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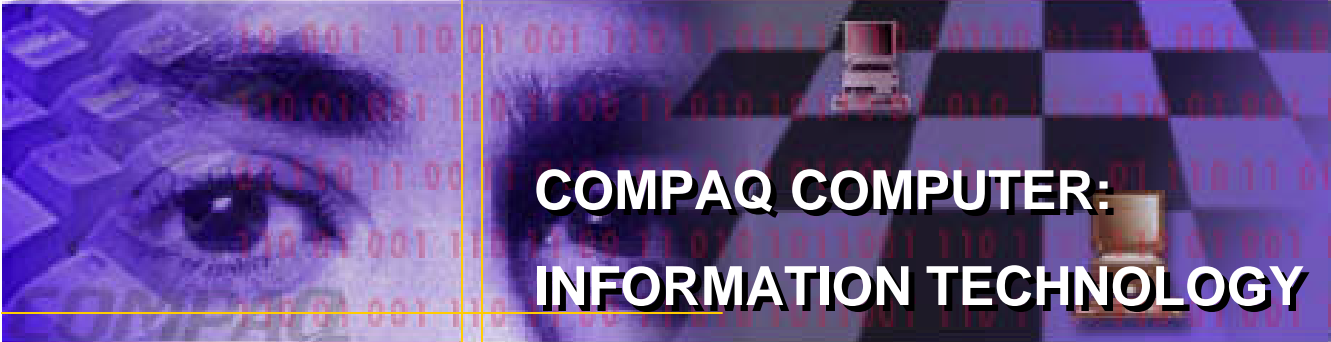
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COMPAQ COMPUTER: INFORMATION TECHNOLOGY

**CENTER FOR RESEARCH
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SEPTEMBER 1999

IN A COMPANY IN TRANSITION

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Abstract

Compaq Computer, based in Houston, Texas, is the world's largest personal computer manufacturer and the fourth largest information technology (IT) company. From 1992-1997, the company's aggressive high volume PC strategy propelled it to high growth rates in revenues, while its leadership in PC servers sustained strong margins and drove profit growth. Starting in 1995, former CEO Eckhard Pfeiffer began to transform Compaq from a pure PC company to a full-service IT company that could compete with the likes of IBM and Hewlett-Packard. The key strategic moves were the acquisitions of Tandem Computer and Digital Equipment Corporation in 1997 and 1998, giving Compaq a diverse line of technologies and service capabilities.

Compaq stumbled badly in 1998 as it faced new challenges in the PC market and tried to assimilate Tandem and Digital. In particular, Compaq struggled to catch up with Dell Computer, whose direct sales, build-to-order model gave it a big advantage in cost and speed over Compaq's indirect sales, build-to-forecast approach. When the company disappointed investors with poor results in 1999, the board removed Pfeiffer and replaced him with Michael Capellas. Since Pfeiffer's departure, Compaq has reorganized itself along business lines, streamlined its distribution channels and developed a new electronic commerce strategy called "NonStop eBusiness."

In 1994, Compaq began building a global enterprise information system to support its manufacturing and order fulfillment operations. The systems were built primarily around SAP applications, running on Compaq PC servers and the Windows NT operating system. Compaq's IT people were forced to distribute the SAP applications across ten interconnected sites around the world and customize extensively in order to run on Windows NT and meet Compaq's needs. The company had a very centralized IT organization until 1998, but the structure has started to change with the decision to break up the SAP group into separate teams for each major business unit. Further reorganization is likely to align IT with the new organizational structure announced in 1999.

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COMPAQ COMPUTER: INFORMATION TECHNOLOGY IN A COMPANY IN TRANSITION

Jason Dedrick and Kenneth L. Kraemer

" Compaq does not currently have in place processes for order entry, production of individualized units and direct distribution that can operate efficiently to manage a large portion of its current PC sales."

Compaq form 10-Q, Quarter ending March 31, 1999

I. INTRODUCTION

Compaq Computer, based in Houston, Texas, is the world's largest personal computer manufacturer and the fourth largest information technology (IT) company. From 1992-1997, the company's aggressive high volume PC strategy propelled it to high growth rates in revenues, while its leadership in PC servers sustained strong margins and drove profit growth.

Starting in 1995, former CEO Eckhard Pfeiffer began to transform Compaq from a pure PC company to a full-service IT company, with the goal of becoming a \$50 billion company that could compete with the likes of IBM and Hewlett-Packard. The key strategic moves were the acquisitions of Tandem Computer and Digital Equipment Corporation in 1997 and 1998, giving Compaq a diverse line of technologies and service capabilities.

Compaq began revamping its information systems in 1994, building global enterprise information systems to support its globally optimized manufacturing and order fulfillment operations. The systems were built primarily around SAP applications, running on Compaq PC servers and the Windows NT operating system in order to demonstrate that large enterprise systems could run on Compaq hardware. Compaq's IT people were forced to distribute the SAP applications across ten interconnected sites around the world and customize extensively in order to run on Windows NT and meet Compaq's needs.

Compaq stumbled badly in 1998 as it faced new challenges in the PC market and tried to assimilate Tandem and Digital. In particular, Compaq struggled to catch up with Dell Computer, whose direct sales, build-to-order model gave it a big advantage in cost and speed over Compaq's indirect sales, build-to-forecast approach. When the company disappointed investors with poor results in 1999, the board removed Pfeiffer, who had been credited for Compaq's previously stellar performance. Since Pfeiffer's departure, Compaq has reorganized itself along business lines, streamlined its distribution channels and developed a new electronic commerce strategy called "NonStop eBusiness."

Compaq has gone through a series of IT reorganizations aimed at giving business units more control over IT decisions and resources. Compaq's new CEO, Michael Capellas, came to the company in 1998 as CIO and was the force behind this reshaping of the IT organization. It is likely that newly hired CIO Robert V. Napier will continue the process in order to align IT with the new corporate structure, while also working to implement Compaq's e-business strategies.

II. BUSINESS ENVIRONMENT AND STRATEGY

Competition

Compaq sells PCs to corporations, small and medium enterprises (SMEs), government agencies and consumers in countries around the world. Major PC competitors include IBM, Hewlett-Packard, Dell, Gateway, Apple, and Toshiba, as well as many smaller branded PC makers and thousands of companies making “white box” PC clones. Compaq, IBM and HP are the leading indirect PC vendors, selling through distributors, resellers and retailers—the so-called “channel.” Dell and Gateway are the leading direct vendors, selling directly to end users.

Compaq’s biggest challenge now comes from Dell, which has nearly caught up in U.S. market share and is gaining ground worldwide (Tables 1 and 2). Until recently, Dell’s growth came mostly at the expense of other PC makers, as Compaq continued to achieve high growth rates and expanding market share. By the late 1990s, however, Dell was challenging Compaq in its key corporate markets and Dell’s growth became a direct threat to Compaq. The Dell threat became more serious since Dell has introduced successful notebook and server lines, competing in Compaq’s most profitable market segments.

Table 1. PC and midrange server market share in revenues, 1997 and 1992

Worldwide PC market share (%)			Worldwide midrange server market share (%)		
	1997	1992		1997	1992
Compaq	13.1	6.4	IBM	16.8	24.2
IBM	9.6	11.3	Compaq	15.8	n.a.
Dell	8.5	3.6	HP	12.3	8.1
Packard Bell	6.9	1.8	Sun	8.5	<2.3
HP	6.4	<1.5	DEC	6.5	10.6
Gateway	5.1	<1.5	NCR	4.6	6.1
Toshiba	4.6	4.0	Fujitsu	3.6	8.8
Apple	4.3	11.5	NEC	3.3	7.3
NEC	4.1	8.1	Toshiba	2.9	3.8
Acer	3.5	1.9	Siemens/Nixdorf	2.6	3.5
Fujitsu	3.3	1.6	Dell	2.6	n.a.

Source: McKinsey & Co. *1998 Computer Industry Trends*

Table 2. PC market share in units, 1998

	Worldwide (%)	U.S. (%)
Compaq	13.8	16.1
IBM	8.2	8.0
Dell	7.9	12.7
HP	5.8	7.5
Packard Bell/NEC	4.3	n.a.
Gateway	n.a.	8.4

Source: Dataquest press release, January 29, 1999

Since the acquisition of Tandem and DEC, Compaq has faced a new set of competitors in those companies’ markets. For instance, Compaq now owns DEC’s Alpha processor, OpenVMS and Tru64 UNIX operating systems, and Tandem’s Himalaya fault-tolerant servers. This puts it in competition with companies such as IBM, Fujitsu, Sun and HP in

high-end server markets. More importantly, the Tandem and DEC acquisitions brought Compaq over 20,000 service professionals. Compaq has used these new technologies and service capabilities to promote itself as a full-service IT company that can provide end-to-end technologies and services for large corporate customers. This puts it in competition with IBM and HP in enterprise systems and also with service providers such as EDS and CSC.

