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# Michael Dell: Winning on the Demand Side of the Information Revolution

## Prologue: Dell Computer's Quick Delivery to NASDAQ

On October 27, 1997, a financial crisis in Asia set off a frenzy of activity on the U.S. stock markets. By the end of the day, the New York Stock Exchange had fallen by 554 points and the NASDAQ Composite, representing stocks of small and medium-sized companies, had dropped 115.<sup>1</sup> These were unprecedented declines, fueled by record levels of trading activity in both markets.

The NASDAQ was the world's first electronic stock market, and a substantial portion of the trades made by individuals—in excess of 25%—were conducted on-line.<sup>2</sup> On October 27, the NASDAQ received more than twenty million hits at its Internet trading site, NASDAQ.com, straining its information-processing infrastructure. To handle the huge increase in on-line traffic, the NASDAQ ordered eight sophisticated new server systems from Dell Computer. Thirty-six hours later, Dell delivered the customized, fully tested systems to NASDAQ. Within three days, the exchange was using the Dell equipment to conduct on-line transactions.<sup>3</sup>

Even in the rapid-fire pace of the Information Age, this was an extraordinarily fast delivery of customized high-technology products. NASDAQ's director of interactive services was astonished that the exchange had received the systems so quickly and without being charged extra for the rapid turnaround. "Originally Dell got in with us on price," he explained, "but that's not the issue now. Their customer support and service [are] what's driving our relationship now."<sup>4</sup> In the ruthless competition that prevailed among computer makers, such loyalty was a decided strategic advantage.

The NASDAQ order of 1997 was an accomplishment Michael Dell could hardly have dreamed of in 1984 when, at the age of nineteen, he founded a small business to assemble personal computers. In the intervening years, his company's operating model, strategic position, and the broader PC industry had undergone tremendous change, much of it at breakneck speed.

The first microcomputer or personal computer was developed in 1974 by a small firm in New Mexico that did not long survive. The next year, PC makers in the United States shipped 43,000 machines. By 1995, annual shipments totaled almost 45 million.<sup>5</sup> Dell Computer's expansion was no less striking. During the company's first sixteen years, sales climbed at a compound annual rate of more than 50%.<sup>6</sup> By the end of the twentieth century, Dell had yearly revenues of more than \$18

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Professor Nancy F. Koehn prepared this case based on her book, *Brand New: How Entrepreneurs Earned Consumers' Trust from Wedgwood to Dell* (Harvard Business School Press, 2001). HBS cases are developed solely as the basis for class discussion. Cases are not intended to serve as endorsements, sources of primary data, or illustrations of effective or ineffective management.

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billion and was the fastest-growing major computer maker in the industry.<sup>7</sup> It employed more than 36,000 people in 33 countries and sold to customers in 170 nations.<sup>8</sup>

The U.S. capital markets consistently recognized Dell Computer's successful expansion. During the decade of the 1990s, the company's stock price surged 87,000%, making it the best performing stock on the Standard & Poor's 500.<sup>9</sup> Michael Dell's personal wealth soared with this appreciation. In 1991, at age twenty-six, he was worth \$300 million, ranking 368<sup>th</sup> on the *Forbes* Four Hundred for the United States.<sup>10</sup> Seven years later, his wealth exceeded \$13 billion, and he had become the fourth richest person on the *Forbes* ranking.<sup>11</sup> By the end of the century, Dell had a net worth of more than \$21 billion and was the wealthiest American under the age of 40.<sup>12</sup>

Industry observers and other business leaders credited the company's founder with having revolutionized the PC market. Ford Motor Company CEO Jacques Nassar commented in 1999 that "occasionally, rarely, history is made when a gifted new leader, who has a vision of new processes and technologies, produces a brilliant new business model. Henry Ford did it in automobiles, Michael Dell has done it in PCs."<sup>13</sup>

Like Ford, Michael Dell was fascinated by a new technology. From the time he discovered personal computers as a teenager, he could not keep his hands off them, constantly taking the machines apart and reassembling them to improve their performance. The more he learned about how computers were made and what they could do, the more certain he became that the PC was a revolutionary innovation with wide-ranging applications for business and household consumers. "I knew," Dell said, remembering his initial perspective on the personal computer, "that if you took this tool, previously in the hands of a select few, and made it available to every big business, small business, individual, and student, it could become the most important device of this century."<sup>14</sup> From Dell's first experiences tinkering with computers, he wanted to exploit the technological, industrial, and other supply-side possibilities of the Information Revolution.

But Dell had also recognized from the outset that to achieve sustained success in the young PC industry, he and his company would also have to compete effectively on the demand side of the market. In 1984, he had realized that how a new product such as the PC was presented, sold, and serviced to consumers was very important, and he used this insight to build strong relationships with customers. These connections helped Dell anticipate what consumers wanted and earn their loyalty. By the early twenty-first century, Dell Computer's business model, which was based not only on efficient manufacturing and "mass customization," but also direct connections with buyers, had become the industry standard.<sup>15</sup> Millions of business and home users around the world associated the Dell brand with quality information technology (IT) products, direct sales, customer control, and responsive service and support.

## Evolution of the Personal Computer Industry

The technological foundation of the PC—the microprocessor—was invented in 1969. That year, Marcian E. "Ted" Hoff, an engineer working for the newly formed Intel Corporation in what became known as the Silicon Valley region of California, figured out how to create a silicon chip that would serve as a kind of functional headquarters for small-scale computers. The microprocessor or "computer on a chip" used software instructions to execute a wide range of operations for calculators, computers, and other machines. Because it eliminated the need to build hard-wired circuits for each individual operation, the microchip laid the groundwork for radically decentralized computing capabilities.

