

## **COMPAQ COMPUTER CORPORATION: Initiating a Price War<sup>1</sup>**

Nineteen-ninety-two had been a turnaround year for Compaq Computer Corporation. Revenues were up 25% to \$4.1 billion. Net income for 1992 was up 63% to \$213 million. Compaq, America's third largest maker of PCs in 1992, had achieved these results after initiating pricing wars at a time of slow industry growth, earnings declines, and market share shifts (Exhibit 1). With rapid product introductions and price reductions throughout 1992, Compaq's new president, Eckhard Pfeiffer, had transformed his company into a low-price competitor. He explained to stockholders:

Recession, intense price competition and shifting channels of distribution hit the personal computer industry in 1991. For the first time, Compaq experienced a decline in revenue and earnings. We responded aggressively and decisively. We created new strategies for products, service and support, distribution and advertising. We restructured operations and lowered costs. In short, Compaq emerged ready to compete in a tough environment.

In fact, Compaq's PC shipments for September, 1992, reached a record 200,000 units.

### **Exhibit 1: Compaq Computer Corporation's Quarterly Results**

<b>Fiscal Quarter (\$millions)</b>	<b>Ending 6/30/92</b>	<b>3/31/92</b>	<b>12/31/91</b>	<b>9/30/91</b>
Net Sales	826,976	783,048	873,401	709,370
Cost of Goods	577,043	520,705	548,381	465,912
Gross Profits	249,933	262,343	325,020	243,458
R&D Exp.	44,148	44,595	45,425	50,798
S.G.& A Exp.	164,481	159,546	178,881	164,261
Inc. Bef. Dep.	41,304	58,202	100,714	28,399
Non-op. Inc.	-12,827	2,486	-12,165	146,238
Inc. Bef. Tax	28,477	60,688	88,549	-117,839
Other Income	9,915	4,666	2,609	3,588
Net Income	28,996	45,326	66,562	-70,256

Compaq's record sales had resulted from its new low-priced, high performance ProLinea PCs, introduced in June, 1992. The new product line had generated a three-month order backlog and had forced competitors to cut prices. Compaq's original Deskpro lines had also generated record sales as new, lower priced models were introduced. In August, 1992, the company added a new line of low-priced, high performance laser printers to complete its networking product-line. The new strategy was then extended to Compaq's ProSignia network servers as Pfeiffer made across-the-board price cuts that averaged 32 percent in September. Compaq's 486DX33 server, priced at \$4499, sold for \$1000 to \$1500 less than equivalent servers from Dell and IBM. According to Kevin Bohren, Compaq's vice president for systems marketing, explained their pricing approach. "We decided to listen to what it was customers wanted. This is designed to meet the needs they have today, not what they might need tomorrow." The new strategy was supported by cost cutting and economies of scale that Compaq was achieving through its high volume sales. The company's lowest

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priced computer was only \$799. "I know that everybody out there wants to be where we are," said Pfeiffer. "The challenges we faced in 1991 reshaped Compaq. We're leaner and more competitive now, and ready to serve our worldwide customers as never before."

Third quarter profits in 1992 were \$50 million on revenues of \$1.07 billion, in contrast with a third quarter loss in 1991. By year end, Compaq reported record revenues of \$4.1 billion, up 25 percent over 1991, and net profits of \$213 million, up 63 percent. After accounting for 6.6 percent of world PC revenues in 1992, analysts were projecting Compaq's share to increase to 10 percent in 1993. Compaq's success had forced IBM to respond with its own low-price PCs as the price war entered full swing. As IBM and Compaq took on the second- and third-tier clone makers who comprised 53% of the PC market, everyone was entering the price war. CompuAdd, for example, cut its prices from 10% to 21% on five popular models to counter the Compaq and IBM moves. IBM's "direct response" program allowed customers to specify their own configurations of its new *ValuePoint* products and order by telephone. Custom built PCs were another way in which IBM and Compaq were attempting to provide value, and take away from the clones makers' market shares. The question was, "How far would the price wars go?"

### **Compaq's Background**

Houston-based Compaq was a world leader in the manufacture of desktop, portable and notebook personal computers and 386 microprocessor-based business machines that were IBM compatible. IBM compatible machines utilized the industry standard AT-bus and had over \$100 billion of installed hardware, software and peripherals worldwide. The company was founded in 1982 by a group of TI engineers including Bob Canion, Jim Harris and Bill Murto. The first product had been an over-engineered and premium priced portable computer that ran all software compatible with the IBM PC. The new company had been funded by Ben Rosen, president of Sevin-Rosen Partners -- a high tech venture capital firm that had funded Lotus Development Corporation. Rosen was chairman of Compaq's board of directors.

Compaq had broken revenue records in its first three years of operations with sales of \$111.2 million, \$329 million, and \$503.9 million, and shipping its 500,000th personal computer in 1985. The company's rise to the Fortune 500 list in 1985 was the fastest on record. With the introduction of its Compaq Portable and Compaq Plus PCs, the company had sold computers as top-of-the-line, premium-priced products with strong performance, design, quality, reliability and advanced user features. The company introduced its 286 microprocessor-based Deskpro and Portable computers in 1985, its 386 microprocessor-based Deskpro computers in 1986 and Portable computer in 1987. In 1988, the company introduced its SLT/286 laptop computer. Compaq then introduced the first 486-based Deskpro desktop computers, its powerful Compaq SystemPro network server, a notebook sized Compaq LTE computer, and an advanced graphics board and color monitor in 1989. Sales and service had been available only through authorized dealerships. Compaq employed more than 11,000 people worldwide by 1990. With advanced product development,

Compaq's investment in research and development was 6.0% of sales. By 1990, the company reached sales of \$3.6 billion and ranked 157 in the Fortune 500.

Compaq had entered the European market in 1984 establishing operations in Germany, the United Kingdom and France. By 1989, Compaq had a billion dollars in sales and had the second largest share in the European PC market, according to Dataquest. The company had also established sales subsidiaries in Australia, Austria, Belgium, Canada, Denmark, Finland, Hong Kong, Italy, Mexico, the Netherlands, New Zealand, Norway, Singapore, Spain, Sweden and Switzerland. In support of its global sales efforts, Compaq had built manufacturing facilities in Scotland and Singapore. Computers were sold through 3,800 dealers, of which 1800 dealers operated in 66 countries including Eastern Europe and Latin America. Over 58% of Compaq's sales were in foreign markets.

In 1991, Compaq's sales slid 17 percent as its share in the corporate market fell to upstart competitors like Gateway Computer, Dell Computer, AST Research, and others that offered lower priced machines and better service. As shown in Exhibit 2, sales for 1991 had been \$3.3 billion, a decline of nine percent from 1990 sales of \$3.6 billion. Compared the \$455 million profit in 1990, 1991 income of \$131 million fell 71 percent. Compaq's declining performance in 1991 had occurred after a recession in North America and much of Europe, with falling demand in key markets, and price cuts driven by intensive competition. While worldwide unit sales increased four percent, North American revenue actually fell 16 percent and international revenue fell three percent.

Compaq's management had been slow to respond to the changing market and co-founder and chief executive, Rod Canion, was replaced by Compaq's board of directors after a 14-hour board meeting on October 24, 1991. Compaq's 51 year old chief operating officer, Eckhard Pfeiffer, was given the job of moving the company into cut-rate PC's. Canion had resisted the shift in strategy, feeling that the "profit problems were due to the recession." Pfeiffer had seen similar downward pricing in calculators in the 1970s, when he was a marketing executive for Texas Instruments, and agreed with the board's demand for drastic action. Other top executives also resigned, including co-founder Jim Harris.

Pfeiffer had argued earlier that it was time to cut costs and prices to respond to cheaper priced competitors that were taking market share. Within ten days after his appointment as CEO, Pfeiffer announced that costs would be cut 35 to 50 percent as the company prepared to compete in every segment of the market. He announced in January, 1992, that Compaq would match any manufacturer in the world on price. According to Pfeiffer, "We threw our old pricing policy overboard. We are now pricing to market." Previously, the company had only focused on performance, adding bells and whistles and pricing them above IBM machines. Compaq was one of the few computer companies to build its own power supplies. It also over-designed castings, over-designed radio-emission shields, and added other high-cost features that did little for performance. According to a former engineering manager:

Success fueled good pay raises and good positions. Compaq people were spoiled by that. There was so much momentum from this culture that when the market changed quickly, Compaq could not adjust very quickly.

### Exhibit 2: Compaq Computer Corporation's Financial Analysis

	1991	1990	1989	1988
<b>Sales</b> (\$ millions)	<b>3,271.4</b>	<b>3,598.8</b>	<b>2,876.1</b>	<b>2065.6</b>
Cost of Sales	2,053.6	2,057.9	1,715.2	1,233.3
<b>Gross Margin</b>	<b>1,217.8</b>	<b>1,540.9</b>	<b>1,160.8</b>	<b>832.3</b>
Research & development	197.3	185.7	132.5	74.9
S,G&A	721.6	706.1	538.7	390.6
Income Before Dep. & Amort.	298.9	649.1	489.6	366.8
Non-Operating Income	-144.9	-7.7	-5.1	--
Income Before Tax	154.0	641.4	484.5	119.3
<b>Net Income After Tax</b>	<b>130.9</b>	<b>454.9</b>	<b>333.3</b>	<b>255.2</b>
Depreciation (\$ millions)	165.2	135.3	84.6	49.0
Income Tax Rate	15.5%	33.7%	34.1%	32.5%
<b>Net Profit Margin</b>	<b>7.0%</b>	<b>12.0%</b>	<b>11.1%</b>	<b>12.0%</b>
Cash	452.2	434.7	161.3	281.2
Receivable	624.4	626.5	530.3	428.3
Inventory	436.8	543.6	559.0	387.0
Other Current Assets	269.2	83.1	61.9	18.1
<b>Current Assets</b>	<b>1782.6</b>	<b>1687.9</b>	<b>1312.5</b>	<b>1,114.6</b>
Accounts Payable	195.6	292.4	253.9	238.6
Debt Due	.6	.5	30.5	NA
Other Liabilities	441.7	350.1	279.0	241.2
<b>Current Liabilities</b>	<b>637.9</b>	<b>643.0</b>	<b>563.4</b>	<b>479.8</b>
<b>Working Capital</b> (\$ millions)	<b>1144.7</b>	<b>1044.9</b>	<b>749.1</b>	<b>634.7</b>
Long-Term Debt (\$ millions)	73.5	74.0	274.4	274.9
Net Worth (\$ millions)	1930.7	1859.0	1171.6	814.6
<b>Return on Total Capital</b>	<b>12.3%</b>	<b>23.5%</b>	<b>22.8%</b>	<b>24.1%</b>
<b>Return on Net Worth</b>	<b>11.8%</b>	<b>23.2%</b>	<b>27.2%</b>	<b>30.5%</b>

Source: Value Line, May 1, 1992 and annual report.