Strategy

Compaq's business strategy has gone through three major phases during its seventeen years in business. From 1982-1991, Compaq was a premium brand PC maker. It sold industry standard IBM-compatible PCs, but distinguished itself by its design and engineering capabilities. Compaq was the first company to successfully reverse engineer the IBM PC BIOS, allowing it to sell IBM-compatibles, and was the first company to offer new designs (such as the first portable PC) and introduce new technologies such as PCs based on Intel's 80386 processor. During this period, Compaq targeted customers who needed high quality, well-engineered PCs and were willing to pay a premium for them. Compaq sold its PCs through a network of about 1,000 dealers in North America.¹

By 1991, Compaq's growth was slowing and it faced competition from a slew of PC makers who built low-cost IBM clones using standard designs and components. In Compaq's second strategy phase, new CEO Eckhard Pfeiffer moved to cut costs and recast the company as a mass market PC maker. Compaq cut back on R&D spending (from 6% in 1991 to 2.1% in 1994²), reduced production costs by simplifying its designs and outsourcing some of its production (largely to low-cost Asian manufacturers), and laid off 1400 employees as part of a cost-cutting restructuring. Compaq changed its distribution strategy to reach new customers such as consumers and small business. It worked with distributors such as Merisel, Tech Data and Ingram Micro to sell PCs to value added resellers (VARs) and expanded its retail presence in stores such as CompUSA, Office Depot and Circuit City.³

Compaq also introduced new product lines for the home and small business markets and became the biggest seller of consumer PCs, which account for about \$5 billion in annual revenues. These moves were accompanied by major price cuts across Compaq's product lines that transformed Compaq from a premium brand into a price leader. Compaq's aggressiveness in the consumer retail market has nearly destroyed former leader Packard-Bell. The home and small business markets are low margin businesses for Compaq, but helped it to achieve high volume and lower average costs across its PC lines.

A key part of Compaq's success has been its leadership in the Intel-based PC server market, where it has consistently held a market share of over 30%. Working closely with Microsoft, Compaq was a leader in promoting Windows NT servers as lower cost alternatives to Unix in the low end of the market. Compaq was also the first to offer NT workstations bundled with

¹ Adrian Ryans and Mark Vandenbosch, 1995, "Compaq Computer Corporation 1995," Richard Ivey School of Business and Harvard Business School, HBS case #95A011.

² McKinsey & Co., *The 1995 Report on the Computer Industry*, and *The 1993 Report on the Computer Industry*

³ Ryans and Vandenbosch, 1995.

enterprise software such as SAP R/3, helping to move NT beyond the role of departmental server. This helped expand the PC server market and strengthened Compaq's market position.

Compaq's strategies paid off handsomely. Sales tripled from \$3.2 billion in 1991 to \$10.8 billion in 1994, and by 1995 Compaq was the number one selling PC brand worldwide. Success continued through 1997, with sales reaching \$24.6 billion and return on invested capital reaching a company record of 60.1%.⁴ However, Pfeffer had already begun to move Compaq to a third strategic phase in order to continue its high growth rates. He decided that the time had come to transform Compaq "from a PC company to a global IT—and Internet—leader."⁵ No longer would Compaq be satisfied just to sell PCs; now it would challenge IBM as a provider of a full range of IT hardware, software and services for global corporations.

This shift in strategy was highlighted by the acquisitions of Tandem and Digital Equipment Corporation (DEC), which immediately expanded Compaq's customer base and gave it access to the technologies and service organizations of those two companies. Compaq felt that it could not wait to develop the capabilities it needed internally and decided to acquire them instead. DEC and Tandem had high-end server technologies, large sales and service organizations, and an established presence in large corporate and governmental accounts. The new company is far different from the old one, now referred to as "Compaq Classic" within the company.

Distribution

Compaq sells PCs primarily through the indirect channel, reaching customers through a network of over 40,000 resellers worldwide. Compaq's channels consist of direct sales through Compaq's sales force in accounts with over 1000 employees, two-tier sales through distributors and VARs and retail outlets for consumer products, and dealers and systems integrators for complex installations in commercial and government markets. Compaq offers training and certification programs for channel partners to support Compaq products and software such as Microsoft Back Office and SAP R/3 running on Compaq hardware.

Like other indirect PC vendors, Compaq has struggled to reduce inventory levels and match supply to demand. With PC components declining in value at 1% or more per week, holding inventory is very expensive. Compaq has been accused at times of "stuffing the channel," or shipping more product than it forecasts to sell, in order to push sales and market share. When demand lags, the channel must be cleared out, often at a loss, before new products can be introduced. In these cases, dealers and resellers cut prices to move inventory, but Compaq takes the loss because of price protection policies that protect the channel from price declines.

The inefficiencies of Compaq's distribution strategy were brought into focus in recent years by the success of Dell's direct, build-to-order strategy. Dell was able to steadily increase its inventory turnover to 60 times per year by 1999, while Compaq only turned its inventory over 14 times. The difference in cost and time-to-market with new products put Compaq at a big disadvantage against its most aggressive competitor.

⁴ Compaq annual report, 1998.

⁵ Compaq annual report, 1998.

“To get a sense of Dell's edge, consider the travels of a typical Compaq PC sold to a corporation. Based on often hazy forecasts of demand, Compaq builds a machine. Then Compaq tests, inspects, boxes, and stores the PC before sending it to a reseller's warehouse, where the machine sits until a customer finally puts in an order. Until recently, that wait has averaged six to eight weeks. Of course, each customer's computing needs are slightly different. So once the reseller receives an order, the computer is unpacked, its case is opened, parts are installed or removed, the case is closed, software is loaded, and the whole thing is tested, inspected, packed, and shipped to the customer. IBM and HP send their products on similar treks.”⁶

Optimized Distribution Model

Compaq recognized the problems with its distribution system and began to develop its own build-to-order strategy in 1994. The strategy was broadened in 1997 into what Compaq calls its Optimized Distribution Model (ODM). "ODM signals the beginning of a new era at Compaq," according to Eckhard Pfeiffer. "With the launch of ODM, we are sending a shock wave through the industry...The new model will shape the way all Compaq products are designed, built, configured, distributed, ordered, purchased, serviced, and upgraded, as well as the way Compaq engages customers and works with its reseller partners."⁷ Two years later, however, Compaq was still revising ODM, and had fallen far short of its inventory goals.

What is ODM, and why has Compaq had such trouble implementing it? ODM is a strategy for linking Compaq's supply chain from supplier to final customer to execute build-to-order production within an indirect sales model. The goal of ODM is to deliver 95 percent of all products anywhere in the world within five days or less.

ODM has three elements: Build to order (BTO), where Compaq builds standard configurations to orders that come in from channel; configure to order (CTO), where Compaq builds nonstandard configurations from a list of approved components; and the Channel Configuration Partner program (CCP), or channel assembly, where Compaq authorizes channel partners to build systems on its behalf using components supplied by Compaq.⁸

BTO was the simplest part of the model; it simply said that Compaq would manufacture its PCs when the order came in instead of building and shipping to forecast. CTO required a shift in production to incorporate more customization, but production remained under control of Compaq. CCP, or channel assembly, required the greatest changes on the part of Compaq and its channel assembly partners (CompuCom Systems, Inc., ENTEX Information Services, Inc., GE Capital Information Technology Solutions, Inacom Corp., Ingram Micro Inc., MicroAge Inc., Tech Data Corporation and Vanstar Corporation). Final assembly and configuration was shifted from Compaq's plants to those of its channel partners, which theoretically would save time and costs by eliminating the need for additional configuration after final assembly took place. However, the realization of these savings was hampered by difficulties in execution.

⁶ “Now Everyone In PCs Wants To Be Like Mike. Michael Dell, That Is.” David Kirkpatrick Reporter, Associate Patty De Llosa, *Fortune*, 09/08/1997, Page 91+

⁷ John Teresko, 1998, “Replacing Inventory With IT,” *Industry Week*, 5/4/98, page 38

⁸ Peter Jordan, “Assembling Channel Assembly -- A long time coming, channel assembly is just now rolling out the door,” *VAR BUSINESS* 6/8/1998.

There are several reasons that ODM has failed to achieve its goals. One was the acquisition of DEC, which forced Compaq to shift a great deal of its energy into assimilating DEC and took attention away from ODM. Equally important was Compaq's unwillingness to let the program work if it risked losing some sales volume. Rather than wait for orders to come in, it continued to push products into the channel in order to increase sales and market share. The first reckoning came in early 1998, when Compaq was caught with excess inventory in the channel and saw its profits disappear.

