players in hardware production. They will also certainly face heavy competition from Taiwan, Korea, Singapore and eventually China in those hardware markets, and will find it difficult to maintain decent profit margins.

Meanwhile, Japan's weaknesses in software and information services has left its companies out of large and highly profitable markets such as entertainment content, databases, network services and system integration. Even now, multimedia is seen in Japan mostly as an opportunity to sell more devices, not to develop content or services. Many people still argue that Japanese companies can succeed by building hardware for the information economy, but the largest and fastest growing segments of the market are in software and services.

To conclude, Japan is not about to disappear from the computer industry, and its companies will undoubtedly find ways to stay competitive in many segments of the market. However, more production will continue to move offshore and competition in hardware markets will intensify. Japanese companies will have to restructure themselves

to promote innovation and develop "soft" industries to complement their manufacturing prowess. The challenge of restructuring and nurturing innovation will largely define Japan's future in computers.