As competition began meeting Compaq's performance at lower prices, the company began losing the growing low-priced segment of the market. According to Pfeiffer, "The business we left behind was wide open to the competition, and they went after it with a vengeance." Reorganization to cut overhead and employment by 1,700 people was announced on October 23, 1991. Consolidations and asset redeployment was carried out across the company. Compaq wrote off \$135 million in restructuring its operations, adding new distribution channels, adopting a more competitive pricing policy, and seeking ways to improve its operating efficiencies, including purchasing parts from outside suppliers. Also, the company shifted its service policy to be more customer friendly. By the last quarter of 1991, sales and profits began to improve though net margins continued to stay low. While Pfeiffer expected sales to reach record levels for 1992, there wasn't much room for error. Pfeiffer's new policies included slashing bloated costs, forgetting gold-plated technology, except where it really makes a difference, and, most important, redirecting Compaq's engineering capability to building high-quality computers at low prices. But could Compaq continue its research and development expenses in the future.

When Pfeiffer took over, few analysts believed that Compaq could survive in the new, low-margin climate, much less thrive. After 1991's drop in profits, Pfeiffer changed the company's basic strategies:

Our corporate priorities start with customer satisfaction. Compaq intends to serve the changing needs of its customers. Experienced corporate buyers remain an important market for Compaq, but a growing number of first-time buyers are shopping for home or small business use. This group has different requirements and purchases from different channels than most corporate customers.

Our new PC Division will continue serving the large corporate customer, but has expanded its focus to individuals and small businesses. To compete in this market, the company will introduce entry-level products and new methods of distribution, such as superstores selling to individual buyers.

Since 1991, Compaq's operating costs were cut from 25.7% of sales to 16.4% in 1992, close to the operating level of Dell, with 14.5% of sales.

### **New Product Strategy**

At the heart of Compaq's new strategy was an entirely new range of PCs, unveiled in June, 1992. While PC sales were nearly three-quarters of Compaq's revenue, the new range of PCs was targeted to more than double sales in the fast-growing "home-office" market. The new machines were priced one third less than its old line and prices were continuing to be slashed as the price wars heated up.

In 1991, Compaq had introduced four of five new products for its corporate customers. The Compaq Deskpro 386N (for network) was the leading seller in the rapidly growing business networking market. Compaq upgraded the performance of this low cost product in 1991 making it an attractive stand alone system. Its TechPAQ on-line reference and diagnostic tool met technical support demands of authorized Compaq dealers and customers. New products included a System Manager for advanced system management capabilities for PC-based network servers and multi-user host systems. In September, the company introduced its Deskpro/M line using a new systems board the separated components into five subsystems to help users upgrade their systems. In October, 1991, the sophisticated Compaq Portable 486c was introduced using Intel's 33-MHz 486 microprocessor and an active color matrix display. In January, 1992, the company added two Lite notebooks operating at 25 and 20 MHz. Appendix A lists the products and services developed by Compaq over the past decade. Pfeiffer explained:

Applications are also evolving in new directions. PCs are no longer simply personal productivity tools, but components in complex networks incorporating many types of computer products. Compaq pioneered the PC systems market in 1989 with the Compaq SystemPro and our programs providing specialized multi-vendor customer support.

Today, Compaq is a leader in the networked computer market, offering us a unique opportunity for growth and technological leadership. Our systems division will leverage this position and our experience, delivering not only hardware products, but software, support, service and integration assistance -- complete solutions.

According to Pfeiffer:

At Compaq, we believe in value-- a combination of price, performance and quality. Customer needs are not always met by products simply assembled from off-the-shelf components. In 1992 we intend to bring products with value and our quality message to the market.

Price remains key to customer satisfaction. Compaq cut its prices dramatically in 1991 and early 1992. We will continue to take the actions necessary to stay competitive.

By June, 1992, the company had introduced 41 new products, including new entry level ProLinea machines for home and small business markets. While introducing its low priced machines at \$899, below Dell's lowest price machine, the company attempted to differentiate its products with higher quality and increased features. According to Business Week:

One of Pfeiffer's most important decisions was his approach to the new low-end product. He organized an independent business unit to tackle the project and by last December was being briefed on a machine that looked nothing like traditional Compaq and didn't even bear the Compaq label. There was even talk of having it built by an outside subcontractor. Shortly after the team presented its garish blue prototype, Pfeiffer hopped a flight to Munich to spend Christmas with his family.

But something was wrong, so Pfeiffer had them start again and build a low price machine that was a real Compaq. Using the Compaq logo and in-house manufacturing became key to the ProLinea desktop and Contura laptop successes. The key was in taking advantage of Compaq's reputation as revealed by surveys, "They all came back and told us what an incredible name and confidence Compaq brought to this industry, even during a period of trials and tribulations."

To get the ProLinea's price down, engineers designed custom circuits to reduce the number of chips needed in each model. Fewer chips also meant less chance of quality problems. As a result, Byte Magazine gave the ProLinea a great review, noting that a Compaq was still a Compaq, even for \$1000. "The ProLinea still has what it takes in the important areas. Performance is good, and its high level of integration should make it a reliable system." According to Pfeiffer:

Already a technical leader in both the PC and PC systems markets, we now will be more cost and price competitive. The Compaq reputation for quality and reliability is unrivaled.

Compaq products are superior to our competitors' in quality and reliability. We pay meticulous attention to detail. We require every component supplier to meet standards beyond those of other manufacturers in the industry. Each new product is torture-tested in extremes of heat, cold and humidity in environmental labs. And as a standard procedure, we test our personal computers with no fewer than 300 hardware and software products, ensuring compatibility with industry standards.

The company planned to introduce a SystemPro with Intel's 586 microprocessor operating at 100 MIPS by the end of 1992.

Compaq planned to continue its new product introductions through 1993. Products in development included (1) portables, such as a pen-based notebook and handheld machine; (2) desktops, such as a new entry-level line of low-end PCs priced comparable to the ProLinea line, a DeskPro/i based on Intel's new Pentium 200 MIPS microprocessor with 50 gigabytes hard disks, and high end machines more powerful than existing Deskpro/M systems; (3) a SystemPro server with four Pentium processors and a single-user printer for under \$22,000; and (4) low-end, single user laser printers for under \$1000. Compaq also intended to overhaul all components for improved server availability by 1995. Future developments would be tied to existing systems, would bundle network software, and would include partnerships with software vendors to add value to their products.

### **New Services**

PC networks and multi-user environments based on the Compaq SystemPro were on the cutting edge of office technology. The solutions, though providing many advantages, were complex and involved products from a number of companies. To help customers install and operate these systems, Compaq introduced a number of direct support programs.

We now offer technical guidelines, hotline services, and a support network involving our engineering staff working in tandem with those of the leading hardware, software and operating system companies in our industry.

A toll free support line was offered to Compaq customers needing basic assistance. For authorized resellers, a fee based service was available to support complex networking and multi-user environments. A specialized dealer program supported multivendor solutions using Compaq products in Banyan, Novell, Microsoft and SCO operating environments.

General Electric Computer Services and TRW customer service division were authorized to provide complete warranty service and support for Compaq products. Together, they added 1600 field service technicians and over 480 locations to Compaq's network support. Technical alliances were signed with 15 hardware, software and operating system companies:

These alliances help ensure that customers experiencing problems with their PCs in multivendor environments get fast answers rather than finger pointing from the vendors. Alliance partners are committed to work together to resolve issues. We share with them a telephone hotline, cross-train on products and exchange technical information.

In Houston, Compaq worked with Texas Commerce Bancshares to create its advanced consumer loan operation networking 300 Compaq personal computers. EDS was Compaq's first worldwide systems integrator, selling and integrating Compaq products into advanced computer networks. The company also had 160 value added resellers who combined proprietary hardware or software solutions with Compaq computers for sale to small business.

## **The Production Strategy**

Compaq did as much of their manufacturing as possible. Fixed costs were about 6.3 percent of sales, compared with 1.5 percent for Dell. To get manufacturing costs down, production processes were redesigned in Houston, Singapore, and Scotland. The entire system was built on a single production line, rather than assembling components in different locations. Testing moved from 100 percent of subcomponents to statistical sampling. Finished systems were fully tested. Since 1991, Compaq had cut its manufacturing costs by 52 percent and had cut material costs by \$200 million. Since Pfeiffer took over, cost of purchasing has become a number one priority, cutting costs in half by using their purchasing power. Testing time has dropped from 96 hours to four. Over 2,400 workers have left the company. In spite of these efforts, Compaq's prices were still about 30 percent higher than Gateway, the lowest-priced national brand. While there were skeptics that he could be the best in both manufacturing and distribution, Pfeiffer was optimistic. According to Business Week:

By owning its own source of suppliers for important parts, he says, Compaq can control costs and quality better than any other PC maker--and get innovations to market faster. Even now, Compaq's research budget is \$180 million a year, about 5 percent of sales. Granted, that's down from \$197 million last year, but it blows Dell's budget--\$33 million on \$890 million in sales last year--out of the water.

According to Pfeiffer, "We are predestined to continue the leadership role in this industry because we have the resources."