The development of the microprocessor also initiated an intense race to install ever more power onto a silicon wafer. Gordon Moore, one of the founders of Intel, predicted that the number of transistors that could be put onto the same size chip would double every year. (He later extended the period to eighteen months).<sup>16</sup> His prediction became known as "Moore's Law," and unlike most such prophecies, it has proven remarkably accurate.<sup>17</sup>

As productivity galloped ahead, the cost of any function that a microchip could perform declined dramatically. Falling computing costs helped focus industry managers, engineers, and others' attention on exploiting the latest and most efficient microprocessing innovations. Declining costs also helped make hundreds of applications practicable that were once prohibitively expensive. In the last quarter of the twentieth century, microprocessing chips that automatically controlled a myriad of operations were incorporated into cars, cash registers, garage door openers, kitchen appliances, and many other products.<sup>18</sup>

The personal computer, of course, was the most important application of microchip technology. In 1974, Ed Roberts, an Albuquerque, New Mexico businessman, developed the first PC. He designed the machine around the latest Intel microprocessor, the 8080, calling his invention the Altair after a star in the Aquila constellation.<sup>19</sup>

The Altair, a bulky box about the size of a case of soda or beer, had no keyboard, monitor, external memory, or printer.<sup>20</sup> Its internal memory was a scanty 256 bytes. (By contrast, most desktop PCs in the late 1990s contained 64 million bytes of memory). Targeted at hobbyists, the Altair sold for \$395 in kit form and \$621 preassembled.<sup>21</sup> To enter programs and data, users flipped switches on the front of the computer. Results appeared as patterns of flashing lights above the switches. Roberts' innovation proved very popular and within a few months, he had a backlog of 4000 orders.<sup>22</sup> Most of these customers were electronic hobbyists and programmers.<sup>23</sup>

A host of start-up companies, many of them based in northern California garages, emerged to produce machines similar to the Altair. Some of these enterprises, like Apple Computer, quickly became major players in the PC industry. Larger, established companies, including Tandy Radio Shack, Commodore, and Atari, also began producing PCs.

The most popular of the early machines, the Apple II, was introduced in 1977. The brainchild of Steve Wozniak, Steve Jobs, and Mike Markkula, it was the first PC to look and feel like a consumer product. Unlike competing machines, the Apple II was aesthetically appealing. Housed in a sleek case of beige plastic, the computer included a full-sized keyboard and supported color graphics as well as text. A small television monitor and floppy disk drive were optional peripherals. Numerous software programs, such as games and word processing, could run on the machine. The Apple II enjoyed tremendous commercial success, opening a market that reached beyond hobbyists to include business customers, initially in primarily engineering-related industries.<sup>24</sup> At the end of 1980, more than 120,000 units had been sold, and Apple had established a leading position in the young PC industry.<sup>25</sup>

Meanwhile, continued improvements in microprocessing capacity enhanced the PC's memory and speed. Such efficiency gains, coupled with the PC's growing popularity, greatly stimulated software production, as hundreds of hobbyists created programs to run on the new machines. Most of the early software inventors were enthusiasts who created computer languages for their own use. Harvard undergraduate Bill Gates and his high school friend Paul Allen, however, saw significant commercial possibilities in manufacturing software.<sup>26</sup> When they first discovered the Altair in 1975, they decided to go into business adapting computer languages for the PC and perhaps other similar machines. Convinced that there was no time to lose in exploiting this window of opportunity, Gates

dropped out of Harvard.<sup>27</sup> Allen quit his job at Honeywell. The two moved to New Mexico and began the business that was later to become Microsoft, in an Albuquerque hotel room.

### *Early Marketing and Distribution*

By early 1980, the worldwide installed base of personal computers totaled almost 610,000 machines, almost two-thirds of which were in the United States.<sup>28</sup> On both the supply and demand sides, the PC market remained a collection of dynamic, but disparate, cottage industries. Hardware and software manufacturers designed their products for one particular computer; virtually every model on the market was incompatible with competing models.<sup>29</sup> In this scattered marketplace, early PC consumers had few industry standards or generally recognized attributes on which to base purchasing decisions. Most relied on word-of-mouth recommendations from colleagues, friends, and salespeople.

Individual manufacturers reached potential customers by advertising in specialty magazines, trade shows, and computer clubs. The Altair and other early PCs were distributed principally by mail order. But as the market expanded, new outlets developed, including retail stores dedicated to personal computers. During the late 1970s and early 1980s, PC retailers multiplied, stimulated partly by manufacturers' interest in distributing their products as efficiently as possible.<sup>30</sup> In 1975, for example, Roberts began to create a network of franchised distributors to sell the Altair.<sup>31</sup> Tandy Radio Shack, which began manufacturing personal computers in 1977, sold PCs through its national chain of electronics stores and its newly created Radio Shack Computer Centers, dedicated PC stores that offered both Tandy products and those of leading manufacturers. The company's sales of computer-related products boomed, climbing from 1.8% of its North American revenues in 1978 to almost 13% in 1980.<sup>32</sup> ComputerLand, a retail franchise operation for PCs started in the late 1970s with the aid of California-based PC manufacturer IMSAI, opened its first store in 1977. Two years later it had more than 100 outlets, four years after that, in 1983, there were almost 460.<sup>33</sup>

By 1980, the PC industry was well established, especially among hobbyists and business users with engineering or computer experience.<sup>34</sup> Over 490,000 units were shipped that year, totaling more than \$1 billion in sales.<sup>35</sup> This was a small market relative to those for mainframes and minicomputers, but it was growing at an annual rate of more than 30%.<sup>36</sup> New and existing companies wanted a piece of the action, and in the early 1980s, Osborne, Kaypro, Xerox, Hewlett-Packard, DEC and Wang in the United States—along with European makers such as Olivetti and Philips, and Japanese manufacturers NEC, Toshiba, and Fujitsu—began producing PCs.<sup>37</sup>

The most important entrant to the PC market, however, was IBM. More than any other single company in the 1980s, IBM transformed the personal computer industry, breaking open the business market for the new machines by making them necessary equipment for a wide range of companies and inadvertently attracting a host of new competitors, such as Dell Computer.

The transformation unfolded quickly. In 1980, an IBM task force was given some 20 months to develop a personal computer and build a national and global marketing organization for it.<sup>38</sup> Pressed for time, the task force decided that IBM would build its PC from components made by outside suppliers rather than developing its own proprietary hardware and applications. The task force also decided to leave the introduction of specific peripherals to third parties, basing the new computer on an open architecture, meaning system specifications would be made public.<sup>39</sup>

IBM contracted with Intel to produce the PC's microprocessor.<sup>40</sup> For the machine's operating system, task force members initially approached Gary Kildall, a Northern California software developer who had designed a popular operating system compatible with Intel-based

microcomputers.<sup>41</sup> After an early meeting with Kildall did not go well, IBM turned to Bill Gates and Paul Allen of Microsoft. Now based in Seattle, the two entrepreneurs had already agreed to supply IBM with a number of programming languages for the PC.<sup>42</sup>

Microsoft did not have an operating system in 1980, and there was no time to develop one from scratch. So Gates purchased the licensing rights to a viable product, QDOS (Quick and Dirty Operating System), from Seattle Computer Products, a local company. He and his Microsoft colleagues then made the system compatible with the PC that IBM was developing, renaming the operating system MS-DOS (Microsoft Disk Operating System).<sup>43</sup> In exchange for supplying IBM with an operating system, Microsoft received a one-time payment of \$80,000.<sup>44</sup> Microsoft, however, maintained control of the software, retaining the right to license it to other companies. Although neither party realized it at the time, this was destined to be one of the most important business deals of the twentieth century.