"The company felt a more dramatic shift to ODM and a trimming of dealer inventories might hurt revenue, says Walter Winnitzki, analyst at PaineWebber in New York. To cushion the blow, Compaq continued to pump more products into the channel based on demand estimates and hoped to spur more sales, Winnitzki says. Compaq also had its eyes on expanding its market share, and it may have been willing to take risks to achieve that goal, some analysts say. Those risks proved too great when competitors IBM Corp. and Hewlett-Packard Co. quickly joined in on a round of price cutting initiated by Compaq."⁹

Another problem with ODM has been its complexity. In North America alone, Compaq had 10,000 resellers, dealers and retailers selling Compaq products, supplied by 39 channel partners (18 corporate resellers, 12 distributors and nine direct response/retailers), who bought directly from Compaq. These 39 channel partners held inventory in 100 warehouses, in addition to inventory held by other resellers, dealers and retailers. Under the best of conditions it was difficult to implement a build-to-order system that would process orders quickly and keep inventory under control.

In addition, Compaq was trying to achieve several goals with ODM, leading to a complicated solution. Compaq wanted to reduce inventory by building PCs to order, yet it wanted to maintain product availability throughout the channel, which normally was done by keeping sufficient inventory in the channel. Also, it wanted to offer configure-to-order service so that resellers would not have to open up the box and make final configurations for end users. This led to the creation of a three-part model whose complexity nearly matched that of the problems it was trying to solve.

One issue raised about channel assembly is processor plug-in, i.e., whether the channel assembler can install the microprocessor and do the burn-in process. By 1998, IBM and Hewlett-Packard were letting resellers plug processors into motherboards, but Compaq was holding out, fearing a loss of quality control.

Without processor plug-in, however, some of the time saving benefits of channel assembly are lost. According to VARs, processor plug-in gives them greater flexibility in system assembly while significantly reducing inventories. They say the problem with having the vendor do system testing is that the processor and some memory need to be installed on the motherboard in order to burn-in the system. Once the processor and memory installed, the vendor has created a partially finished system that must be shipped from the vendor to the channel assembly facility, and then to the user, a process that can add up to 10 shipping days.¹⁰

⁹ Nick Turner, "Computers & Technology Compaq's Best Laid Plan For Inventory Goes Awry," *Investor's Business Daily*, 7/14/1998, Page A8

¹⁰ Craig Zarley, "Compaq reshapes channel landscape," *Computer Reseller News*, 5/10/1999, Page 1

One response to the problem of having to ship twice was to co-locate Compaq's major channel configuration partners at Compaq plants, so that shipment of the partially finished system was eliminated. In 1998, Compaq announced a co-location agreement with distributor CompuCom Systems at Compaq's Houston campus. CompuCom's Configuration Services Center performs final assembly, software loads and advanced configuration services on Compaq desktop PCs, workstations and servers.¹¹ In addition to CompuCom, Compaq established co-location partnerships with Tech Data in and Ingram Micro as part of its PartnerDirect plan in 1999.

The pressure from Dell and Gateway led each of the three major indirect vendors to develop their own versions of channel assembly (see Appendix A). However, channel assembly has been a frustrating experience for both vendors and channel partners. For instance, participants in IBM's Authorized Assembler Program need to invest \$5 million to equip themselves for processor plug-ins, on top of requirements to buy a minimum of \$150 million worth of product and spend \$150,000 to obtain ISO 9002 certification. In addition IBM, Hewlett-Packard and Compaq require resellers to invest in proprietary versions of shop-floor software necessary for processor plug-in, significantly adding to their costs.¹²

Other problems with channel assembly involve the need to revamp information and logistics flows. Every Compaq channel partner uses different systems and Compaq had to create links between its own information systems and the different systems used by its channel assembly partners. Ray Robidoux, Compaq vice president of ODM operations, said that Compaq's timetable for processor plug-in "partially depends on the channel's ability to get their [electronic data interchange] systems and testing capabilities in place."¹³

Direct Sales

In November 1998, Compaq began offering direct sales to end customers over its DirectPlus web site. Under the "Customer Choice" banner, Compaq allowed customers to buy PCs directly from Compaq, through traditional resellers, or at kiosks in retail outlets.

The decision was driven by the fact that an increasing number of customers wanted to buy directly from the vendor, often over the Internet, and Compaq was not willing to cede this market to Dell and Gateway. "We have simply decided that we are not going to miss out on that one-third of the total market," Pfeiffer said.¹⁴

In spite of Compaq's efforts to appease its channel partners, which included a 6% agent fee paid to VARs when their customers used the DirectPlus program, the decision to sell direct created serious misgivings among Compaq's distributors and resellers. These channel members feared that Compaq would compete with them on price for the same products.

¹¹ "CompuCom 'Co-Locates' with Compaq to Increase Manufacturing Efficiency and Reduce Product Delivery Time and Cost," *Business Wire*, 7/7/98.

¹² Jeff Bliss, "Expense May Thin Ranks Of AAP Plan," *Computer Reseller News*, April 13, 1998.

¹³ Craig Zarley, "Compaq reshapes channel landscape," *Computer Reseller News*, 5/10/1999, Page 1

¹⁴ Dwight Silverman "Compaq saw writing on the wall /Customers demand direct sales mode" *Houston Chronicle*, 11/12/1998, Page 1

DirectPlus bypassed distributors completely, and channel partners feared that it was a step in the direction of bypassing the channel altogether.¹⁵

After hearing complaints from the channel about DirectPlus, Compaq announced a pilot program called PartnerDirect which involved distributors in the fulfillment of direct orders and offered more favorable distributor and reseller terms. A major component of PartnerDirect is the co-location of two distributors—Ingram Micro and Tech Data—in Compaq’s Houston plant. When VARs place an order through PartnerDirect, Compaq will manufacture the basic system and the distributor will install third-party components, configure the system, provide financing and ship the order to the end user or to the VAR.¹⁶

In June, 1999, Compaq announced it would open 17 new call centers to take orders, with a goal that 25% of sales will be direct by the end of the year.¹⁷ In 1999, it also announced direct sales in Europe and Japan.

Distribution Alliance Program: Streamlining the channel

After the firing of Eckhardt Pfeiffer, Compaq’s first major move was to streamline its distribution channel, announced on May 10, 1999. A new program called the Distribution Alliance Program (DAP) was hailed by Compaq as “the biggest change we have made in our history.” DAP cuts the number of distributors who buy directly from Compaq from 39 to just four alliance partners—Ingram Micro, Inacom, Merisel and Tech Data (Although not part of the Alliance, CompuCom, as a co-located Compaq integrator, will continue to provide integration and configuration services for direct large-account sales). As of August 1, the other 35, along with all of Compaq’s resellers, had to purchase Compaq PCs from the four alliance partners. As a result, the number of inventory stocking points in North America was cut from 100 to just 30, which is expected to improve inventory control and ensure product availability for resellers.¹⁸

III. ORGANIZATION OF BUSINESS ACTIVITIES

In the past, Compaq organized its business segments on a geographic basis. Profits and losses historically have been reported for three regions: North America, EMEA (Europe, Middle East and Africa), and other (including Japan, Greater China, Asia-Pacific and Latin America). The bulk of Compaq’s revenues come from North America and Europe, although it is a market leader in a number of Latin American and Asian markets (Table 3).

Table 3. Revenues and operating profits by region, 1998 (in \$ millions)

	North America	EMEA	Other
Revenues	13,411	10,135	3,720
Profit	1,666	1,845	339

Source: Compaq 1998 annual report

¹⁵ Jan Stafford, “Compaq Expands Direct Effort, But VARs and distributors will play bigger role in Compaq’s plan,” *VAR Business*, March 26, 1999.

¹⁶ Stafford, 1999

¹⁷ Matt Hamblen and Kathleen Ohlson “Compaq : Reality Sinks In,” *ComputerWorld*, 6/21/1999, Page 30

¹⁸ Craig Zarley, “Compaq reshapes channel landscape,” *Computer Reseller News*, 5/10/1999, Page 1

Until 1999, business lines were divided among PCs (commercial and consumer), enterprise systems (Alpha, Tandem and Intel servers, workstations, storage) and services. The breakdown of revenues is presented in Table 4, which shows that Compaq is still primarily a hardware company, even after its acquisition of DEC's large service business.

Table 4. Revenues by business line, 1998 (% of total)

Commercial PCs	37
Consumer PCs	16
Enterprise systems	34
Services	13

Source: Hoover's Online

In June 1999, Compaq announced that it would formally reorganize its businesses into three groups, each with its own profit and loss responsibility. The three groups are

- (1) Enterprise Solutions and Services
- (2) Personal Computer
- (3) Consumer

In addition, Compaq announced:

- creation of a global Sales and Marketing group with responsibility for sales processes across all business group lines.
- establishment of a dedicated organization to manage all of Compaq's electronic commerce activities.
- creation of a customer advocacy organization, combining Compaq's quality and customer satisfaction organization with its customer advocacy initiatives.¹⁹

Once complete, the realignment is expected to eliminate \$2 billion in operating costs, according to Compaq. It is also expected to create stronger alignment of business processes, from engineering and manufacturing to sales and service, around specific customer groups.