Suppliers were also pushed to cut prices. Conner Peripherals lost its position as main disk-drive supplier when Quantum beat their price. Compaq then sold its 20 percent share in Conner for a \$86 million gain. According to a Dell manager, "Since June, they're really back in there, being competitive for the first time in two years. I'd put them among my toughest competitors now." Steven Hamblin, a newly created vice president of worldwide logistics, targeted a minimum 10 percent cut in Compaq's \$800 million of materials stocks, putting pressure on standardization of suppliers and components.

Unit shipments jumped 40 percent as market share began to improve after falling from 5.3 percent in 1990 to 4.5 percent in 1991. By the third quarter of 1992, revenues climbed 50 percent, to record \$1.07 billion and earnings hit \$49.4 million, surpassing all estimates. Compaq's stock price rebounded from a low of \$22 in December, 1991, to \$40, though it had yet to reach its high of \$74 in early 1991. According to analysts, "It's one of the great turnarounds in the world. It is a rare example of a company that recognized a change in their environment and responded in the absolutely correct way."

But Pfeiffer was not finished. With the help of McKinsey & Company, Pfeiffer spent five months transforming the company. Now he was developing the company's long-term strategy:

We have done phase one, involving a 25 percent reduction in workforce, down to 9000, lopping \$225 million off the annual payroll. The focus now is clearly on future strategy. This company is totally transformed.

### **The Distribution Strategy**

The number of distribution outlets were expanded from 3,300 to 8,300 outlets worldwide as the number of channels were expanded to reach new markets. By June of 1992, Compaq had over 4000 dealers in the U.S. By tripling the number of mass merchandisers to 600 outlets, the company reached consumers and small business. The new ProLinea and Contura lines sold through mass merchandisers as well as through computer stores, including CompUSA, Circuit City, and Office Depot. According to marketing manager Gian Carlo Bisone, "We want to have our products where our customer want to buy them. We have to play on all the tables." By the end of 1992, Compaq planned to enter Dell's territory, selling in catalogues and via telemarketing. The company also planned to target the traveling manager and salesman with its pen-based developments in 1993.

By July, Compaq was outshipping both IBM and Apple in the dealer channel. Compaq's sales through ComputerLand doubled over the prior year, reaching to 26 percent of their sales. In spite of adding a third production line in both Houston and Singapore, production of 200,000 units per month had been unable to work off the sales backlog by September. Longtime dealers were not happy with the new channel competition or with the product shortages. According to InaCom, a chain of 1,200 dealers, "We've been trying to shift customers to other lines, but they've been surprisingly patient." Despite the shortages, InaCom's shipments soared 80 percent in the third quarter.

### **The Market Strategy**

While developing next generation prototypes, like Apple's handheld personal digital assistant, Compaq was planning to stick to its current market areas over the next five years. The plan was directed at pursuing the corporate PC market with traditional products and using ProLinea to build a new high-volume business among small businesses and consumers. The concern, however, was that customers who once paid \$3,000 to \$5,000 for a Deskpro would now opt for a \$1000 ProLinea. But according to Pfeiffer, "Our volume of all existing products is up dramatically. There's been practically no cannibalization. This comes as a very, very pleasant surprise." Price cuts on Deskpro helped keep the corporate business while the new ProLinea had brought back customers who had left for price considerations. To protect these markets, Compaq was refocusing its strategy. According to Business Week:

The plan for shoring up this part of the business revolves around networking, mainly with servers, the high-end PCs that are hubs for networks of desktop PCs. Compaq made an ambitious play for this market with the SystemPro line, starting in 1989. But SystemPro was a symptom of Compaq over engineering. Price tags ran as high as \$26,000, and a proprietary multiprocessor design

required new software that didn't exist. The result: Compaq has less than 10 percent of the server market.<sup>2</sup>

In September, the new ProSignia servers were introduced, using Intel's i486 processor, at \$2,700 -- 55 percent less than the lowest priced SystemPro. According to Compaq's systems manager, Gary Stimac, "We will shake up the server market like we shook up the PC market a couple of months ago." Analysts expected Compaq's server sales to reach \$375 million in 1993. Pfeiffer believed that if the hub of a network was a Compaq, it would be a lot easier to sell the spokes -- the computers and peripherals that connected to it. That was why he added laser printers with a model specifically designed for networks. Compaq's new printers, three years under development, were about twice as fast as similar Hewlett-Packard models at a price \$1000 below HP's. Analysts expected printer sales to add \$90 million in sales in 1993.

### **New Technologies**

Compaq had been committed to developing RISC technology as part of the ACE consortium. The group planned to use a RISC chip built by MIPS Computer Systems Inc. instead of Intel chips. Compaq also bought 13 percent of Silicon Graphics Inc., a workstation maker, to jointly develop a MIPS computer for Compaq. But in April, 1992, Pfeiffer pulled the plug on RISC development, withdrew from ACE and sold Silicon Graphics stock for \$150 million. He then rebuilt relations with Intel in hopes of giving Compaq access to next generation Intel microprocessors.

Compaq intends to compete in all segments of the PC market. We have done an excellent job at the high end of desktop and portable markets. In 1992, we will continue to pioneer advanced new products, including those using a technology known as reduced instruction set computing, or RISC.

How much further did they need to cut prices and costs to stay competitive? To what degree did their continued production provide advantage? What was required for continued success?

### **The World Computer Industry - 1992**

Most competitors in the computer industry would rather forget 1991. The economic downturn in the U.S. during the first half of 1991 caused industry sales to fall nearly \$1.5 billion as shown in Exhibit 3. Computer users, affected by the recession, had cut expenses and investments related to computer equipment. Slow industry sales resulted in price cutting as computer makers struggled to stimulate sales, with resulting losses of income for the year.

Exhibit 4 provides financial information from Value Line on several of the key U.S. competitors. The number two computer firm, Digital Equipment, had ousted its founder after reporting the largest quarterly operating loss ever and charging off \$3.1 billion over two years to cut 18,000 workers and vacate 165 facilities. Instead of making a profit as estimated

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<sup>2</sup>Op. cit.

by Value Line in May, IBM reported an 1992 loss of nearly \$5 billion, the largest in its history. Wang filed for Chapter 11 protection under the bankruptcy laws. France's Group Bull laid off 8,000 workers and closed 8 of 13 factories. Others, like Italy's Olivetti and Siemens Nixdorf, were also downsizing. According to Business Week:

It is not just computers that are getting smaller, its most of the companies that make them, too. They're deconstructing -- shutting factories, cutting jobs, spinning off subsidiaries, farming out work, and slashing management.

Even the younger generation is feeling the pinch. Relative kids such as Apple, Sun Microsystems, and Compaq are attacking costs, too. Apple Computer Inc. and Compaq Computer Corp. have laid off thousands to cut overhead and stay a step ahead of the hundreds of wannabes nipping at their market shares. Only in Japan, it seems, have companies avoided downsizing. But they may be next.

Sales are slowing, and Fujitsu Ltd. reported a \$160 million loss for the first half of fiscal 1992.<sup>3</sup>

### Exhibit 3: U.S. Computer & Peripherals Industry

Value Line Composite Statistics	1993e	1992e	1991	1990	1989	1988
Sales (\$ millions)	170,000	155,000	140,500	141,926	130,085	118,688
Operating Margins	17%	16.0%	14.5%	18%	17.9%	20.0%
Depreciation (\$ millions)	13,100	12,000	11,500	9,436	9,001	7,769
Net Profit (\$ million)	8,400	6,700	4,700	9,018	8,145	10,438
Income Tax Rate	40.0%	40.0%	38.0%	39.9%	40.3%	35.5%
Net Profit Margin	4.9%	4.3%	3.3%	6.4%	6.3%	8.8%
Working Capital (\$ millions)	34400	31700	30600	30820	31101	34735
Long-Term Debt (\$ millions)	24000	22000	20000	17995	18331	14855
Net Worth (\$ millions)	77600	73000	70100	75498	68279	68291
% Earned Total Capital	9.5%	8.0%	6.0%	10.5%	10.2%	13.3%
% Earned Net Worth	11.0%	9.0%	6.5%	11.9%	11.9%	15.3%
% Dividends to Net Profit	45%	54%	73%	36%	39%	29%
Average Dividend Yield	2.5%	2.5%	2.8%	2.8%	2.6%	2.5%

Source: Value Line May 1, 1992

Digital, IBM and Unisys had cut costs to meet the competitive pressures and was expected to continue these efforts. Sun Microsystems, the leader in workstations, subcontracted all components manufacturing and invested only in development of its Solaris operating software and Sparc microprocessors.

As computer prices fell, the industry's net income fell from 6.5 percent of sales in 1985 to minus 0.12 percent for 1991. Noone expected profits to rise again to their previous highs. Gross margins had fallen from their high of 70 percent to under 30 percent for PCs. Personal computer revenues grew to over half the industry's revenues as shown in Exhibit 5. As the industry structure continued to change, IBM expected mainframe growth of only 1-2 percent as compared to growth of 30 percent per year for its workstations. IBM and Digital Equipment (DEC) never expected PC's to threaten their high-margin mainframe and mini computer business so quickly. Companies were being forced to decide in which segments of the industry they were going to participate, and what value added activities they were going to provide. From the beginning of 1991 to late 1992, IBM's financial performance had been

<sup>3</sup>Business Week, November 23, 1992, p. 44.

seriously affected by this competition as shown in Exhibit 6 and was forced to take action before its performance and market position deteriorated further.