The IBM PC was officially launched in August 1981, right on schedule. Its base price was \$1,595, which included one floppy drive, 64 kilobytes (K) of random-access memory (RAM), and a monitor. With software applications, a printer, and other peripherals, the entire package cost close to \$3,000. The IBM PC was an extraordinary triumph. In the first full year of production, the company's microcomputing revenues topped \$500 million. Three years later, they had skyrocketed to \$5.5 billion, the fastest recorded revenue growth in industrial history.<sup>45</sup>

IBM's new product created the first truly mass market for the personal computer. U.S. shipments of PCs, mostly IBM or IBM-compatible machines, soared from 760,000 in 1981 to 2.5 million the following year and more than 6 million in 1985.<sup>46</sup> But it was not individual consumers that fed the exploding market.<sup>47</sup> Less than one in six U.S. households owned a PC in 1985.<sup>48</sup> The vast majority of personal computers—about 80%—were purchased by corporate and other business customers. (Exhibit 1).<sup>49</sup>

IBM segregated the customer base for its new product, leveraging its powerful brand, sales force, service organization, and established customer relationships to sell PCs to large corporate clients and relying on retailers such as Sears and ComputerLand to distribute the product to small and medium-sized businesses. To promote its PC to these latter customers, IBM ran a massive print and television advertising campaign featuring a Charlie-Chaplin-like tramp who used the PC to solve business problems.<sup>50</sup>

This two-pronged marketing strategy proved effective both in legitimizing the personal computer in the minds of data-processing managers and in accommodating the scattered small business customer base that generated average purchases insufficient to support the cost of the company's sales force.<sup>51</sup> IBM's effort to build a large market for PCs among smaller companies was extremely successful, exceeding all expectations.<sup>52</sup>

The success of the IBM PC created a tremendous opportunity. In the early and mid-1980s, hundreds of companies, mainly start-ups such as Compaq, Dell, and AST, began to build IBM-compatible machines (also termed "clones") using IBM's open architecture as their blueprint and buying Intel chips and Microsoft's operating system. At the same time, countless software engineers and amateurs hurried to develop applications for IBM-compatible machines. As the market exploded in the 1980s, common standards emerged for software and hardware. By 1985, most PC-related development and production efforts were aimed at IBM-compatible PCs. (Apple Computer, which kept both its hardware and software proprietary, remained an important exception.)

Without Big Blue's corporate overhead and sales costs, most of these companies, or "clones" as they came to be called, could undersell IBM. Price and, thus, manufacturing costs rapidly became the

most important drivers of competition among clone makers. It was fierce rivalry, driven principally by supply-side factors, and price wars erupted frequently. In this environment, few companies earned consistent profits. Atari and Texas Instruments, for example, each lost tens of millions of dollars trying to produce low-cost computers for home users, and in 1983, Texas Instruments announced that it would exit the business.<sup>53</sup> Even Apple saw its early leadership erode, despite a vigorous advertising campaign and the 1984 introduction of the superb Macintosh computer. In 1982, Apple's market share was 22%; two years later, it had fallen to 11%.<sup>54</sup>

This was the stage on which Michael Dell chose to make his debut. The intensity of the competition in the personal computer industry did not intimidate him, even as a college freshman. Nor did IBM's size or remarkable success with the PC. Dell believed that he could capitalize on the company's triumph by assembling IBM-compatible computers and providing consumers better service, more choice, and a superior buying experience than was currently available.

## Dell's Beginnings

Michael was born in Houston on February 23, 1965, the second of three sons of Alexander and Lorraine Dell. Alexander, an orthodontist, and Lorraine, a stockbroker, had met and married in Brooklyn, New York, before moving to Houston in the early 1960s.

The Dell household was a lively one, filled with the activities of three smart boys. Michael and his two brothers, Steven and Adam, competed at ping-pong and other sports. When the games grew rowdy, Alexander Dell would admonish his sons to play civilly together. Then, he would take each child aside and say, "But win."<sup>55</sup> Family dinner table discussions centered on economic subjects, such as the Federal Reserve's policies, the oil crisis, inflation, and promising stocks. "In our household," Michael Dell explained, "you couldn't help being aware of commercial opportunities."<sup>56</sup>

By the time Michael was age 9, he had a checking account. At age 12, he became interested in stamp collecting, taking a job as a bus boy in a nearby Chinese restaurant to finance his purchases. Rather than buy stamps from retail dealers, who earned a fee, Michael decided to create his own small business buying and selling. "Then I could learn even more about stamps," he remembered, "and collect a commission in the process."<sup>57</sup> He obtained a reseller's license and lobbied neighbors to consign stamps from their collections to him.<sup>58</sup> Michael then advertised "Dell's Stamps" in a national trade journal, typing and mailing out a twelve-page catalogue to support the ad. "Much to my surprise, I made \$2,000," he said. "And I learned an early powerful lesson about the rewards of eliminating the middleman."<sup>59</sup>

At age 16, he took a part-time job as assistant subscription coordinator for the *Houston Post*. The position involved cold-calling names from listings provided by the telephone company. Michael quickly realized that two groups of people were especially interested in buying a newspaper subscription: newlyweds and those who had recently moved into a new residence. In his first effort at customer segmentation, Michael devised ways of reaching these groups, hiring friends to collect names and addresses of couples who had recently applied for a marriage license. The teenagers also obtained lists of applicants from specialized home mortgage companies. Michael contacted those with the highest mortgages first, using his Apple II computer to write each customer a personalized letter and offer them a newspaper subscription. Subscriptions came in by the thousands.<sup>60</sup> By the time he was 17, Michael had become the *Post's* top salesman, earning commissions of \$18,000 in a single year.<sup>61</sup>

### *Dell's Passion for Computers*

Michael had bought his first electronic calculator at age seven, “fascinated by the idea of a machine that could compute things.”<sup>62</sup> As he grew older, computers absorbed more and more of his attention. He constantly sought opportunities to learn how they worked and what they could do. When his junior high school installed its first teletype terminal, Michael was hooked. “If you stayed after school,” he recalled, “you could play around with it and write programs or input equations and get back answers. It was the most amazing thing I’d ever seen.”<sup>63</sup>