Manufacturing

Compaq's manufacturing involves a mix of in-house production and outsourcing.

Commercial desktops and high-end servers are manufactured in-house, with increasing participation of distributors in assembly and configuration. Low-end servers, consumer desktops and notebooks are outsourced to reduce cost.

Compaq operates manufacturing facilities in Houston, Scotland, Singapore, Brazil and China. These facilities produce standard products ready for final configuration in its own configuration centers or by distributors and resellers. The use of common mechanicals, hard drives, memory, power supplies and other components enable Compaq to achieve economies of scale in high volume manufacturing. Warehousing and inventory costs are reduced by requiring suppliers to pay the cost of warehousing at a facility near Compaq's factories. Compaq has immediate access to parts but does not have to pay for them or for the cost of storing them until it accepts delivery.

¹⁹ Brooke Crothers, "Compaq sees shortfall, plans reorg," CNET News.com, June 17, 1999

In 1999, Compaq will source over \$7 billion of computers, peripherals, components and parts from Taiwanese firms such as Inventec, Arima, Mitac, First International Computer, Tatung, ADI and Lite-on.²⁰ Like most other PC makers, Compaq has increasingly turned complete design and manufacturing responsibility of notebooks to Taiwanese manufacturers. Compaq also makes extensive use of contract manufacturers such as Solectron to build motherboards and basic systems ready for final configuration.

IV. COMPAQ'S USE OF INFORMATION TECHNOLOGY

Compaq's IT systems underwent a major revamping during the 1990s in concert with the company's various reengineering efforts. The main goals were to improve control and coordination of operations and provide managers with information needed to run the business. The core project was an implementation of SAP R/3 enterprise resource planning software throughout the company.²¹

Organization of IT functions

Compaq's IT organization has been highly centralized, with most resources concentrated at the corporate level. Under former CIO John White (1994-1998), IT work was focused around projects such as data warehouse development or SAP implementation. In 1998, the corporate IT department had a staff of 1500 with a budget of \$300 million, which was not charged out to business units. There was no formal alignment of IT according to product or business lines.

During this time, major IT directions were decided at the corporate level. However, geographical units had their own IT staff which provided local support and development, and since the geographies had profit and loss responsibilities, they sometimes made IT decisions based on local needs. For instance, there was a corporate policy that Compaq would have only one central data warehouse, in Houston, but in reality there were unofficial data warehouses in other regions as well. Also, formal management of IT infrastructure came from Houston, yet regional data centers were "owned" by the regional business units.

From 1998 to 1999, significant reorganization has taken place in IT. The first stage was the integration of Tandem, DEC and Compaq under one IT structure and making personnel decisions for the new organization. Unlike Compaq, DEC and Tandem had organized IT by business line. For instance, most of DEC's IT resources were located in the business units, with only a small central IT organization whose costs were charged out to the units.

In August 1998, John White retired as CIO and was replaced by Michael Capellas, who took the first steps to align IT along business lines, beginning in December 1998. A major change in the management of Compaq's extensive SAP organization took place in February 1999. SAP implementation had been carried out to this point by a centralized team, which was

²⁰ *Commercial Times*, (Taiwan). Compaq to Bring Taiwan Partners into Web-based Business System. June 16, 1999.

²¹ Much of the information on Compaq's IT strategies, organization and execution comes from interviews with past and present IT executives.

sometimes criticized for its lack of responsiveness to the needs of individual business units. Capellas restructured the SAP project so that different business units have their own SAP groups and make their own SAP spending and implementation decisions.

Michael Capellas was promoted to the position of Chief Operating Officer in May 1999, at the time of the corporate reorganization, and in July was named CEO. A new CIO, Robert V. Napier, was named in July, and faces the task of further reorganizing the IT function to match the new business organization. It is likely that IT will be further decentralized, with resources placed under the control of the business units.

History of IT development

Compaq's original IT systems were developed in the mid-1980s, running on small Hewlett-Packard mainframe computers. The key application was an enterprise system called ASK, which handled manufacturing and order processing functions. Compaq's systems were decentralized, with separate systems running in different regions and even countries. Each regional system had its own highly modified version of ASK code, customized to meet local needs. Compaq also used an e-mail system from Banyan.

The system was considered good for its time, but it had serious limitations, which hurt Compaq's ability to do effective planning and to better match production with demand. Compaq used a PC-based system for planning, with no underlying relational database. Planning was done on a six-week cycle. New product road maps were sent to the sales force six weeks in advance, and then to manufacturing to make plans for 30 days of production.

Because Compaq sold through channel, planning was several weeks behind actual demand, leading to excess inventory and problems with product availability as the company rapidly expanded its distribution network. By 1994, Dell's success in reducing inventory and speeding products to market was beginning to be recognized, putting additional pressure on Compaq to speed its processes.

In 1994, the company began to put a new IT infrastructure in place to support a dramatic speed up of the planning and production cycle. Selling indirectly meant there would always be inventory in the channel, but Compaq aimed to significantly reduce inventory throughout the supply chain.

Three key goals were set for the new IT initiatives:

- Upgrade the entire corporate IT infrastructure, including replacing the Banyan e-mail system with Microsoft systems.
- Replace the ASK system with a centralized enterprise resource planning (ERP) system.
- Put a planning system in place to cut planning cycles from six weeks to one week, with daily updates to manufacturing.

The strategy was implemented by John White, but the chief sponsor was Eckhard Pfeiffer, with the support of the board of directors.²² Although the projects would have a price tag in the hundreds of millions of dollars, the company felt the benefits would far outweigh the costs. The new IT systems were expected to produce benefits of up to \$500 million per year as early as 1995, when Compaq's revenues were around \$10 billion. These benefits would be achieved in several ways, including inventory reductions, faster cycle times, lower material costs and a reduction in returned goods.

Metrics were put in place to track improvements in inventory levels and customer satisfaction and reductions in write-offs. A side benefit of the new systems is that they could produce more dynamic and agile metrics, with real time reporting for most data and daily reports of everything else. Before, these types of data were consolidated only on a monthly basis.

At the heart of the new systems was the rollout of SAP R/3 applications throughout the company, supported by Oracle databases. The goal was to develop a single central planning system, since Compaq organized supply, manufacturing and order fulfillment on a global basis. The existing country or regional planning systems were not adequate to support global operations.

A key decision was to develop major enterprise systems on Compaq's own hardware, which at the time meant Intel-based PC servers, using software from Compaq's key partner Microsoft. This allowed Compaq to show that its hardware could handle large enterprise applications, but it also created serious challenges to the IT department. SAP was not even certified to run on Windows NT with Oracle databases when the project started. As a result, Compaq had to start database development on HP Unix systems. Application code was developed on NT from the start, and after one year the databases were cut over to NT.

Initially Compaq hoped to develop one central database to support manufacturing and order entry for the entire world. However, due to limitations of Windows NT, and sluggish SAP performance, it was necessary to distribute the SAP system to ten data centers around the world, including:

- 1 central database (Houston), with 1 back-up system.
- 3 SAP instances for manufacturing (Singapore, Houston, Europe)
- 4 SAP instances for order entry (Asia, Europe, U.S., other Americas)
- 1 SAP instance with a master data system that includes all definitions of products and customers.

At the heart of the system was the Total Order Planning System (TOPS), built by Compaq using SAP tools. This system handles the daily manufacturing planning for the three major plants, with twice daily updates from SAP systems (and legacy systems before SAP was implemented) at each plant.

²² Compaq used some outside help to develop the new IT strategy. The lead consultant was Price Waterhouse, a firm with a project management, IT, and business process-history at Compaq. In 1994-95, Compaq relied on McKinsey & Co. for expertise in business-process reengineering. The company also used other consultants with special skill sets, such as Cap Gemini.

While Compaq built its systems on SAP, it did extensive customizing to achieve the performance levels needed. On standard SAP code, one manufacturing replan took seven days, and producing a basic inventory report took 17 hours. By the time Compaq's IS people were done, they could do six replans per day and produce 108 inventory reports in two hours. The speed problem was solved by streaming data from the various systems into a custom-built data warehouse called Voyager, in which data was synchronized six times per day.

With these systems in place, Compaq has moved to a one week planning cycle with real time updates. From Wednesday to Friday, demand forecasts are gathered from the various regions and production plans are developed. From Saturday to Sunday, materials requirements are calculated and reports are sent to suppliers. From Monday to Tuesday, suppliers make shipments and Compaq factories report what they've received, and inventories are recalculated. On Wednesday, the process begins again.