#### Exhibit 4: Major Computer Competitors

	1992e	1991	1990	1989	1988
<b>IBM Corporation</b>					
Revenues (\$ millions)	69000	64792	69018	62710	59461
Operating Margin	20.5%	17.2%	23.7%	23.5%	23.8%
Net Profit Margin	5.8%	3.3%	8.7%	8.4%	9.8%
Working Capital (\$ millions)	7475	7345	13644	14175	17956
<b>Digital Equipment Corp.</b>					
Revenues (\$ millions)	13650	13911	12943	12742	11475
Operating Margin	2.0%	9.6%	10.5%	15.9%	18.8%
Net Profit Margin	(loss)	2.8%	4.1%	8.4%	11.4%
Working Capital (\$ millions)	3025	3563	4332	4501	4516
<b>Apple Computer Corp.</b>					
Revenues (\$ millions)	7150	6309	5558	5284	4071
Operating Margin	15.0%	13.9%	16.5%	14.4%	17.1%
Net Profit Margin	7.6%	7.1%	8.5%	7.7%	9.8%
Working Capital (\$ millions)	1955	1646	1376	1399	956
<b>Compaq Computer</b>					
Revenues (\$ millions)	3800	3271	3599	2876	2066
Operating Margin	14%	14.2%	21.8%	20.0%	19.8%
Net Profit Margin	6.8%	7.0%	12.0%	11.1%	12.0%
Working Capital (\$ millions)	1550	1145	1045	749	635
<b>Sun Microsystems</b>					
Revenues (\$ millions)	3750	3221	2466	1765	1052
Operating Margin	15.0%	16.0%	15.2%	10.8%	15.4%
Net Profit Margin	5.3%	5.9%	4.5%	3.4%	6.3%
Working Capital (\$ millions)	1440	1088	805	417	273
<b>Dell Computer Corp.</b>					
Revenues (\$ millions)	1100	890	546	389	258
Operating Margin	9.3%	9.3%	10.0%	4.8%	9.7%
Net Profit Margin	5.7%	5.7%	5.0%	1.3%	5.6%
Working Capital (\$ millions)	310	283	95	58	63

Source: Value Line May 1, 1992

According to *Business Week*:

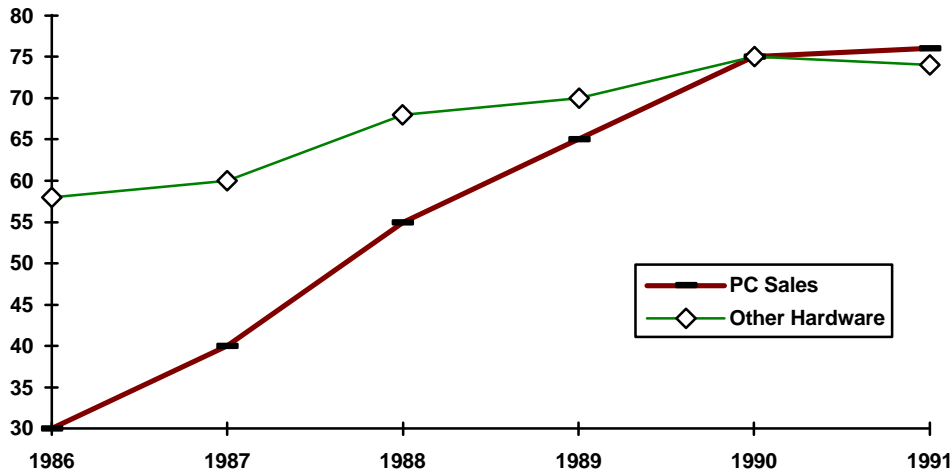
They may write software, build parts, or make complete systems. They may sell computers built by others. They may team up with partners. Or they may just help customers choose and install computers to solve specific problems. But even the mightiest, it seems, can no longer do it all.<sup>4</sup>

While the U.S. market began to strengthen in 1992, overseas markets like Japan and Germany remained weak. With about fifty percent of industry revenues depending on foreign sales, the computer industry was expected to stay in turmoil. For example, on September 29th, IBM Corporation, the world leader in computers, announced that it would cut its workforce by 40,000, dropping its workforce from 400,000 in 1985 to just 300,000 by

<sup>4</sup>Op.cit.

1993. Some analysts expected IBM's payroll to decline another 50 percent by the end of the decade.

**Exhibit 5: Changing Structure of the Computer Market**



Source: *Business Week*, November 23, 1992.

The growth in competition was forcing IBM to respond after its worldwide personal computer unit market share declined from a high of 23 percent in 1986 to 16 percent by August, 1992. In spite of cutting its computer prices, IBM's share of the PC market fell from 19 percent to 16 percent between May and August of 1992 as Compaq's price cutting strategy began to take hold. Gross margins on PCs dropped 30 percent, accounting for two of IBM's six percentage points overall decline in gross margins.

**Exhibit 6: 1992 Quarterly Results (\$millions)**

1992 Results:	Compaq		DEC		IBM	
	Revenues	Net Income	Revenues	Net Income	Revenues	Net Income
Quarter 1	970.8	114.3	3520	117	13,545	(1731)
Quarter 2	717.8	20.3	3945	(871)	14,732	114
Quarter 3	709.4	(70.3)	3293	28.6	14,433	172
Quarter 4	873.4	66.6	3479	(138)	22,082	(1382)

**The Role of Component Suppliers**

For most of the early history of computers, IBM effectively controlled the technological evolution of the industry. At the time IBM entered the computer industry, it had to make its own chips, circuit boards, disk drives, terminals, printers, tape drives, and shipping containers. IBM wrote software and provided teams of salespeople, consultants, and technicians to set up their customer's systems. Proprietary software kept customers locked in, paying high prices. Personal computers improved when IBM introduced a new microprocessor chip. Display graphics improved when IBM introduced a new graphics standard for hardware or software. But in the late 1980s, IBM made a design decision for its personal computer which initiated a transformation in the personal computer industry.

IBM's attempt to speed the introduction of its first personal computer lead designers to use off-the-shelf parts, most notably the Intel microprocessor and Microsoft operating system. The designers also elected to utilize a modular structure and to publish its interface standards. This "open architecture" allowed firms to design specialized computer boards that could perform more exotic tasks, leaving IBM free to make large numbers of the basic system's components. Open architecture decisively spurred IBM's exponential growth in PC sales.

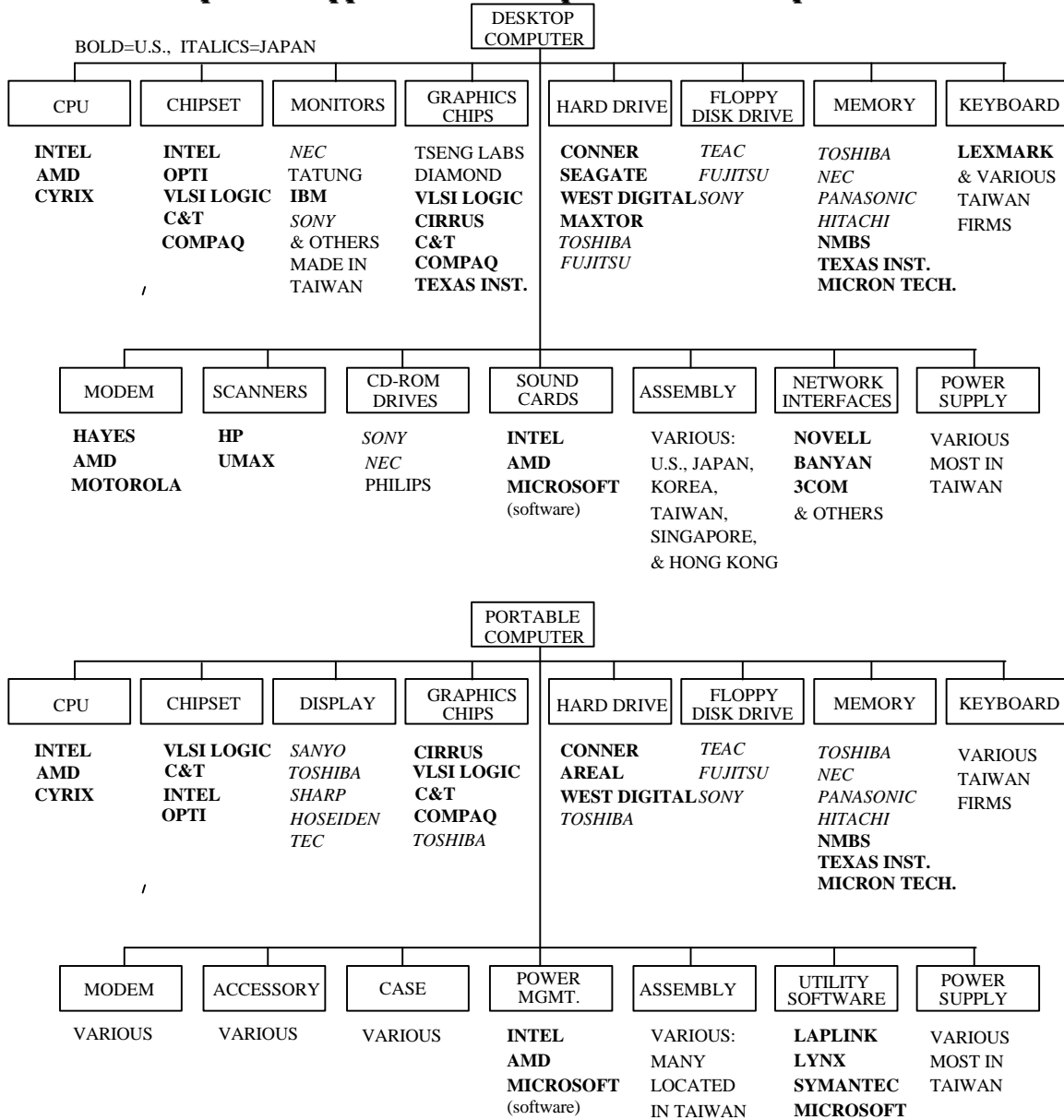
Eventually, off-the-shelf components and innovative add-ons created a vast supplier market that provided components to new manufacturers that introduced competing computer designs. By the late 1980s, thousands of electronics firms were designing and making computers, chips, boards and assorted devices that could be plugged into or attached to the basic IBM unit. More importantly, firms like Seagate Technologies (disk drives), VLSI Technology (chips), Rockwell (modem chips), Intel (microprocessors), Tseng Labs (graphics chips) and Adaptec (hard drive controller chips) pioneered important new technologies and components. These firms introduced new components that dramatically altered the capabilities of any computers that contained them.

Demands for these new supplier components came from customers as well as from manufacturers. Often, customers cobbled together new applications for their personal computers. As one example, early business users of portable computers began carrying bulky modems to connect their machines to their firm's mainframe computer system over a telephone network. In addition to spurring development of new modem technologies, the needs of specific sets of customers spurred modem makers to develop interfaces to cellular telephones. By 1992, modem manufacturers were beginning to incorporate cellular telephone technology directly into their modems.