His computer interests expanded. In high school, Michael worked as a student assistant to the principal, writing administrative programs to track student absences and plan school budgets.<sup>64</sup> He logged long hours on the school’s mainframe terminals.<sup>65</sup> After classes and on weekends, he went to a local Radio Shack to use the PCs there. Michael also devoured computer magazines and became fascinated by the electronic architecture of the Apple II and other popular machines. He begged his parents to let him have his own PC, and for his fifteenth birthday, they consented. As soon as he got his hands on the new, expensive Apple II, he took it apart to see how it was made. His parents were furious.<sup>66</sup>

A short time after Michael had acquired his Apple II, IBM introduced its PC. The teenager was immediately struck by the new computer’s commercial possibilities and soon switched machines. “While the Apple had lots of games,” he said, “at the time, the IBM was more powerful. It had software and programs for business usage, and although I didn’t have a lot of business experience, I had enough to know that this PC was going to be *the* choice for business in the future.”<sup>67</sup>

In June 1982, unbeknownst to his parents, Michael skipped school for several days to attend a national computer conference that was being held in the Houston Astrodome. For the first time, the sixteen-year-old got a real sense of the burgeoning PC industry. The conference opened his eyes to a world of component makers, PC manufacturers, related equipment suppliers, and distributors. The conference intensified his interest in understanding the economics of making and selling PCs, and Michael set up a computerized bulletin board—a forerunner of email—to exchange notes with others interested in the business.

At the same time, he began purchasing components and peripherals, such as memory, disk drives, and monitors, to improve his own PC’s performance. Then he began to buy and improve used machines. “I would enhance a PC the way another guy would soup up a car, and then I would sell it for a profit and do it again,” Michael Dell explained.<sup>68</sup>

Although enrolled at the University of Texas at Austin in the fall of 1983, Dell devoted less time and energy to his premed classes than to computers. Working from his dorm room, he continued to upgrade IBM PCs, buying machines from local dealers with excess inventory and enhancing their performance before selling them to Austin business people at 10 to 15% below retail.<sup>69</sup>

Supply was not a problem as rapidly escalating demand for IBM PCs occasioned inefficiencies in the distribution system that often left retailers with too many or too few machines. Monthly quotas imposed by IBM frequently exceeded what retailers could sell.<sup>70</sup> The reverse was also the case. “A dealer,” Dell explained, “would order 100 computers and receive only 10. So the next time, to get what he wanted, he would order 1,000. Maybe then he’d get 633, when he’d needed only 100.”<sup>71</sup> Retail dealers often bought more PCs than they needed in order to qualify for discounts on large orders.

A “gray market” outside the established channels quickly developed to sell machines that dealers were left with. Rather than carry excess inventories, distributors sold extra PCs at a reduced markup

over wholesale to small resellers such as Dell. This tactic, explained an authorized IBM dealer, allowed an individual distributor to “show IBM that he was a ‘high volume seller’” and entitled to “favorable treatment from the company when, in fact, he was a major conduit for the gray market.”<sup>72</sup> These informal outlets fueled the industry’s expansion. “There was no discipline at all in the marketplace,” the IBM dealer stated, “and so the gray market in the machines just took off.”<sup>73</sup> Michael Dell was one of many aspiring entrepreneurs operating in this dynamic shadow market.

The PC industry was too young in the early 1980s to have generated extensive market research. What little evidence there was indicated that price mattered a great deal to potential consumers. Two-thirds of business buyers and 61% of home users polled in 1981 rated price as the most important criterion in selecting a personal computer. Ease of expansion, programming possibilities, and reliability were among other relevant considerations.<sup>74</sup>

Dell had little access to consumer survey research, which was too costly for any but the largest manufacturers to afford. But he had considerable firsthand experience with computers and their users. His years of informally studying the industry revealed several important business opportunities.

Some of these related to the price of PCs. Dell figured out, for example, that although an IBM PC typically retailed for about \$3,000, its components—which were not proprietary to IBM—wholesaled for approximately \$600 or \$700. This meant that retailers typically paid \$2,000 for an IBM machine and marked it up about \$1,000, a figure that Dell considered unreasonably high, given the limited functions retailers were performing.<sup>75</sup> He believed that retailers could and should be answering consumers’ questions and allaying their anxieties about PCs, demonstrating how the complicated new product operated, and feeding back to manufacturers valuable information about consumer priorities, complaints, and reactions that could be incorporated in production, marketing, and other supply-side decisions.<sup>76</sup>

But as the 18-year-old Dell saw it in 1983, PC distributors were falling far short of their potential. Most offered PC consumers little or no product support. “The people operating the computer stores didn’t even know much about PCs,” he recalled. “For the most part, they had previously sold stereos or cars and thought that computers represented the next ‘big ticket’ fad, so they figured, ‘Why not?’”<sup>77</sup>

Meanwhile, the rapid proliferation of these new products posed numerous problems for users. In the early 1980s, few secretaries and administrative assistants knew how to set up a personal computer. Few business managers understood what “system error” and other messages flashing across their PC monitors meant, and few medium-sized and virtually no small companies had an information technology (IT) department with a dedicated help desk.

Not only business consumers, but distributors as well, were openly clamoring for help. In the months after introducing its PC, IBM received thousands of calls on toll-free lines that it had installed for quality complaints. Most callers were not trying to resolve quality problems, but rather obtain operating information or technical support that retailers were not providing.<sup>78</sup> Frustrated dealers themselves contacted IBM to learn how to respond to the queries they were receiving from end-users. The situation was even worse with companies that made IBM-compatible machines. Competing principally on price, most of the clones generally offered little or no customer support.

In the emerging chaos, Dell perceived another important opportunity related to how PCs were sold. He became convinced that many business consumers cared about more than price and computing power. They also wanted, he believed, knowledgeable, responsive service, after-sales support, and some say in how their machines were configured. But in 1983, few manufacturers or retailers were providing these benefits, particularly to small and medium-sized companies. Dell’s

informal, one-person PC assembly shop was a striking exception. Working from his dorm room, the college freshman was providing more computing capabilities, operating information, customer support, and control, often at a lower price, than most established retailers in the Austin area, and he had more orders than he could handle. An expanded operation, he speculated, might compete with larger distributors. A PC business organized around direct sales, product support, and consumer input could fill a significant gap in the market. This turned out to be the *key* business vision of Dell's career.