The rollout of SAP systems was done incrementally, starting in Mexico and Canada in 1995. Compaq started in less critical regions and business functions in order to get bugs out of the system before critical systems were changed over. The need to distribute SAP over ten locations, with order entry separated from manufacturing, only became clear as the systems were being developed. In many cases the transition went very smoothly. In Belgium, for instance, SAP went online at midnight one day, and by the end of the day, the first order had been processed and the first report sent to the central Voyager database. There was no downtime at all in the cutover. However, there have been some glitches in the system that caused problems in supplying components such as CDROM drives to resellers in North America. The glitches came not from the SAP solution but from components Compaq wrote itself, according to Compaq.²³ Similar problems arose in Australia, again attributed to non-SAP applications.²⁴

As of mid-1999, the SAP rollout was completed for most geographies and functions. Europe and Asia-Pacific were completed along with most of North America. Worldwide financial accounting systems were running on SAP, while order management and manufacturing systems were in place for some business lines, with others expected to be completed by the end of the year. The integration of DEC and Tandem into the Compaq SAP system is still underway.

Compaq was unable to build all of its enterprise systems using SAP, due to the limitations of R/3 in several areas. When it was necessary to use other applications, Compaq has used a strategy referred to as "big circle partners", meaning they work with a few key partners whose applications are used for different spheres or functions. The most important partners include Siebel Systems for customer relationship management, i2 for supply chain planning and management, Industrial Computer Corp. (ICC), whose Shop Floor Data Manager product is used in manufacturing processes, and Microsoft for applications as well as architecture. Other applications are used for specific needs, and Compaq has developed its own customized solutions for others. (see Appendix B for Compaq's IT structure)

²³ Elliot Markowitz & Jerry Rosa, "Compaq addresses delays, Glitch In New Systems Resulted In Holdup Of CD-ROM Drive Delivery," *Computer Reseller News*, Aug. 31, 1998.

²⁴ Dominique Jackson, "ERP Glitches Disrupt Compaq Order System," *The Australian* 10 Nov 1998 p36.

In general, the goal for big circle partners is to have them work closely with Compaq to tailor their applications to Compaq's needs, then give ownership of the custom features to the partner to incorporate in the partner's product. This takes the burden of ongoing development and upgrades away from Compaq and allows the partner to offer the new features to other customers (sometimes with a period of exclusivity for Compaq).

Supply chain planning and management

Developing internal IT systems was only part of the solution to Compaq's need to speed planning and execution and reduce inventory. Equally important was developing systems to link its entire value chain more tightly, from suppliers to distribution. Compaq needed to be able to let resellers know when goods could be delivered based on its own inventory and manufacturing capabilities and the ability of suppliers to provide needed components.

Compaq developed a custom-built supply chain planning application called Explorer²⁵ to do real time available-to-promise (ATP) calculations, supported by three times a day updates from suppliers. The system is now being replaced by a new version based on i2 Technologies ATP technology. The ATP system enables resellers to quote and promise order delivery to customers in real-time, while obeying reseller constraints with respect to lot sizes, number of shipments, and the time interval between shipments. Compaq can aggregate forecasts, manage inventory, and reserve capacity and material. Demands can be prioritized based on the available supply and allocated to sales channels and key customers with ranking rules.²⁶ Compaq has announced that the i2 implementation will be complete by the end of 1999.

Supplier integration

Another major project has been developing electronic data interchange (EDI) links with Compaq's many suppliers. Compaq already uses EDI to send materials requirements to major suppliers. Real time execution signals are sent to suppliers to trigger shipments, and update materials requirements are updated weekly, as part of planning cycle described above.

As of 1999, many suppliers still can't supply the information that Compaq needs, particularly smaller suppliers and companies in Asia who have historically lagged in using IT.²⁷ Compaq began a new project in 1999 to develop web-based links with suppliers in Taiwan, where it will procure \$7 billion worth of goods. Compaq plans to set up direct links with 20 of Taiwan's original equipment manufacturers over a period of three years.²⁸

The Internet is expected to be a big plus because signals are delivered immediately and don't stay in the supplier's or Compaq's network for some time. Before, suppliers might drop ship a product to a Compaq customer and send a signal to Compaq, but the message wouldn't make it to Compaq until the next day, leaving Compaq's own data incorrect for 24-48 hours.

²⁵ Located in Houston, Compaq often uses NASA terms such as Voyager and Explorer for its project names.

²⁶ "Compaq Computer Licenses I2 'S ATP Solution," *Manufacturing Automation*, 9/1/1997

²⁷ Dedrick and Kraemer, 1998.

²⁸ "Compaq to Bring Taiwan Partners into Web-based Business System," *Commercial Times*, Taiwan.

Now, with the Internet, notification is in real time and netting out of inventory, shipments and financial data is immediate.

The big problem has been getting EDI connections set up with suppliers. It takes 4-6 months for each supplier to get set up, and Compaq can only work with a limited number at one time. The problem may be solved by using the services of companies who provide the interconnection service on a commercial basis.

IT in manufacturing

Compaq employs legacy systems to control manufacturing processes in its facilities. It also implemented Shop Floor Data Manager (SFDM), a manufacturing execution system (MES) from Industrial Computer Corp. (ICC), starting in the late 1980s. SFDM was a part of a strategic initiative to provide more timely information for quality and process control and for decision support. One benefit was providing repair-work tracking that enabled Compaq to improve product design. Partly as a result of improvements in design and quality control, Compaq in 1994 became the first computer manufacturer to extend its new-product warranty from two years to three years. The Houston facility also reduced work-in-process by 42 percent, cut in-process defects by 72 percent and nearly doubled capacity without major capital investment.²⁹

In 1996, Compaq management chose SFDM as the MES software to be used at all its worldwide sites for final assembly, and for North American customer service. It was already installed in Houston and a facility in Scotland and global implementation was carried out from 1997-1998. SFDM fills in a gap in SAP R/3 capabilities by managing the actual shop floor production processes. In practice, a production order is generated by SAP, and then SFDM takes over the manufacturing processes until the product is ready for shipment, at which time a signal is sent to SAP. SFDM also feeds a corporate integrated quality data collection (IQDC) data warehouse, which management can access via an executive information system (EIS) to view real-time status of production on any line in the world.³⁰

Showcasing Compaq products (“Running Compaq on Compaq”)

Until it acquired DEC and Tandem, Compaq's entire product line was based on the Wintel PC architecture. The company has tried to use its own technologies wherever possible, believing it would reduce costs and help it better understand the problems facing its customers. Compaq took a risk in deploying SAP on the unproven NT architecture starting in 1995 to show that it could run enterprise systems on its own hardware. This choice had its costs, but it has helped Compaq develop a close partnership with SAP to demonstrate SAP's capabilities on Compaq hardware and to provide support to customers running SAP on Compaq. Compaq has similar relationships with Siebel and i2 Technologies. In each case, these relationships help sell Compaq hardware by bundling popular software and having a deep knowledge of how to support those applications.

²⁹ Frank O. Smith, “Around the world,” *Manufacturing System*, 1/1/1998, Page 68

³⁰ Smith, 1998, Page 68

In 1995, Compaq again showed its commitment to use the latest Windows technology internally when it aggressively rolled out Windows 95 throughout the company. Through its involvement with Microsoft in developing Windows 95 and its own early use of the new operating system, Compaq was able to offer support to customers as they made the transition.

"Our focus is on support readiness, and because of Compaq's unique Lead Systems Partner for Windows 95 relationship with Microsoft, our support group has had a chance to get ahead of the learning curve on Windows 95," said Leroy Fronk, head of Compaq's Windows 95 internal migration team. "We have had a support team running Windows 95 on their Compaq PCs for several months now; our staff has been at Microsoft in Redmond learning from the support work they are doing with their early testers; and we have been providing some internal support here at Compaq to get ready for the questions our customers will have as they learn this new operating system."³¹

Intranet

In 1996, Compaq developed a corporate intranet called Compaq Inline to serve as an internal communications network and knowledge management system. Compaq Inline uses Compaq servers running Windows NT, and was built with commercial software packages such as FrontPage as an authoring tool and Internet Explorer as the browser.

Compaq Inline links all of Compaq's departments and business units and provides a tool for accessing corporate information across the company. Every department has its own server containing data and information, but prior to Compaq Inline, there was no centralized way to search this information.³²

Compaq Online

Compaq developed a global extranet called Compaq Online. The system matches orders with manufacturing and delivery in real time in order to give resellers the ability to configure, price and order products online, and do final assembly and testing of products. The extranet links to Compaq's planning systems to adjust manufacturing plans and schedules every eight hours at the company's plants in Dallas, Houston and Brazil, as well as distribution centers in Amsterdam and Scotland.

Compaq Online links Compaq's resellers to the company's SAP R/3 order entry systems. Orders placed on Compaq Online enter Compaq via the SAP and are passed through to manufacturing, finance, purchasing and other processes. Compaq Online is further linked to Compaq's EDI system to update suppliers on components requirements.