IBM began slowly losing its technological leadership as suppliers became more innovative. This point was driven home when IBM introduced its PS/2 Series computers in mid-1986. The PS/2 was intended to be a significant improvement over existing designs. In particular, it incorporated IBM's new VGA graphic display hardware and software. The key component was a graphics chip that IBM hoped would be clone-proof. In less than a year, however, five or six small chip-makers had produced chips that copied and extended IBM's capabilities. The chips that matched IBM's unclonable design initially cost less than \$50 per unit in quantity. By 1989, component makers had introduced a host of new chips and add-on cards that established a defacto SuperVGA standard. This rapid response by component makers became the norm for other components in PC design.

As innovative components became more accessible, computer manufacturers began to do less and less component design. By 1991, new computer makers were entering the industry as component assemblers concentrating on the judicious selections of available components. The two charts in Exhibit 7 list key components for typical desktop and portable computers and ranks leading manufacturers for each component.

**Exhibit 7: Component Suppliers For Desktop & Portable Computers**



Since anyone could assemble a computer from the available components, the challenge facing established computer manufacturers like Compaq was to introduce new and better configurations faster than competitors. Customers had also become very knowledgeable as the trade press compared products and aggressively informed consumers about the merits, demerits and costs of each new computer design. A design could not become a major market success unless it offered more price-performance value than its competitors. This required that new designs utilize the best possible combination of components for the price. To be successful, computer manufacturers were forced into a continuous cycle of new component sourcing, new design configurations, and new product introduction to stay up with the latest introductions.

The Exhibit 8 shows some of the milestones in the development of portable computers. In most cases, component suppliers had the goal of making portable computers smaller, lighter and faster, and giving portables a longer battery life. The technologies included the following:

**CPU** - The microprocessor chip is the "brain" of the computer. Chip makers improved it by making it process data faster and by making it consume less power.

**Logic Chip Sets** - These chips do the "housekeeping" for the CPU. Chipmakers gradually packed these functions onto fewer chips that took up less space on a computer mother board. By 1991, functions that had required 7 or 8 chips were packed into a single chip.

**Power Conservation** - Component suppliers developed various schemes and devices to turn off parts of the portable computer when they were not in use, if only for a few fractions of a second. Early on, special chips were used for this function. Later these functions were integrated into the CPU.  
**Memory** - It took over 500 memory chips to store 4 million characters in 1983. In 1992, the same material could fit on only 2 chips. Designers could offer far more memory while continuing to downsize their computers.

**Exhibit 8: Evolution In PC Product Development**

CPU	INTEL 80386	AMD 80286	HARRIS 80C286	INTEL 80386SX	INTEL 80486	INTEL 80386SL	AMD 80386	INTEL 80486SX
LOGIC CHIP SETS	6 CHIP 286 mbd		5 CHIP 386SX mbd	XT on 2x4" mbd	2 CHIP 286 mbd	3 CHIP 386SX mbd	2 CHIP 386SL mbd	2 CHIP
POWER CONSERVATION	Power conservation chipset			Power smart chipsets				
MEMORY	256k DRAM		1Mb DRAM		4Mb DRAM			16Mb DRAM
MASS STORAGE	3.5" HD		small 3.5" HD	2.5" HD	2.5" HD 40Mb	Portable CD-ROM	Small SCSI drive	1.8" HD
REMOVABLE MEDIA	3.5" Floppy					20Mb Flopical	Flash Memory	
DISPLAY SCREENS	CGA LCD	DCGA LCD	EGA LCD	VGA LCD	Color EGA	Color EGA LCD	Color VGA LCD	
TOSHIBA MODELS	T1100	T1000	T3200	T3100E	T1600	T1000SE	T1000XE	T1000LE
	T3100	T1200	T5100		T5200	T3200SX	T3100SX	T3200SXC
							T2000SX	T2000SX
COMPAQ MODELS	Portable III	Portable 386	SLT/286		LTE/286	LTE	LTE386S20	Portable 486C
							SLT386S20	
	87		88		89		90	91
								92

**Mass Storage** - The smallest disk drives shrank from 1 lb. in 1985 to less than 6 oz. in 1992. Their power consumption fell accordingly.

**Removable Media** - Components suppliers developed a number of innovative ways to store data temporarily or to transfer it to other computers. These approaches led to lighter and lighter portable computer designs.

***Display Screens - Component manufacturers perfected the manufacture of Liquid Crystal Displays (LCDs) that were light, rugged and consumed minimal power.***

Compaq's new portable computer models coincided with the introduction of the next-generation of component. Toshiba, the market leader in portables since 1988, introduced a new model when a next-generation component appeared. Compaq's approach was a bit more conservative. Its new models tended to appear less often, but made greater performance leaps when they did appear. Managing product design depended on one's suppliers. Any one of the major component suppliers could become the source of a next generation-component. Beginning in the mid-1980s, manufacturers could no longer count on maintaining a stable relationship with any specific component vendor unless it were sure that the component maker would remain competitive. Suppliers frequently entered and exited almost every component category.

### **The Personal Computer Competitors.**

Since 1991, the PC world had been reshaped. In 1992, according to Dataquest, a market-research firm, IBM (12.4%), Compaq (6.6%) and Dell (3.5%) held 22.5 percent of the \$47 billion world revenues for personal computers. Another 17 percent of revenues was held by Apple (11.9%) and Japan's NEC (5.1%), two players selling computers that were not compatible with the IBM-based industry standard. The remaining 60.5 percent of industry revenues went to the many new "clone makers" such as Gateway 2000, Zeos, AST, Northgate, Wyse Technology and Blackship. Companies like AST Research and Dell Computer had taken market share in the low-end of the market and were expected to continue to add more sophisticated machines as more powerful microprocessors became available. Low-cost chips had allowed "second tier" competitors to build large scale systems that surpassed IBM's biggest mainframes. This was the market that both Compaq and Dell were targeting.

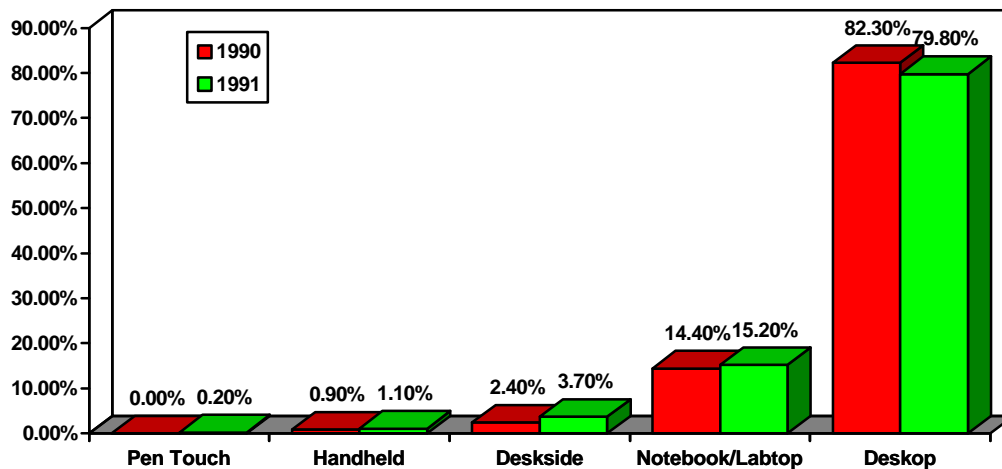
Michael Dell, chairman of Dell Computer of Austin., Texas, had been one of the first to realize that the PC had become a commodity and so required new marketing techniques. As a result, Dell had developed core competencies in distribution and marketing, not computer technology. Dell handled orders and queries from 30,000 customers per day while continuously introducing new models and options. With mail-order sales methods and unrivaled phone-support of customers, the firm cut the cost of doing business and passed the savings on to customers. Dell's strategy was simple, set a new profit margin of five percent, then price PCs accordingly. To keep costs down, most manufacturing was contracted out with only final assemble and testing of its own computers. Dell shunned automation to stay more flexible with people. Dell made each computer to the customer's order specifications once the cash was in hand. As many as 12 different types of computers were assembled on each line, with each computer having a customer name attached. Several hundred telephone staff provided sales and technical support and obtained immediate customer feedback on product needs and service requirements.

In response to the commodity business developments, Compaq Computer of Houston, Texas, withdrew from the high performance RISC market, focused on its core PC

business, and adopted the same direct-sales techniques. Lower prices stimulated customer demand for commodity desktop computers and encouraged companies to develop new technologies that could provide products with higher margins, such as pen-based PCs, portable handheld "digital assistants," and high end supercomputers. The evolving segments in the personal computer business are shown in Exhibit 9. New technology products were expected to continue to generate new demand for the coming decade.

Both Dell and Compaq are attempting to build brand awareness to take on the clone makers. According to Dell's product development manager, Glenn Henry, "Brand value is now the critical thing." To keep customers loyal, both companies had to provide excellent sales and service back-up. With over 85% of sales orders over the telephone, Dell's customer support telephone hotlines were the most sophisticated and respected in the industry. Compaq was relying on its three year warranty, while it built its hot-line service. Dell was also offering systems integration services to corporate clients and customized software packages.