Dell initially targeted experienced users in small and medium-sized businesses such as legal and medical offices, banks, manufacturing operations, and government agencies. Most of these consumers, he found, understood the power of the emerging standard for personal computers, wanted higher performance at less cost than they could get from PCs available through IBM-authorized dealers, and frequently desired some control over the configuration of their machines. He also realized that these users valued informed, responsive service, yet required less information and product support than most first-time buyers. Dell believed that this consumer segment was underserved by most PC makers and distributors.

## Getting Started

In the fall of 1983, Dell began approaching potential customers. He acquired a vendor's license, which enabled him to bid on computing contracts for the state of Texas, and subsequently landed several government orders. He also placed ads in local newspapers and sold door-to-door at Austin law offices and other small businesses.<sup>79</sup> As word of Dell's enterprise spread, sales escalated. By early 1984 Dell was selling \$50,000 to \$80,000 a month in upgraded PCs and components.<sup>80</sup>

Michael's parents grew increasingly worried that he was neglecting his academic work for business interests. In the fall, Alexander and Lorraine Dell flew to Austin for a surprise visit to their son, calling him from the airport. Michael barely had time to hide the computers in his roommate's shower before they arrived.<sup>81</sup> Arguments erupted between the son and his parents. During one of their discussions, Alexander Dell asked Michael what he wanted to do with his life. "I want to compete with IBM!" the son replied. As Michael remembered it, his father "was not amused."<sup>82</sup>

## On His Own

Over his parents' objections, Dell moved his operation into a two-bedroom condominium. In January 1984, he registered the name PC's Limited with the State of Texas and, four months later, incorporated the company as Dell Computer Corporation with an initial investment of \$1,000. After hiring several people to take and fill phone orders, he moved his operation again—this time to a 1,000-square-foot office. In May 1984, Dell decided to devote all his energies to his growing business. The decision to leave school was not an easy one, and he arranged to take a leave of absence from the university. "Where I come from," he recalled, "not going to college is not an acceptable option. Convincing my parents to allow me to leave school would have been impossible. So I just went ahead and did it, whatever the consequences. I finished my freshman year and left. After a while, my parents forgave me. A little bit after that, I forgave them, too."<sup>83</sup>

By the summer of 1984, monthly sales of Dell's upgraded IBM PCs had reached \$180,000 and continued to rise at dizzying speeds.<sup>84</sup> The company moved three times between June and late December 1984, outgrowing not only its headquarters, but its phone system, electronics

infrastructure, and organizational design. By early 1985, the young company employed more than 50 people. In its first full year, Dell Computer Corporation earned revenues of \$6 million.<sup>85</sup>

Like most entrepreneurs running a new venture, Dell had his hands in everything: working the phone lines, planning product features, managing finances, and hiring employees. He logged 18-hour days, often sleeping on a cot in the office.<sup>86</sup> Mundane operating issues followed hard on the heels of broader strategic and organizational problems. What time should the office open? How should phone orders be taken, compiled, and relayed to employees assembling PCs?<sup>87</sup> By what criteria should the organization evaluate prospective and existing workers? How much inventory was needed when sales were doubling monthly? Who were the most important competitors and what were they doing?

Much of what Dell and his colleagues accomplished early on was a result of learning by doing, of inventing solutions to problems as they occurred and trying not to make the same mistake twice. Rapid growth meant constant change—in staff, financial management, supplier agreements, office infrastructure, and operating policies. Dell remembered how he and his first employees approached issues related to upgrading and, later, manufacturing PCs:

We'd say "What's the best way to do this?" and come up with an answer. The resulting process would work for a while, then it would stop working and we'd have to adjust it and try something else. For example, we had started by writing orders by hand and pinning them up on a clothesline. After a while it became clear that this system couldn't handle the volume of orders coming in. So we hired a guy to write an order-entry program. But because our computers weren't networked, the salespeople would enter orders on their PCs and I would go around collecting the orders on diskettes and compile all of them into an order database. The whole thing was one big experiment.<sup>88</sup>

### *A New Model*

Although he had gotten started in the PC business by upgrading IBM machines, in 1985 Dell decided that his company should make, market, and distribute its own brand of IBM-compatible machines. In July, the company's Turbo PC appeared under the PC's Limited name. Base price was \$795, less than half the price of IBM's PC.<sup>89</sup> Two months later, the firm introduced its first product based on the leading-edge technology at the time, Intel's 286 microprocessor.<sup>90</sup> New models followed in April and August of 1986.<sup>91</sup> Priced aggressively below IBM personal computers and other compatibles, each new line outsold the previous one.<sup>92</sup> At the close of the 1985 business year, Dell sales topped \$30 million.<sup>93</sup>

Making his own products eliminated Dell's dependence on PC distributors for supplies of stripped-down machines to meet growing demand. Manufacturing his own machines also increased control over product development and manufacturing, enabling Dell to better exploit the rapidly expanding capabilities and declining costs of computing technology. The decision helped the young company communicate with consumers more effectively by exploiting its direct sales model. For several years, Michael Dell had been skeptical of PC retailers' ability to meet customer's changing needs for a new product. Most third-party sellers, he believed, were not well informed about the PCs they distributed. Many were also unsuccessful in relaying consumers' priorities back to manufacturers. This indirect channel, according to Dell, "was based on a marriage of the unknowing buyer and the unknowledgeable seller." As the PC market developed and users grew more familiar and demanding with the technology, Dell was certain that such a "marriage could not last."<sup>94</sup>

Producing his own machines also afforded Dell a means to differentiate his company's offerings from those of other clone makers. In 1985, hundreds of companies were making IBM-compatible machines. Most were small start-ups, but a few were enjoying tremendous success simply by undercutting IBM's prices.<sup>95</sup> Prominent among these was Compaq Computer. Within three years of its founding in 1982, the Houston-based company's annual sales topped \$500 million, earning it a place in the *Fortune* 500.<sup>96</sup>

Compaq sold its products through third-party distribution networks. Developed by a former IBM executive, the company's retail strategy relied on outlets such as ComputerLand and Sears, many of which were already selling IBM PCs, but willing to add Compaq products because of their slightly higher profit margins. Compaq, moreover, had no direct sales force to compete with retailers' stores and its promised steady stream of inventory would be a welcome respite from IBM's frequent supply problems.<sup>97</sup>

Although he viewed Compaq's rapid growth as evidence that a huge market existed for high-performance IBM-compatible machines, Dell was unimpressed with Compaq's strategy for putting its products in front of consumers. Selling through independent dealers forced Compaq to share retail space and salespeople with some of its strongest competitors and prevented it from ensuring that third-party representatives thoroughly understood its products and their distinctive attributes. More important, it was an impediment to tailoring product development, manufacturing, marketing, and distribution efforts to consumers' changing preferences.