Service and repair

In 1997, Compaq was receiving complaints about its maintenance and repair services from both resellers and end users. Problems included slow response to service calls and slow

³¹ "Compaq Leverages Microsoft Partnership In Aggressive Internal Windows 95 Transition; Global Rollout Will Enhance Customer Support," *Business Wire*, 8/15/95

³² Hailey Lynne McKeefry, "Compaq Puts Employees 'Inline' With Intranet Site," *Electronic Buyers' News*, 11/11/1996, Page 82.

reimbursement of authorized service partners (ASPs). Compaq decided to revamp its entire service and repair system. Among the changes were the creation of COLinq Plus, a new Internet-based parts order and tracking tool used by its 5,000-plus service providers in North America; a 37 percent increase in call center staff, and the addition of a second Customer Support Center in Atlanta. Resellers were required to order warranty parts directly from Compaq rather than through distributors in order to maintain warranty status on the parts.³³

Compaq also announced it would reward better performing ASPs with a reimbursement plan that linked payment to customer satisfaction. COLinq Plus allows resellers to track their own service orders and warranty upgrades, and also track the progress of their competitors. The tool ranks service providers based on service and support performance. Service partners can not see the names of their competitors but are able to see where they rank nationally. The system ran into some serious glitches however in 1998 including problems calculating pay-per-performance reimbursements, and was shut down for a time to fix the problems, leading to a four-month backlog in reimbursing service providers for warranty parts and labor.³⁴ There were also problems getting parts to resellers to make repairs, and users were sometimes left with PCs and even servers that could not be repaired for days.³⁵

Internet and electronic commerce

After being criticized for being late to the Internet, Eckhard Pfeiffer announced Compaq's NonStop eBusiness strategy only days before his ouster in April, 1999. The initiative and brand name have survived, and in July, Compaq fleshed out many of the details of a strategy aimed at making it a one-stop source for hardware, software and services needed for companies to do business on the Internet. The plans involve bringing together new announced and existing Internet offerings under one banner.

Compaq opened three customer NonStop eBusiness Architectural Centers and allocated 7,000 service professionals into e-commerce practices. Services include consulting, outsourcing, systems integration and infrastructure development.

Compaq offers a variety of hardware and software options to support web sites and e-commerce. Applications from partners such as Microsoft, Netscape, Lotus and Check Point run on various platforms, including DEC, Tandem and Compaq servers running Compaq's Tru64 Unix, Windows NT, and Linux operating systems.

Online service and support: ActiveAnswers

An important part of Compaq's NonStop eBusiness strategy is ActiveAnswers, a web-based service launched in 1998 to support customers and solutions providers with information on planning, installing and operating enterprise software on Compaq hardware. ActiveAnswers contains tools, guides, technical information and complementary applications to support users

³³ Christina Torode, "Compaq turns eye to service -- Invests in parts ordering systems, tech support call centers," *Computer Reseller News*, 10/20/1997, Page 71

³⁴ David Myron, "Compaq Throws SMBs A Direct Initiative: Channel Vendor's new plan poses challenge for small and midsize Business VARs" *VAR Business*, 12/7/98

³⁵ Brett Mendel, "Custom server struggles," *LAN Times*, 4/27/1998, Page 1

of products from vendors such as SAP, Baan, Microsoft, Novell, Oracle, Siebel and others. Compaq draws on its own experience running many of these applications, such as its SAP implementation on Windows NT, to enrich the quality of information on ActiveAnswers.

ActiveAnswers is built on a Microsoft SQL Server database that includes reports developed internally by Compaq and by business partners such as consultants, IT service providers and other implementers. Also included are references to relevant books, with instant ordering capabilities. Customers can search the database for information to solve specific problems, and news is published to subscribers with particular interest areas. There is also a Webzine called "Clip" with news and technology briefs on enterprise applications. In addition to the data repository, Compaq is developing community resources such as discussion forums in which subscribers can post and respond to questions.

In July 1999, Compaq announced enhancements of ActiveAnswers, including three new jointly developed Internet security products: AXENT Raptor Firewall with Virtual Private Network (VPN), Check Point VPN-1 and Trend Micro Server-based Virus Scanning. Other new, jointly developed products include Oracle Business Applications, Oracle NT Transaction Processing, SAP Business Information Warehouse and Compaq Management Agents. Compaq's press release stated that ActiveAnswers has over 28,000 registered users including resellers, consultants, systems integrators and end-user customers.³⁶

Small Business Online Services

Compaq offers a number of web-based services for small businesses (Table 5).

Table 5. Compaq online services

Service	Description
online.backup	Automatic data backup over the web
online.commerce	A suite of e-commerce software based on Microsoft Site Server that allows customers to build and operate a website or online store front.
online.briefcase	Web-based support for mobile users. Browser-based access to home PC from any device and software to synchronize and update multiple home PCs.
online.postage	Purchase Internet postage and print digital stamps onto envelopes and labels.
online.connectivity	Easy Internet connections via GTE or Compuserve.
online.library	Sales of selected business and technical books and CDs. Link to Barnesandnoble.com
online.delivery	Electronic delivery of critical and confidential information over the Internet.
online.auction	Link to eBay.

Some of these services are little more than links to other businesses such as Compuserve or eBay, while others offer more substance. There are no services that are not available in some

³⁶ *Business Wire*, "Compaq Takes Complexity, Risk and Implementation Time Out of eBusiness with New NonStop eBusiness Solutions and Services," 7/7/99

form from other online vendors, but Compaq customers may value Compaq's brand name as a guarantee of quality and security for services such as backup and briefcase that involve transfer of personal or corporate data. Others such as online.commerce depend on the combination of brand name and the quality of the tools offered.

Government, education and medical market (GEM)

In 1998, Compaq upgraded its e-commerce capabilities for the public sector (GEM) market. Compaq's GEM improvements include customized user interfaces for each of its public sector online stores, including Compaq Education Online; Compaq Government Online; and Compaq Healthcare Online (all accessed through www.compaq.com). Compaq can customize a store to meet the requirements of specific public-sector agencies, providing secure access to information specific to the agency's purchasing guidelines. Compaq also creates extranets for agencies that include pricing, configuration and service options to support specific contracts.³⁷

All of the GEM stores feature a product catalog, a quote-generation capability and online ordering. Once orders are made, they are automatically transferred into a SAP R/3 database for order fulfillment. All GEM orders are fulfilled through Ingram Micro, which opened a new facility in Memphis, Tennessee, dedicated to that business.

One of the unique elements of GEM is its ability to pay commissions to resellers for orders made online by government agencies. When customers use GEM, they are prompted to identify the reseller of record. When Compaq gets an order that doesn't have a reseller ID on it, the customer is called and asked which reseller they want listed as the agent of record.

Online SAP hosting service

In May, 1999, Compaq announced it would host SAP's R/3 applications for small and medium-size businesses via the Web. The service is offered through Compaq resellers and integrator partners that specialize in SAP applications. The applications are to be delivered over the Internet and hosted at Compaq's data center in Colorado Springs. The service includes a 99.95 percent uptime guarantee as well as operations support. The cost runs from about \$600 per concurrent user per month for 50 people to \$300 per user per month for 600 people.³⁸

Online configuration

Compaq announced in June 1999 that it would offer online product configuration using an application from PCOrder.com, whose configuration software is used by many resellers and vendors in the industry.³⁹ The agreement means that pcOrder will provide e-commerce

³⁷ Herman Mehling, "Upgrades Government Site: Compaq Adds More Shine To GEM Online," *Computer Reseller News*, July 13, 1998.

³⁸ "Compaq will host SAP R/3 apps for midsize companies," *PC Week* 5/24/99

³⁹ "Compaq inks deal with PCOrder.com," CNET News.com, June 29, 1999

support for Compaq worldwide for all products and customer segments. Previously, Compaq had been using pcOrder software in some of its Compaq Online extranets.

Compaq considers the partnership with pcOrder to be an important step in supporting its hybrid distribution model. It is working with pcOrder to develop the systems needed to support Compaq's Customer Choice strategy that allows customers to choose whether to buy direct or through a reseller. Compaq will work with pcOrder to create a consistent customer experience on the front end linked to intelligent routing of orders to the appropriate back end fulfillment system, either internal or external. By supporting Compaq's full product line, including DEC and Tandem products, pcOrder is expected to help with the integration of the three companies' marketing and order fulfillment processes.

PcOrder technology will be used to develop customized catalogs for different customer segments and to provide different pricing options for different user segments. It will provide configuration support for Compaq's expanding network of call centers and make it possible to offer third party options in addition to standard Compaq configurations. It will also be used for third party product support, providing technical specifications and information sources for third party products offered by Compaq and its resellers.