**Exhibit 9: World Market Shares By PC Product Types**



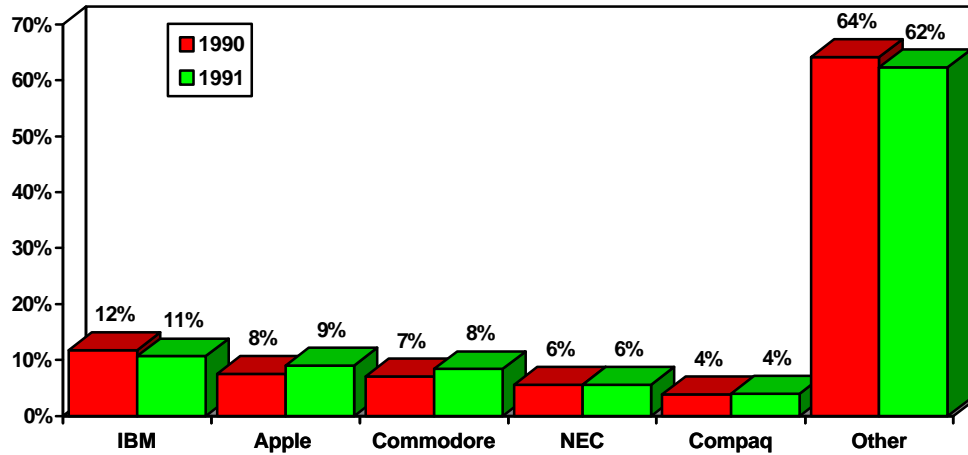
IBM and Toshiba had introduced pen touch computers without much success. One of the major U.S. suppliers of pen technology, Momenta Corp., filed for bankruptcy protection after spending \$40 million in venture capital without generating demand for its \$5000 pen/keyboard system. IBM's pen touch Thinkpad 700T had only sold a few hundred units. Apple Computer's handheld pen-based personal assistant, dubbed Newton, was postponed after forecasted sales were scaled back from 300,000 to 77,000 units. As a result, Hewlett-Packard had little competition in the handheld market. HP sold only 110,000 of its HP95LX handheld computers but held the largest share in the hand-held market.

Of the portable computer segment, laptops had accounted for about ten percent and notebooks, 5.5 percent. But the laptop market was seen as maturing rapidly in the international market. Notebooks continued to shrink in size as hard disk drives were reduced in size from 3.5" to 2.5" to 1.8". In June, 1992, HP announced that it would soon introduce a 1.3" matchbook size disk drive, taking much of the advantage away from flash memory's

speed/density. The industry was also merging computers and communication technologies. For example, Apple, IBM, AT&T, and Motorola were working to develop personal communication system or personal digital assistants, pocket-sized computers with wireless communications for improved usability. Market shares for the major PC makers by unit sales is shown in Exhibits 10 and 11.

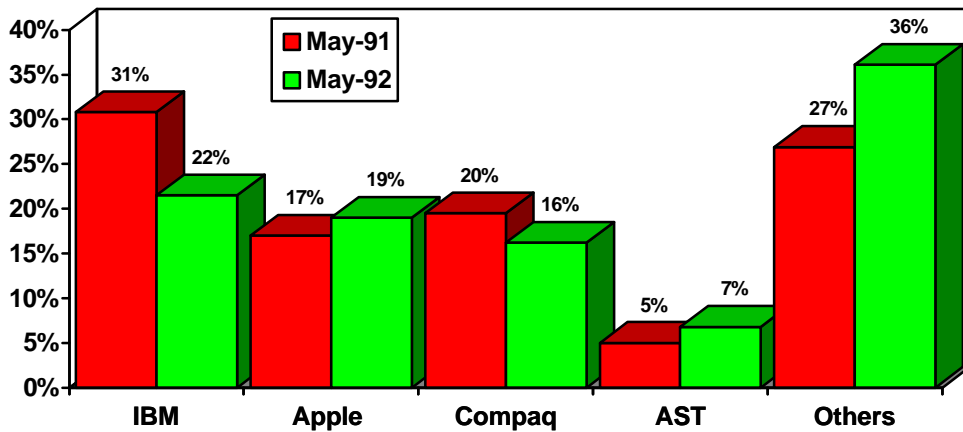
**Exhibit 10: World PC Market Share By Competitor**

(Total shipments were 25,020,000 units in 1991 and 23,990,000 in 1990.)



Source: Dataquest, Information System Industry Analysis, April, 1992.

**Exhibit 11: North American PC Market Share By Competitor**



Source: Microcomputer Weekly, July 13, 1992.

**Breaking the Entry Barriers**

Once the computer manufacturers were no longer able to lead the innovation process, barriers to entry fell. Dozens of Far East suppliers began to supply computer components for use in desktop computers, and then portable computers. By 1992, the majority of computers

sold in the U.S. market were assembled from low-cost, standard components that typically originated in small firms from Taiwan. As low-cost components became readily available, prices began to fall rapidly as shown in Exhibit 12. Notebook computer "street" prices fell from \$4755 to \$2472 and desktop prices fell 14.8% between March and May of 1992.

**Exhibit 12: PC Prices For Comparable 486 Models**

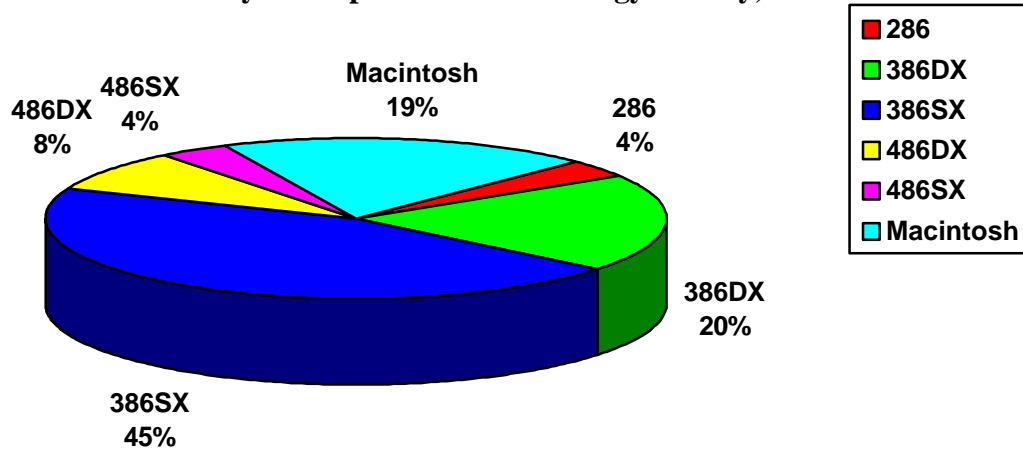
Company	Model	Processor	RAM	HD	Monitor	Operating system	Price
IBM	PS/Value Point 425SX	486SX/25	8 Mbytes	80 Mbytes	SVGA color	OS/2 2.0	\$1,629
DEC	DECpc425sx LP	486SX/25	4 Mbytes	122 Mbytes	SVGA color	DOS Windows/mouse	\$1,449
Compaq	ProLinea 4/25e 120/w	486SX/25	4 Mbytes	120 Mbytes	SVGA color	DOS Windows/mouse	\$1,612
Dell	Dimension 486/SX25	486SX/25	8 Mbytes	80 Mbytes	SVGA color	DOS Windows/mouse	\$1,798
Gateway 2000	4SX-25	486SX/25	8 Mbytes	80 Mbytes	SVGA color	DOS, Windows, MS Works	\$1,565

Source: InformationWeek, October 26, 1992, p. 15.

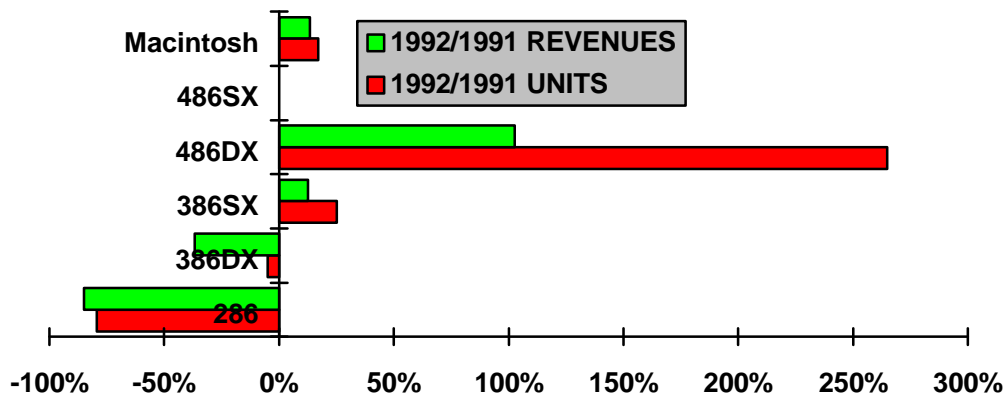
Lower prices and margins caused a major decline in industry profits. Nearly half the resulting decline in profits was estimated to have gone to customers in the form of lower prices. Suppliers had also increased their share of the profit pie from 20 percent in 1986 to 31 percent in 1991. Companies like Intel and Microsoft had been the big winners as the market valued their contributions higher than computer assembly. Conner, Quantum and Seagate dominated the disk drive market. Andersen Consulting and Electronic Data System dominated systems integration. Hewlett-Packard had 43 percent of the \$5.4 billion U.S. laser printer market. Apple joined forces with Japan's Sharp Electronics Corp. to develop handheld computers, and IBM teamed up with Toshiba Corp. on color LCD screens and memory products. In contrast, France's Group Bull began selling NEC's mainframes, IBM's workstations, and Zenith personal computers (acquired by Bull in 1990). NEC owned 4.7 percent of Bull and IBM owned 5.7 percent of the French company.

Advances in microprocessor technology continued to double the amount of computer power a dollar could buy every 18 months. The share of microprocessor types in the market are shown in Exhibits 13 and 14. For example, Digital's new Alpha chip was being adopted by Cray for its parallel supercomputers. Apple and IBM were also cooperating to use IBM's powerful reduced instruction set computing (RISC) PowerPC processor, manufactured by Motorola, in future desktop computers. The partnership, Taligent, planned to use Apple's operating system software, thereby cutting IBM's dependence on Microsoft and Intel. And Hewlett-Packard and Sun Microsystems were each looking for partners to use their RISC chips. With the growing cost of chip development, the industry was expected to standardize around several processors, including those from Intel and Motorola.