In the mid-1980s, Dell began to formalize a different business model based on *personal* interaction with consumers. Individual customers typically placed orders via toll-free calls. Institutional consumers were initially cold-called by Dell sales representatives trained to work with particular customer segments. Order information was relayed to the company's nearby factory, which assembled computers according to customer specifications. Completed orders were shipped directly to customers within one to three weeks.<sup>98</sup>

Dell's "made-to-order" sales and manufacturing model grew out of its founder's insights into the demand side of the personal computer market. But it yielded important supply-side benefits as well. By eliminating third-party salespeople (and their customarily high retail margins), Dell's company's could reduce its distribution costs substantially below those of its rivals. Many of these savings were passed onto customers, enabling Dell Computer to profitably undersell IBM and others. In 1986, for example, a line of Dell's personal computers based on the 286 microprocessor chip sold for between \$2,500 and \$3,900. Comparable machines from IBM were priced between \$4,600 and \$5,800; those from Compaq between \$4,300 and \$5,000.<sup>99</sup>

The direct model also incurred lower inventory costs. Because it built computers *after* customers ordered them, Dell Computer carried almost no inventory of finished machines. PC makers such as IBM and Compaq had to maintain substantial product inventories to stock reseller and retail channels. Building to consumer order, rather than to demand forecasts, also kept Dell's materials inventories relatively low, a boon in an industry characterized by rapid technological innovation. "Component prices," Dell explained:

are always falling as suppliers introduce faster chips, bigger disk drives, and modems with ever-greater bandwidth. Let's say Dell has eight days of inventory. Compare that to an indirect competitor who has twenty-five days of inventory with another thirty in their distribution channel. That's a difference of forty-seven days, and in forty-seven days the cost of materials will decline about 6%.<sup>100</sup>

In its broad outlines, Dell's model of direct selling was not entirely new. Corporate sales forces such as IBM's, had long dealt face-to-face with institutional customers and consumer products companies such as Fuller Brush and Avon Cosmetics employed door-to-door salespeople to market goods to individuals. Dell's model was perhaps most akin to mail-order or catalogue distribution. By eliminating wholesalers and other related costs, catalogue retailers such as L. L. Bean and Spiegel had realized economies similar to those enjoyed by Dell. But none of these other companies were positioned to offer products "made to order" for individual customers, as Dell was able to do.

Dell was not the only PC maker to harness the possibilities of direct selling by phone and mail. In the mid-1980s, a score of clones such as TIPC Network (later renamed Gateway) distributed IBM-compatible machines by mail order. But virtually all of these players competed solely on price. Only a handful offered reliable service or support and even fewer manufactured computers to customer specifications. None invested the resources Dell did to build strong connections with, and understand the priorities and earn the trust of, consumers.

## Building the Brand and Organization

Dell Computer's sales increased rapidly in the mid-1980s, climbing from \$6 million in fiscal 1985 to \$70 million two years later.<sup>101</sup> Even as its market presence expanded, industry experts were openly skeptical of its strategy. Some argued that businesses and individual consumers would not continue to buy costly new products they could not see from a manufacturer they did not know; others alluded to the dubious public reputation of other direct sellers. "Most mail-order houses," wrote one industry reporter in 1987, "were fly-by-night outfits of marginal reputation that imported cheap PC clones from the Far East and resold them at bargain basement prices."<sup>102</sup> Still others criticized Dell's underlying business model, asserting that direct marketing to PC users would devolve into a price war in which profit margins for manufacturers, and in some cases distributors, would be competed away.

Michael Dell's response to these challenges was to build a powerful brand based on high-quality machines and outstanding service. He did not have many compelling examples to follow. Only a handful of computer companies such as IBM, Hewlett-Packard, and Apple had earned widespread consumer recognition and trust for their brands. Both IBM and Hewlett-Packard enjoyed the benefits of longstanding reputations and customer relationships that predated the personal computer. Apple, although a relatively young company, had invested heavily in forging a strong brand based on user accessibility, elegant design, and the creative possibilities of technology. Its name, logo, and products were well known to both business and home consumers.<sup>103</sup>

But most other PC makers in the mid-1980s had not succeeded in establishing a meaningful name, symbol, or identity that consistently differentiated their offerings and commanded buyer loyalty. Major IBM clone makers, such as Compaq and Epson, and large mail-order firms, such as Northgate and Compuadd, based their marketing appeals primarily on cost, pricing their products higher than those of smaller PC makers, but lower than those of IBM and Apple.<sup>104</sup>

Some of the clones emphasized specific functional attributes such as processing speed. "Megahertz wars" broke out often as individual manufacturers scrambled to offer the fastest machine. In 1987, for example, many clones produced machines that ran at 8, 10, 12, and even 16 megahertz (millions of operations per second). Compaq, Leading Edge, and other producers also advertised their dealer networks and product support. But price remained the overriding emphasis of IBM-clone makers.<sup>105</sup>

Dell, however, believed that consumers wanted more than good technical performance at low prices. He was convinced that buyers wanted a satisfying buying experience with informed, helpful sales people and effective product support and service after the sale. He suspected that buyers also desired a strong voice in configuring their computers and peripheral equipment. All of these, Dell reasoned, would only grow more important as the market matured and consumers' familiarity with PCs increased. He intended to develop an appealing brand that customers would associate with current technology, customer control, and responsive service.<sup>106</sup> "I'd much rather design the winning system to sell and support customers," he insisted, "than design an incredibly technically proficient microprocessor that nobody wants to buy. I mean, that's the problem with our industry: There are a lot of technologists who will create wonderful things and then go try to find people who want to buy them. We started with the customer and then worked our way back."<sup>107</sup>

### *Segmenting the Market*

Dell's strategy was neither easy to implement nor inexpensive. Training sales representatives, offering effective customer service and support, and configuring machines to buyer specifications increased operating costs and, potentially, PC prices. Dell's solution to creating a distinctive brand *and* manufacturing personal PCs that rivaled other IBM-compatibles in price was to segment the market.

This was hardly new territory for Dell, who, at age sixteen, had enjoyed considerable success identifying specific newspaper customers. Several years later working in the young PC market, Dell based his segmentation strategy on potential consumers' familiarity with PC technology rather than on their address, marital status, income, or other frequently used criteria. He decided to focus the company's strategic efforts directly on knowledgeable users—people, who, like Dell, envisioned a growing number of applications for the PC, who desired a say in configuring the machines they bought, and who wanted to work with expert salespeople and responsive service technicians.