Alta Vista

Compaq inherited the Alta Vista web site when it purchased DEC, and has operated it as a separate company. Alta Vista is a portal site and search engine, similar to Yahoo! and Excite, yet it had failed to generate the traffic or user loyalty that those site have. In June, 1999, Compaq sold 83% of Alta Vista and its other Internet brands, Shopping.com and Zip2 to CMGI for \$2.3 billion in CMGI shares, giving Compaq a 16% stake in CMGI.⁴⁰

Integrating Tandem and DEC systems

Integrating the information systems of Compaq, Tandem and DEC has been a new challenge. Compaq expected that the task would be made simpler by the fact that DEC was also in the process of implementing SAP, a fact that Compaq's board took into account when making the acquisition. It was expected that having common applications such as SAP, Siebel Systems, and Hyperion budgeting applications could reduce the systems integration time by six to 12 months.⁴¹

Converting Tandem to Compaq's order entry system is already complete, but DEC had 46 order entry systems so it has taken longer. Tandem and DEC are also converting to SAP for manufacturing, a process made easier by the fact that DEC had already started to implement SAP before the acquisition. At the time of acquisition, DEC's SAP implementation was about 30% complete. DEC's worldwide financials were already being done in SAP, but so far its accounting system has not been merged with Compaq's except through the Hyperion budgeting system used by both companies.

⁴⁰ Sandeep Junnarkar, "CMGI buys AltaVista for \$2.3 billion," CNET News.com, June 29, 1999

⁴¹ Tom Stein "Shake On IT -- Corporate Mergers And Acquisitions Are Hot. And The Biggest Winners Are Thinking About IT Before The Deal Is Sealed." *InformationWeek*, 7/27/1998, Page 42.

Integration of SAP systems in the three companies has been complicated by the major differences in the nature of their respective businesses. For instance, Compaq's "Wintel" PCs and servers are based on industry standard designs and require only a single-level bill of materials for manufacturing. By contrast, DEC and Tandem products such as high-end Unix servers have ten- to twelve-level bills of materials, which could not be handled by Compaq's SAP systems. So developing a single materials planning system for the combined company requires further development and integration of systems.

Likewise, DEC's large services business (and Tandem's smaller one) require project accounting and management systems that Compaq previously didn't need. For instance, DEC has a large repair, or "break-fix" business with much different supply chain requirements from Compaq's high volume manufacturing operations. Rather than shipping many parts to a few factories, it is necessary to have spare parts available in geographic proximity to customers around the world, especially for a mission-critical DEC or Tandem system that cannot be allowed to go out of service.

The larger segments of DEC's and Tandem's services business include system integration, outsourcing, consulting and other IT services, which were not part of "Compaq Classic" prior to the merger. These businesses have their own IT requirements, such as tagging customer service calls not only by customer name, but by project, program and even consortium if more than one service provider is involved. An application called Clarify is used for call handling, and SAP is the consolidation point for data that goes into the financial accounting system. Some people say there are economies of scale in putting services into SAP's accounting and production systems along with the hardware business, but Compaq executives admit that there can be significant difficulties in doing so.

IT Spending

Compaq's IT spending prior to the Tandem and DEC acquisitions is estimated to have been about 1.5% of revenues. This is in line with the median level of 1.6% for computer equipment, peripheral and network equipment companies according to Gartner Group. DEC and Tandem IT spending are both estimated to have been in the 3.5-4.5% range, a number that is in line with IT services company median of 4.2%.

Specific estimates put DEC spending at \$630 million and Compaq at \$350 million. At 4% of 1996 revenues, Tandem spending would have been \$100 million. This would put the three companies total at \$1080 million. However, some elimination of overlapping functions and staff reductions should have lowered the total for the combined company. Therefore, we would put Compaq's present spending in the range of \$900 million to \$1 billion, or about 3% to 3.3% of 1998 revenues (Table 6).⁴²

⁴² There are some inconsistencies among the three companies in that Compaq treated software as a capital investment that is amortized over seven years, while DEC and Tandem treated it as an expense. Under new accounting guidelines, software is treated as a capital expense for the whole company now.

Table 6. IT spending estimates

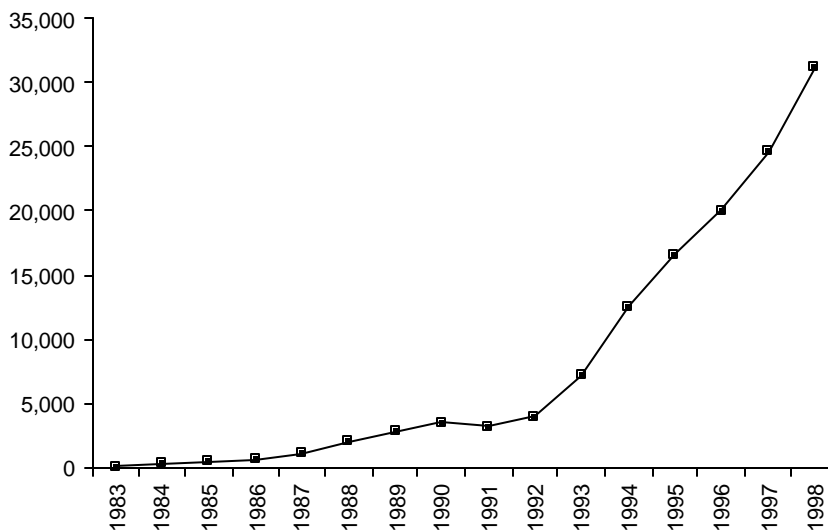
	Total spending	As % of revenue	Per employee
Before mergers			
-Compaq	\$350M	1.5%	\$10,900
-DEC	\$630 M	4.8%	\$11,500
-Tandem	\$100M	4.0%	n.a.
Compaq 1998	\$900M to \$1B	3.0-3.3%	\$13,000 to \$14,400
Industry median (1998)			
-Computer hardware		1.6%	\$7567
-IT services		4.2%	\$2400

Sources: Company estimates for Compaq; Gartner Group for industries

V. Firm Performance

Compaq has been a high-growth company since its inception. Its first year in business, it reached sales of 111 million, the highest level ever recorded for a startup computer company. Sales grew to \$3.6 billion by 1990, with profits reaching \$455 million (Figures 1 and 2). In 1991, however, sales fell to \$3.3 billion and profits to \$131 million. After Compaq's shift to a high volume strategy, sales soared to \$24.6 billion with profits of \$1.86 billion in 1997.

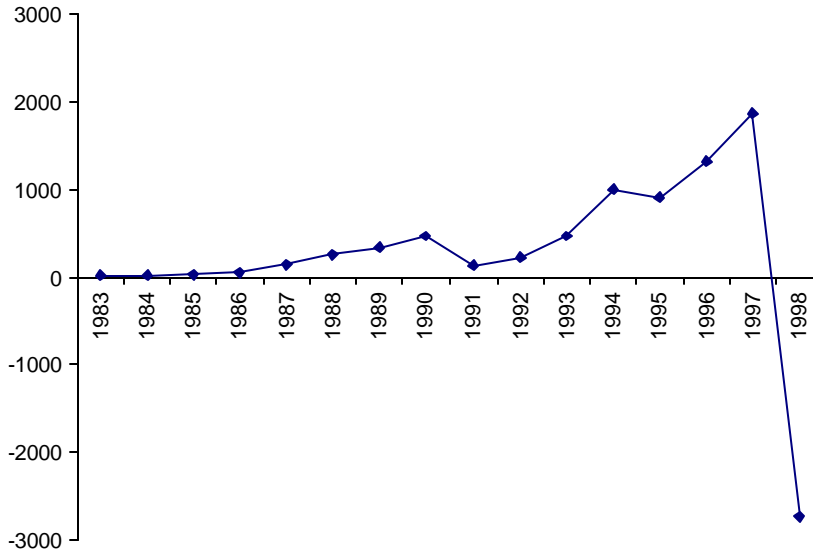
In 1998, Compaq fell into the red, largely because of a \$3.2 billion restructuring charge related to the DEC acquisition.⁴³ More ominous was a 70% decline in operating income, reflecting pricing pressures and difficulties in reducing costs and improving performance in the PC business. Compaq's sales only increased by 27% in 1998, including DEC's revenues, but its head count grew by 66%. SG&A expenses grew from 12% to 16% of revenues, reflecting DEC's higher overhead.