**Exhibit 13: Market Share By Microprocessor Technology In May, 1992**



**Exhibit 14: Percentage Change In Market Share By Microprocessor Technology**



Companies like AT&T were focusing on solving complex information-handling problems for blue chip and global corporations. In 1991, AT&T bought NCR. In 1992, it purchased one third of the largest cellular phone company, McCaw Communications. The company could now offer a broad array of computers and the wires, cables, and radio devices to link them. According to *Newsweek*:

AT&T's sprawling operations are united by a clear corporate strategy: the complete integration of computers and communications. The vision starts with NCR, which, even before AT&T came calling, had foreseen that microprocessors would make centrally located mainframes obsolete and put powerful computers on individual desktops. The computers are NCR's -- but the computers need to talk, and that's AT&T's business.<sup>5</sup>

For example, teleconferences used AT&T's fiber-optic lines and hardware, NCR's computers, McCaw's transmitters. But the key to success was also seen as AT&T's ability to offer competitive prices for both computers and long distance communications.

<sup>5</sup>Newsweek, December 28, 1992, p. 45.

These changes in the PC market lead to stiff price competition and new distribution systems for computers. In addition, many large users began assembling their own computers in-house, benchmarking prices in the market. In response, manufacturers began introducing direct sales to consumers to cut distribution costs and lower prices. Apple Computer responded with new models and lower prices to strengthen its position as new competitors, including Dell, AST, and Packard Bell, created a new second tier of aggressive competitors. Dell and Compaq were attempting to take share from third tier clone manufacturers who held the remaining 40 percent of the business.

By October, 1992, IBM had introduced new low priced computers and adopted its own direct-sales approach. The falling margins of old line competitors were forcing companies to take action to eliminate inefficiencies that were previously covered up by high margins. For example, IBM's chairman, John F. Akers, broke the company into 13 semi-autonomous units in December, 1991, and then, in September, 1992, set up the IBM Personal Computer Co.

On October 20, the new PC unit introduced its own ValuePoint line, having better performance than Intel's 386 and 486 chips and starting at \$795, to compete directly with Compaq's Prolinea line. The downsizing of IBM was expected to continue until IBM figured out where it had competitive advantage. Adstar, IBM's disk and tape drive division, was now selling to the open market. Memory chips and other components were also being sold outside. But according to Jack Kuehler, IBM's president, "There will be some fallout and dislocations. Some won't make it."

IBM Corporation had refocused its personal computer effort by setting up a separate subsidiary. IBM Personal Computer Co. began its life with the rapid introduction of new products. Overall costs at the new Baby Blue, with \$7 billion in annual sales, were cut 25 percent from the prior year's costs. The world's largest PC maker now felt that overhead costs were competitive with Compaq and Apple since its share of corporate expenses were reduced. Baby Blue was expected to generate a loss of just under \$1 billion for 1992.

In mid September, IBM introduced a line of 21 powerful PS/1 computers, using Intel 386SX, 486SX and 486DX microprocessors and hard disk drives of between 85 and 211 MB in size, into the retail market. The line included "Essential" small business models to be sold through office warehouse stores such as Office Max; "Expert" models for more advanced users to be sold through superstores, and "Consultant" models for home users to be sold through retail outlets like Sears and Montgomery Wards. With built-in modems and Prodigy software, IBM was attempting to stay in closer touch with customers in the future. According to Anthony Santelli, IBM's vice president of PS/1, education and standard products, "Prodigy is our backbone. It is how we deliver our support and receive our customer contact. We get a double whammy for that."

A revamped PS/2 and server line, using technically superior Micro Channel Architecture (MCA), were introduced in late September and early October. The new PS/2s

had faster processors, bigger hard drives and improved software. Minimal configurations of random access memory began with 8 megabytes and hard drives of 100 MB. Four new OS/2 models represented IBM's premium grade PC line based on either the 16-bit or 32-bit version of the MCA bus and either Intel or IBM's 486 microprocessor. They had an optional 2.88MB diskette drive. These models also used IBM's new XGA-2 graphics board to drive a new family of color monitors. The high-end model 95 server offered 486DX2 microprocessors and offered an inexpensive PS/2 3514 mass on-line storage system.

On October 20, 1992, IBM introduced its PS/ValuePoint systems to compete with Compaq, Dell and major suppliers. The new, low priced line included models with 386SL, 486SX, and 486DX processors using the low-cost 16-bit Industry Standard Architecture (ISA). Each ValuePoint came in a full-sized case with five slots and five storage bays, one standard 1.44MB diskette drive and, in the two high-end systems, room for 32MB of RAM on the motherboard. Customers had the option of having OS/2 or DOS 5.0 and Microsoft Windows 3.1. The machine included a 30-day money back guarantee and one-year warranty. In order to avoid the same supply problems that plagued Compaq after the announcement of its low-cost Prolinea line, IBM pushed back its initial September launch date to October. The real question is whether IBM could continue to update them at the same speed as their competition. IBM had cut product development times in half, to under six months.

In notebooks, a Compaq stronghold, IBM had been late to the market. It introduced the new ThinkPad 700C (\$4,350) using the largest active color matrix screen on the market (10.4") or model 700 (\$2,750), 9.5" monochrome LCD screen (64 Grayscale). The ThinkPad included an integrated pointing stick and docking station. This product came from Zenith Data Systems with color screen technology coming from Toshiba. Features included 4 megabytes of memory, a 25-megahertz 486SLC microprocessor, a 120 MB hard drive, two- or four-hour continuous-use battery life and power management features.

IBM's new entries dropped prices as much as 40 percent as it matched prices of clone makers such as Compaq and Dell as shown in Exhibit 15. But IBM's prices were still at least ten percent above clone makers' prices, and close to those charged by Ambra, Big Blue's own "clone-making" subsidiary. Since June, Ambra began in Europe selling its own brand name, not mentioning its IBM parent. William McCracken, head of IBM's European PC business, expected the two brands to appeal to different markets. Ambra's strategy was to win sales that would otherwise go to bargain-basement clones. Business buyers were expected to buy IBM branded products. In fact, Computerworld found nearly one third of IBM users buying other brands.

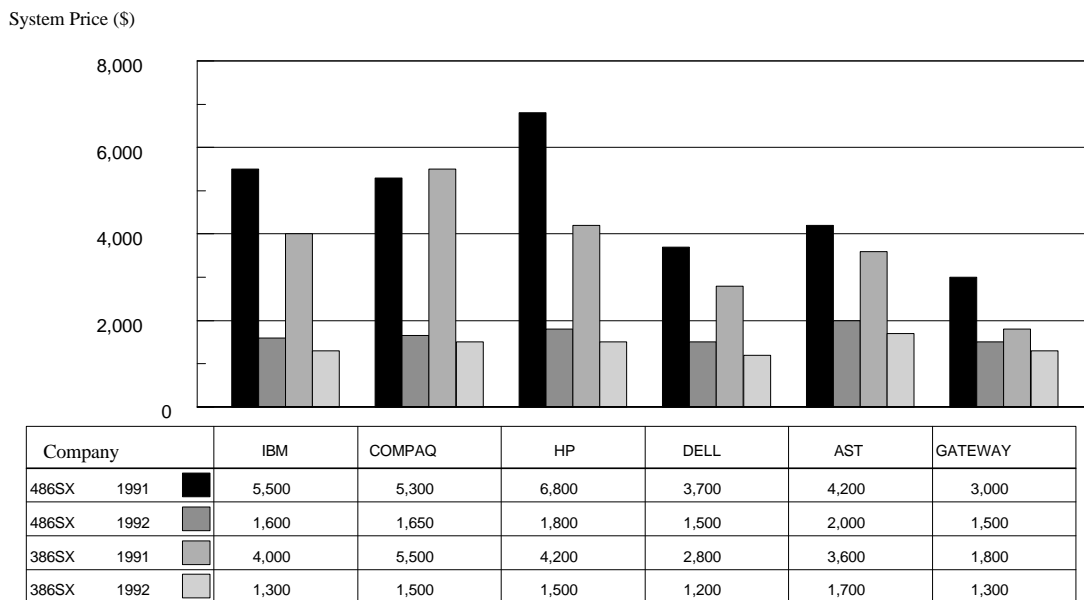
Distribution had been streamlined, especially in Europe, where many of the new computers were shipped directly from the factory to dealers, avoiding regional distribution centers. The new models were sold by PS/2 dealers and through IBM's direct sales force using an 800-number from IBM Atlanta. Michael R. Coleman, vice president of IBM Personal Computer's brand marketing, did not expect the dual channel to create a problem, "I believe that I have a business scenario and plan that will maximize the dealers and maximize

the 800 number with harmony." The question was whether IBM had the direct marketing savvy of such adversaries as Digital Equipment and Dell Computer.

But the clone makers were not standing still. By late 1992, chip and peripheral makers had introduced a new standard for desktop computer design called a "local bus". This standard, set by the Video Electronics Standards Association, tied the computer's key graphic and disk control chips more tightly to the CPU, permitting much faster graphic displays and hard disk access. Unlike previous innovations, the larger computer manufacturers had virtually no involvement in setting this new standard which effectively doubled the processing speed of graphics applications. Several major competitors, including Compaq and IBM, chose to wait for Intel to introduce a competing standard in 1993, a year late. In the meantime, smaller, more nimble manufacturers like Gateway 2000, located in Sioux Falls, North Dakota, had a six month lead in introducing local bus machines and were shipping 2500 local bus units per day by late 1992. Other clone competitors like Zeos, for example, attempted to differentiate its new local bus desktop models by designing-in slots for Intel's new 80586 microprocessor. *PC World* magazine's five "best-buys" included Wyse Technology, ATronics International, Micro Express, TriStar and Leading Edge, not the major brand names. Micro Express and ATronics even offered "Dell-type" after-sales service as they pushed to redefine the industry's leading firms.<sup>6</sup>

### Exhibit 15: Price Changes In Desktop Computers

PC PRICES - 1991 vs 1992



Approximate list price for similarly configured desktop systems

Source: PC Week, Dec 14, 1992, p10.

### Growing Buyer Sophistication

<sup>6</sup>1/30/92, The Economist, p. 58.

Along with increased competition came more sophisticated customers for PCs. With most personal computer technologies becoming standardized, it was easy for anyone to purchase computers by known specifications. It was possible to purchase the industry's low priced Gateway-brand PC based on a 486 chip that sold for \$3,000 in 1991 for \$1,495 in 1992. Noname 486SX clones with 8 megabytes of memory and 130 megabyte hard drives were about the same price. Since everyone expected prices to continue their decline, companies tried to differentiate their products in some way. Compaq introduced its Deskpro I family with a unique built-in audio feature. Others were providing enhanced graphics. In August, Digital introduced its low-cost, modular DECpc LP family offering faster video performance for Microsoft Windows by incorporating the local-bus accelerator chip.