Dell Computer began introducing products, services, and other brand attributes that appealed specifically to these users. Most of them were men who enjoyed keeping tabs on practical hi-tech developments—pragmatic individuals who read computer magazines and tended to be interested in superior PC performance.<sup>108</sup> This segment's understanding of and facility with new technologies made these customers an influential source of information for additional purchasers. Colleagues, family members, and friends often took their high-tech cues from such knowledgeable people, watching what they bought and asking their advice.<sup>109</sup>

Also represented in this customer segment were managers in small and medium-sized companies. Too small to be served by the likes of IBM's sales force, most of these firms bought PCs from third-party retailers or value-added resellers (VARs), that typically offered little in the way of sales information, service, or specialized configurations. But these kinds of benefits, Dell reasoned, could be provided to targeted users on a cost-effective basis. Telephone ordering, for example, was ideally suited to knowledgeable business customers who did not require hands-on product demonstrations or extensive explanations and tended to have fewer product questions than less experienced users.

To serve this segment, Dell Computer hired and trained a growing sales force. For the company's first three years, sales personnel worked primarily off toll-free telephone lines, making cold calls to, taking orders from, and answering questions for potential business customers, initially in Texas and the Southwest and later around the country. By 1987, the telemarketing group was fielding more than 1,700 calls a day from around the country.<sup>110</sup> A 30-day money-back guarantee was offered to allay consumer fears about buying a PC sight unseen. Dell also offered a one-year limited warranty with

free on-site repair and support for customers within 100 miles of designated service providers such as Honeywell Bull, which had 160 locations in the United States.<sup>111</sup>

Dell also established toll-free technical support lines and a 24-hour number for questions and comments. Any customer who dialed the support line and had to wait more than five minutes for a technician was mailed a check for \$25.<sup>112</sup> Based in the company's Austin headquarters, the seventy-five technicians who staffed the phone lines were generally assigned to particular consumer groups and trained to handle inquiries about specific products. Dell representatives used a computerized database to track the service history of each machine mentioned during a call.<sup>113</sup> Approximately 90% of queries and problems were handled to customers' satisfaction in a single telephone conversation.<sup>114</sup> Dell also guaranteed 48-hour shipment of replacement parts and, in early 1987, began offering customers the option of purchasing a service agreement with Honeywell Bull (priced at \$35 a year), which repaired machines on site.<sup>115</sup>

Since his early days upgrading computers Michael Dell had relied on word-of-mouth and newspaper ads to interest potential consumers. When his company began to produce its own machines the founder invested more heavily in print advertising, primarily in computer magazines and other trade publications read by knowledgeable users, to promote not only the company's products, but also its service, support, and warranty terms.<sup>116</sup> Dell's advertising expenses totaled approximately \$3 million—about 4% of sales—in 1987.<sup>117</sup>

Dell and his colleagues also ensured that analysts for *PC Week*, *Computerworld*, *Byte*, *Infoworld*, and other special interest magazines had access to the company's products. This tactic, too, paid off, and by the late 1980s, computer magazines were giving Dell products high marks for quality, performance, power, service, and support.<sup>118</sup>

These endorsements, as Dell had planned, translated into increased consumer interest and sales. For example, *PC Week's* rave review of Dell's first IBM-compatible machine, the Turbo, appeared shortly after the product was introduced in the summer of 1985. Almost immediately the company began selling more than 1,000 Turbo machines per month.<sup>119</sup> Continued praise from industry publications attracted still more consumers, as did the company's participation in computer trade shows and conferences. Dell's fiscal year 1986 sales of approximately \$60 million were double those of 1985 (**Exhibit 2**).<sup>120</sup> About 40% of 1986 sales were to small and medium-sized businesses, a third to larger companies such as Dow Chemical and Price Waterhouse, and the remainder to government and educational users and individual consumers.<sup>121</sup>

### *Listening to Customers*

As sales climbed, Dell's direct relationship with customers provided important demand-side intelligence that affected a host of strategic and operating decisions.<sup>122</sup> Human resource executives and department heads based staffing plans and production levels partly on market estimates gathered through thousands of daily customer interactions. Purchasing managers used these same estimates when ordering from suppliers to reduce inventory costs.

Sales and marketing executives used customer information to evaluate evolving consumer preferences and measured response rates from newspaper ads, catalogues, and other communication initiatives. Equally important, sales representatives relied on customers' order histories to help configure new purchases.<sup>123</sup> Because the sales division had access to buyers' previous purchases, explained Hershel Hochman, vice president of manufacturing in the late 1980s, "we can determine what equipment they already have and their complete repair history. This gives us the opportunity to ensure that customers are ordering equipment appropriate for their needs. You have a sort of

inventory control that you never have on the retail level. You can save yourself a bundle. . . [by not] building machines and buying parts nobody wants or needs.”<sup>124</sup>

Consumer feedback also influenced research and product development directives, helping Dell Computer tailor its product innovation efforts and actual offerings to changing industry conditions. In 1987, for example, Dell decided not to invest in IBM’s Personal System/2 (PS/2) technology. Most business customers had been unenthusiastic about the PS/2 line. It was expensive relative to other PCs; it was slower than other machines; and it was incompatible with some existing components and peripheral equipment. Relying on its own market information, Dell Computer chose instead to expand and upgrade its own line of PCs based on Intel’s existing 286 and 386 microprocessors. In 1988, a consortium of clone makers led by Compaq developed an alternative data highway for IBM-compatible machines. The new design proved not only to be more efficient than the one in the PS/2 line, but also to be compatible with the installed base of clone PCs. The design quickly became the industry standard, and Dell produced several successful lines of computers based on it.<sup>125</sup>

Dell’s management also used customer information from the technical support phones to remedy defects in individual customers’ equipment and to rapidly improve Dell’s overall product line. In responding to calls, technicians logged customer complaints into a database. If an individual customer called the support hot line again, a Dell technician could instantly call up a record of the consumer’s previous difficulties. Executives and engineers then used all of this accumulated information to improve computer assembly. When “we get more than a few complaints,” commented a Dell marketing manager in the late 1980s, “I go about 130 feet to the people who design the thing. Within five or six hours, engineering has fixed the design, and within two or three days, the factory’s got that change incorporated on the line.”<sup>126</sup>

Consumer feedback also helped Dell’s manufacturing managers evaluate suppliers and subcontractors. If, for example, a significant number of machines purchased by an institutional customer exhibited a particular problem, Dell engineers not only tried to solve the problem, but also alerted the vendor of the offending part.<sup>127</sup>