Figure 1. Compaq revenues, 1983-1998 (\$millions)

⁴³ Hoover's Online: Compaq profile

By early 1999, Compaq remained the top PC seller in the world and its revenues topped \$30 billion, yet it continued to fall farther behind Dell in the critical metric of inventory turnover. Inventory turns had increased from five to 14 in 1997, and the company was targeting 25 for the end of 1998. However, progress stagnated and inventory turns actually dropped from an annual rate of 15.9 in the final quarter of 1998 to 13.1 in Q1 1999.⁴⁴

Figure 2. Compaq net income, 1983-1998 (\$million)



Source: Annual reports. Note, 1998 includes a \$3.2 billion charge for DEC acquisition costs

Meanwhile, Dell continued to increase the speed of its direct model, reaching 41 inventory turns in 1998 and hitting an annual rate of 60 turns by 1999. Gateway likewise boosted its inventory turns from 18 in 1997 to 35 in 1998 (Table 7). Perhaps more embarrassing was the fact that Apple, under the direction of former Compaq vice-president Timothy D. Cook claimed to have reached 180 turns (Hoover's gives a more modest figure of 32), helping the company return to profitability after being written off by most of the industry.⁴⁵

Table 7. Inventory turnover as of 1999

PC maker	Turns/year
Compaq	14.9
Dell	60.1
Gateway	34.7
Industry	22.4

Source: Hoover's Online

Compaq had been able to sustain solid profit margins (net income equalled 7.5% of revenues in 1997) thanks largely to high margins on PC servers, where it has held a commanding market share of over 30%. In 1998, however, Dell went after the server market by cutting

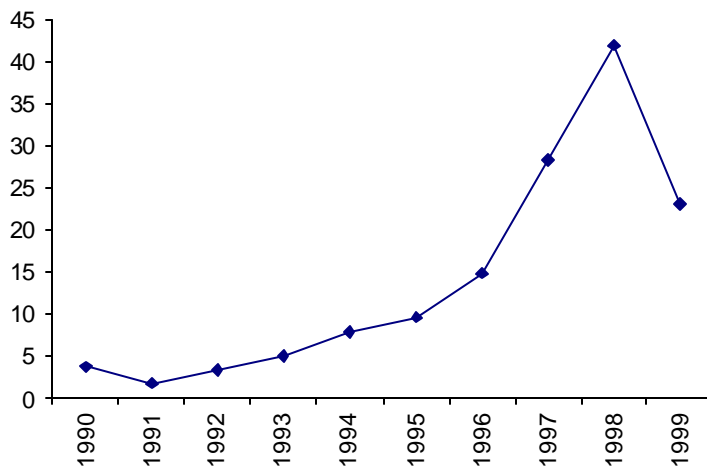
⁴⁴ Edward F. Moltzen, "Inventory Turns, Margins Hit Compaq. Rosen: More Improvements Must Be Made," *Computer Reseller News* (online) Apr. 21, 1999.

⁴⁵ "What's Really Driving Apple's Recovery," *Industry Week*, 3/15/99.

prices dramatically, a move matched by IBM and HP, who were not willing to back down from a challenge to their key corporate accounts. The result was that average server prices declined by 31% from early 1998 to early 1999, a much steeper decline than was seen in desktops, which fell only 16% in spite of the explosion of sub-\$1000 PCs, or notebooks which fell by 10%. Compaq's own average server price fell from \$5626 in February 1998 to \$3998 a year later.⁴⁶

Faced with falling prices and its own troubles assimilating DEC and implementing ODM, Compaq reported disappointing profits the first quarter of 1999, and its stock price fell by over 40% from January to April (Figure 3).

Figure 3. Compaq stock price at FY close (price on June 8 for 1999)



VI. CONCLUSIONS

- The competitive environment in PCs has shifted dramatically in recent years. One factor has been the success of Dell and Gateway using the direct model, cutting inventory costs and bringing new technologies to market faster. Another has been the boom in low-cost consumer PCs. The corporate PC market has seen intense price competition as IBM, HP and Compaq defend their position against Dell's incursions. This price cutting has also hit the PC server market, which accounts for a large share of Compaq's profits.
- Since 1995, Compaq has been transforming itself from a PC maker to a full-service IT company similar to IBM or Hewlett-Packard. The key elements of this strategy were the DEC and Tandem acquisitions, which gave Compaq a wide range of high-end hardware technologies, access to new corporate accounts, and a large cadre of sales and service professionals. However, these acquisitions diluted Compaq's previous strong focus on Intel-based PCs and servers. They also doubled Compaq's head count and required assimilating two companies with radically different cultures and structures.

⁴⁶ Matt Sargent, "Declining PC Prices Are Not Compaq's Biggest Problem", April 14, 1999, ZD Market Intelligence web site.

- While Compaq was busy becoming a full-service IT company, its core PC business began to drift. In 1997, Compaq developed its Optimized Distribution Model (ODM), working with distributors and resellers to offer BTO capabilities and squeeze inventory out of the channel. After two years of tinkering with ODM, as well as offering direct sales itself, Compaq had fallen further behind Dell in the critical metric of inventory turnover while alienating many of its channel partners.
- Compaq's successful strategy of building an extensive indirect distribution channel has created inherent problems in responding to Dell's direct challenge. Every initiative Compaq has taken to simplify distribution or increase direct sales has created resentment among the channel partners who are responsible for most of Compaq's sales. Compaq cannot realistically adopt a direct-only strategy, so it must find a way to make a hybrid strategy work while adding value beyond the PC box in order to regain profitability.
- In its effort to build a \$50 billion full service IT company, Compaq steadily increased the complexity of its product and service lines, technology directions, and organizational structure. It has tried to globally optimize its planning, order fulfillment and manufacturing operations in order to reap economies of scale and better serve global customers. Integrating DEC and Tandem added more layers of complexity even as the company was struggling to achieve its goals of reducing inventory and speeding product delivery for PCs. Meanwhile, Compaq has been trying to integrate its resellers, distributors and suppliers into its own information channels in order to improve the performance of its entire value chain. Finally, it has been developing new web-based systems for sales, service and support.
- The IT systems needed to support such a centralized structure are likewise large and complex. The strategic decision to build those systems on Windows NT servers added even more complexity as it was necessary to distribute Compaq's enterprise systems among ten sites spread among three major geographical regions. This required a tremendous customization effort to overcome the shortcomings of NT and SAP R/3 and meet the demands of Compaq's global processes. The company has had a very centralized IT organization, with a top-down approach to IT strategy and implementation. This structure has started to change with the decision to break up the SAP group into separate teams for each major business unit. Further reorganization is likely to align IT with the new organizational structure announced in 1999.
- Recently, Compaq taken steps to streamline its PC business by reducing the number of distributors who buy directly from Compaq from 39 to 4. The question is how much damage has been done, as the gloating Michael Dell claims his company is in "full account acquisition mode," taking advantage of Compaq's turmoil to steal customers.⁴⁷ Also, new initiatives to increase direct sales and make itself the initial point of contact for service and support are sure to create more friction with resellers. Compaq also has reorganized its business into three business lines with profit and loss responsibilities in order to improve the company's customer focus. Finally, it announced its NonStop

⁴⁷ Reuters, "Dell reaping the rewards of market turmoil?" Special to CNET News.com. June 22, 1999

eBusiness strategy to bring its various Internet businesses together under one brand name, while selling Alta Vista to get out of the consumer-oriented Internet business.

- The choice of Michael Capellas as CEO was surprising to many, but given that many big decisions had already been made in the interim, it was not so surprising that an insider was hired. The choice of a former CIO and COO should give the company a strong focus on improving its own operations and information systems. It also means that the CEO will have a good understanding of the needs of corporate IT departments, which are a key target market for Compaq. What it will mean for Compaq's longer term strategic directions remains to be seen.

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Appendix A. Channel assembly programs of Compaq, IBM and HP

Compaq

Program Name: Optimized Distribution Model

Description: The ODM strategy is broken down into process change and new program development. First, Compaq is moving from a build-to-forecast model to build-to-order (BTO), in which standard products are built on receipt of an actual order. To support BTO, Compaq has developed two programs - the Channel Configuration Program (CCP) and Configure-to-Order (CTO). Through CCP, Compaq provides configurable products to participating channels for their use to build products to customer specification. Under CTO, Compaq will perform the configuration itself at Compaq manufacturing facilities, based on channel orders.

IBM

Program Name: Authorized Assembler Program (AAP); Advanced Fulfillment Initiative (AFI)

Description: AAP was the first of the PC market's channel-assembly programs. IBM business partners custom-configure open-bay systems to end-user specs. IBM currently has 12 business partners assembling some 25% of its commercial desktop products. IBM more recently expanded its fulfillment initiative, which is designed to facilitate the build-to-order element with programs that include shipping parts directly from IBM suppliers to channel partners. In addition, channel partners are performing fulfillment activities at IBM's Raleigh, N.C., manufacturing facility. From there, they can ship assembled PCs directly to customers.

HP

Program Name: Extended Solutions Partnership Program (ESPP)

Description: While maintaining a portion of its traditional manufacturing, Hewlett-Packard is attempting to broaden its offering with ESPP, including three supply chain options, channel assembly, the economy program, and Vendor Express (pilot).

Hewlett-Packard supplies channel partners with base models and components, and the channel configures the product upon customer order. In the economy program, Hewlett-Packard designates certain top-selling models and builds standard units to channel forecast. With Vendor Express, highly customized machines are built to order by Hewlett-Packard and shipped directly to the user. The channel's role is order management and services.

Source: Electronic Buyers' News "How the manufacturing models compare," 12/15/1997 Page 113 (quoted verbatim)

Appendix B. Compaq's IT Structure