The industry increased unit sales 4.1 percent while total revenues decreased by 3.0 percent between mid-1991 and mid-1992. Buyers were quick to purchase the fastest microprocessor technology as shown in Exhibit 16. The newest 486SX and 486DX processors were growing during 1992. IBM was most heavily affected as its older models' sales fell. The market shifted from 386DX-based machines to more advanced 386SX and 486-based machines faster than IBM could respond to the rapid change in product mix. In fact, IBM's attempt to differentiate its machines with a new OS2 operating system had been less than successful. Many buyers were replacing it with Microsoft's DOS 5.0. As competition introduced new models using faster microprocessors, the prices on slower processor machines fell like a rock.

**Exhibit 16: Market Shares By Vendor And Microprocessor Technology**

	Unit Market Share		Revenue Market Share	
	YTD 1992	YTD 1991	YTD 1992	YTD 1991
<b>TOTAL INDUSTRY</b>				
Intel 80286	5.9%	22.0%	3.1%	14.7%
Intel 80386DX	19.8%	21.0%	20.3%	29.9%
Intel 80386SX	43.2%	32.7%	36.4%	29.9%
Intel 80486DX	6.5%	1.7%	3.7%	.7%
Intel 80486SX	2.6%	--	1.3%	--
<b>IBM</b>	<b>22.0%</b>	<b>29.0%</b>	<b>23.9%</b>	<b>30.5%</b>
Intel 80386DX	5.3%	8.1%	6.6%	12.2%
Intel 80386SX	27.2%	31.3%	26.1%	32.1%
Intel 80486DX	17.3%	46.4%	26.6%	51.2%
Intel 80486SX	27.1%	--	38.2%	--
<b>Apple</b>	<b>19.5%</b>	<b>17.2%</b>	<b>21.6%</b>	<b>17.1%</b>
Macintosh	19.5%	17.2%	21.6%	17.0%
Notebooks	20.2%	--	25.3%	--
<b>Compaq</b>	<b>14.7%</b>	<b>18.9%</b>	<b>18.7%</b>	<b>24.6%</b>
Intel 80386DX	28.2%	30.6%	29.7%	27.0%
Intel 80386SX	8.5%	24.3%	10.1%	31.8%
Intel 80486DX	32.1%	24.1%	39.6%	27.1%
Intel 80486SX	27.2%	--	24.4%	--
Notebooks	26.3%	68.2%	28.4%	76.3%
SystemPro	.5%	.3%	2.5%	2.1%
<b>AST</b>	<b>5.9%</b>	<b>4.2%</b>	<b>5.5%</b>	<b>3.8%</b>
Intel 80386SX	7.4%	6.8%	6.5%	5.8%
Intel 80386DX	4.6%	4.7%	.9%	1.3%
Intel 80486SX	--	--	--	--
Intel 80486DX	8.0%	14.4%	6.2%	8.4%
Notebooks	11.5%	--	10.9%	--
<b>ALL OTHERS</b>	<b>37.6%</b>	<b>29.9%</b>	<b>30.1%</b>	<b>23.4%</b>
Intel 80386SX	57.0%	37.6%	57.2%	30.3%
Intel 80386DX	40.3%	26.3%	33.2%	28.2%
Intel 80486SX	27.7%	--	33.9%	--
Intel 80486DX	40.4%	15.1%	27.7%	13.3%
Notebooks	42.0%	--	35.4%	--

## APPENDIX

### Compaq Historical Statistics

Year	Employees (year end)	Space (sq ft)	Resellers (yr end)
1983	600	212000	900
1984	1300	405000	1900
1985	1800	678000	2800
1986	2200	926000	3000
1987	4000	1314000	3000
1988	6500	2869000	3200
1989	9500	4259000	3500
1990	11400	6246000	3900
1991	10100	6246000	3900
	9000	xxx	xxx

Year	Sales (millions)	Fortune 500 rank	Global 500 rank
1983			
1984	329		
1985	504		
1986	625	463	
1987	1224	409	
1988	2066	282	
1989	2876	202	
1990	3599	157	438
1991	3271	136	377
1992Q1	783	xxx	xxx
1992Q2	827		
1992Q3	1067		

### Compaq Customer Support

#### Compaq Customer Support Center

Provides toll-free assistance to any caller with basic product information to support all Compaq products.

#### Compaq Integration Toolkits

Documentation of tested configurations with Banyan VINES SMP, Microsoft LAN Manager, Novell NetWare and SCO UNIX. Integration toolkits and their associated training classes are offered.

#### Compaq Customer Training Program

Offers valuable courses, including integration training.

#### Application Notes

Timely technical information on the installation and configuration of hardware, software and peripherals. Distributed to authorized resellers, incorporated in Compaq QuickFind, or available through the customer support center.

#### QuickFind Support Reference library

A comprehensive CD-ROM database with over 25,000 pages of valuable information and over 5,000 illustrations. Available in yearly subscriptions with quarterly updates.

#### Authorized Service Providers & Resellers

Offer various levels of carry-in and on-site service, both under warranty and out-warranty. Service providers are supported by Compaq, and may take advantage of special hotlines, access to Compaq engineers, access to support from our development partners and air shipment of spare parts.

### Compaq Products

	Intro	Ship	Disc
Portable	11/82	1/83	9/87
Portable plus	10/83	10/83	2/87
DeskPro	6/84	6/84	5/89
DeskPro 286	4/85	4/85	3/87
Portable 286	4/95	4/85	2/87
Portable 11	2/86	2/86	1/90
DeskPro 386	9/86	9/86	5/89
Portable 111	2/87	2/87	5/91
DeskPro 286/12	3/87	3/87	10/90
Portable 386	9/87	9/87	Disc
DeskPro 386/20	9/87	9/87	5/89
DeskPro 386/25	6/88	6/88	5/91
DeskPro 386s	6/88	6/88	10/91
DeskPro 386/20c	9/88	9/88	10/91
SLT/286	10/88	10/88	Disc
DeskPro 286e	4/89	5/89	3/91
DeskPro 386/33	5/89	5/89	3/91
LTE	10/89	10/89	Sp92
LTE/286	10/89	11/89	Sp92
DeskPro 486/25	11/89	3/89	11/91
SystemPro386	11/89	12/89	F92
DeskPro 386/25e	3/90	3/90	Disc
DeskPro 386N	3/90	3/90	Disc
DeskPro 286N	3/90	3/90	Disc
SLT 386s/20	6/90	6/90	Disc
SystemPro486	6/90	6/90	F92
DeskPro 486/33L	6/90	6/90	10/91
DeskPro 486/50L	6/91	10/91	Disc
DeskPro 386/25M	9/91	9/91	
DeskPro 486s/16M	9/91	9/91	
DeskPro 486s/25M	9/91	9/91	
DeskPro 486/33L	9/91	9/91	
Portable 486C	10/91	11/91	11/92
SystemPro/LT	10/91	10/91	F92
DeskPro386s/20N	10/91	11/91	92
LTE Lite/20	1/92	1/92	F92
LTE Lite/25	1/92	1/92	
DeskPro 50/M	3/92	3/92	
Portable 486	4/92	4/92	11/92
SystemPro/e	6/92	6/92	
ProLinea 3/25zs	6/92	6/92	
ProLinea 3/25s	6/92	6/92	
ProLinea 4/33	6/92	8/92	
DeskPro 2/35I	6/92	6/92	
DeskPro 3/33I	6/92	6/92	
DeskPro 4/25is	6/92	6/92	
DeskPro 4/33I	6/92	6/92	
Contura 3/20	6/92	6/92	
Contura 3/25	6/92	6/92	
LTE Lite/25c	6/92	6/92	
DeskPro 66/m	8/92	8/92	
DeskPro 4/66I	8/92	8/92	
PageMarq 15	8/92	8/92	
PageMarq 20	8/92	8/92	
Contura 3/25c	9/92	9/92	
ProLinea 4/50	9/92	9/92	
ProLinea 4/25s	9/92	9/92	
ProSignia 486/33	10/92	10/92	
ProSignia 486dx2/66		10/92	
SystemPro/XS486/50		11/92	
LTE Lite 4/25C	11/92	11/92	
LTE Lite 25E	11/92	11/92	
Portable 486/66	11/92	11/92	
Portable 486c/66	11/92	11/92	

### Other Products

M/S DOS 2	5/83	5/83	9/87
M/S DOS 3	4/86	5/83	9/87
M/S DOS 4	4/89	5/83	9/87
M/S DOS 5	6/91	5/83	9/87
IBM OS/2	4/89	4/89	5/91
IBM OS/2.2	2/88	2/88	Disc
LAN Manager	11/89	Never	
QuickFind	2/91	2/91	Disc
ArrayExpansion	2/91	2/91	Disc
DAT Backup Drive	2/91	2/91	Disc
System Manager	9/91	9/91	Disc
Dual Mode Monitor	6/94		Disc
Color Monitor	9/86	9/86	2/88
VGA ColorMonitor			10/87
		Dsc	
VGA Mono Monitor		10/87	Dsc
Adv Graphics Bd	1/89	1/89	3/91
Adv Graphics Mon	1/89	5/89	Disc
Red. Emiss. Mon.	4/91	4/91	Disc
Advanced VGA	6/91	6/91	Disc
SystemPro dx2 bds	8/92	8.92	Disc
IDA-2 controller	3/92	3/92	Disc

### Compaq Subsidiaries

Country	Opened
Australia	
1985	
Austria	1990
Belgium	
1988	
Canada	1985
Denmark	
1989	
Finland	1990
France	1984
West Germany	1984
Italy	
1986	
Japan	
1991	
Mexico	1991
The Netherlands	1987
New Zealand	1990
Norway	1989
Singapore	
1988	
Spain	
1987	
Sweden	1987
Switzerland	1988
United Kngdom	1984