### *Recruiting Leadership*

By 1987, Dell’s business had come a long way very quickly. Annual sales that fiscal year totaled \$70 million, an elevenfold increase from the company’s first-year sales. Net income had climbed to \$2.1 million in fiscal 1987 from \$32,000 in fiscal 1985—a 6,500% increase.<sup>128</sup>

An enormous expansion in company infrastructure and output underlay this financial performance. Within six months of its opening in late 1986, an 82,000-square-foot factory in north Austin was turning out 7,000 machines a month, each built to a customer’s specifications. By 1987, the company employed more than 350 people in marketing and distribution, service and support, research and development, and manufacturing.<sup>129</sup>

Private debt and retained earnings had funded the company’s early growth. Michael Dell’s family had lent the firm \$500,000 to finance its initial operations—a loan that the company repaid by the end of 1986.<sup>130</sup> The business also took out bank loans, including a \$10 million credit line.<sup>131</sup> A private equity placement was completed in 1987 in the wake of the October stock market crash. But investors were enthusiastic, and the firm raised more than \$21 million.<sup>132</sup> As sales and net income grew in the late 1980s, the company increasingly relied on retained earnings to finance growth.

The young enterprise also conserved resources. With money often tight, employees improvised a range of cost-saving measures. When space was in short supply during the company’s early years of

rapid growth, employees often shared cubicles; when the factory had more orders than its staff could fill, engineers helped assemble machines; and when phone orders backed up, staff from all over the company pitched in to answer calls. "Our sales people would stuff RAM chips into tubes to ship to customers," Dell recalled, "even while they were taking more orders on the phone."<sup>133</sup>

Although Michael Dell had overseen his company's initial expansion, he soon realized that he needed seasoned executive talent. In 1986, he recruited forty-four-year-old Lee Walker, an Austin investment banker and venture capitalist, to join the business as second in command with the title of president and chief operating officer. (Michael became chairman and CEO). One of Walker's first accomplishments was to secure badly needed bank credit. He also recruited several of the nation's prominent executives to Dell's board of directors, including George Kozmetsky, a cofounder of Teledyne, and Robert "Bobby" Inman, former head of the CIA and CEO of Westmark, a private defense company. Both men brought a wealth of experience and important contacts to Dell Computer.<sup>134</sup> Walker also instituted stronger financial controls, restructured lines of managerial responsibility, and reorganized the company's senior staff, demoting some managers and firing others.

It could not have been easy for Michael Dell to relinquish as much control as he did to Lee Walker. It must have been especially hard to watch a newcomer fire people whom Dell himself had once hired and promoted. But he recognized the value of Walker's experience and perspective and stood firmly behind the new president's actions, knowing that "this had to be done for the company's future."<sup>135</sup> During the next several years, he and Walker recruited executives from Prudential Insurance, Standard Oil of Ohio, and other companies. Some of these new leaders, such as Graham Beachum, who had worked at Tandy and IBM before joining Dell as senior vice president of marketing, and Glen Henry, who left IBM to head Dell's product development division, entered the organization at top management. Others, like Morton Meyerson, former president of Electronic Data Systems, signed on as advisers. Dell Computer's hiring at all levels expanded very rapidly (**Exhibit 3**).

Although nearly twice Dell's age, Walker enjoyed working with the company's founder. "People might think the age difference would work against us," he reflected, "but Michael and I discovered that just the opposite is true. We end up completing each other's sentences." For Dell, the relationship was important on several levels. It freed him from direct responsibility for daily operations, allowing him to concentrate on broad strategic issues. Walker also acted as an invaluable sounding board for Dell's business ideas, working with him to help develop the most promising ones and discard the rest. In his role as adviser and confidante, Walker tempered some of Dell's brashness. "Lee helped me get around the potholes," Dell recalled. "Sometimes he was my father; sometimes he was my brother. We were very, very close."<sup>136</sup>

## Expanding the Market

Both Dell and Walker were committed to a strategy of rapid expansion. Although Dell Computer was expected to sell 84,000 machines in 1987, earning revenues of more than \$100 million, it was not yet one of the top 10 PC makers. In terms of total sales, Dell had only about 1% of the personal computer market. Zenith had about 4.4%, Olivetti 5%, Compaq 5.2%, Apple 8.7%, and IBM almost 30%.<sup>137</sup> But Dell was emerging as a recognized player in the industry. Building on widespread media praise for the performance and reliability of its products and after-sales service and support, Dell's senior managers made two important decisions.

### *Targeting Large Corporations*

First, they enlarged the company's field of target customers to include Fortune 2,000 and other large corporations. In 1987, Dell already had some big accounts, such as Dow Chemical and Arthur Andersen. These companies had been attracted initially by Dell's customization capabilities as well as its competitive pricing.<sup>138</sup> But the bulk of its revenues still came from small and medium-sized companies.

Dell executives appreciated the advantages of selling to large institutions. Corporate customers often bought 50 or more computers at a time, creating potential economies of scale in marketing and support. These large customers also upgraded their information technology systems more frequently than household and small business buyers, opening the door to the possibility of repeat sales with relatively high payoffs. Big companies and government agencies also often purchased computer-related products such as modems, disk drives, printers, and software packages, which tended to have high profit margins and low distribution costs. Successful relationships with greater numbers of Fortune 2,000 customers, moreover, would eventually make Dell a safer choice for chief information officers, an advantage exploited by IBM and its powerful brand for decades.

In targeting large institutions, Dell Computer was effectively taking on acknowledged industry leader IBM, which had built its strategy, brand, and organization on selling to the large institutional market.<sup>139</sup> Since introducing the PC in 1981, IBM's share of the office personal computer market had climbed to nearly 40%.<sup>140</sup> But this did not dissuade Dell, Walker and their colleagues. Michael had long wanted to beat IBM at its own game at least in the PC market, and he was optimistic about his chances. He had predicted that as the young PC market matured, the number of sophisticated corporate buyers would grow. These customers, in turn, would be receptive to reliable, high-performance machines configured to user specifications, well supported, and priced below comparable IBM products.<sup>141</sup>

Dell and his senior executives planned to pursue both established and newer routes to large institutional consumers. Proven methods included supplementing print ads in computer magazines with direct-mail initiatives that targeted administrators and purchasing agents in specific organizations. Dell also planned to assemble a team of initially about 25 people to specialize in direct sales to major customers. These sales representatives would call potential corporate customers by phone from their homes, a practice Dell senior management had concluded would be much less expensive than supporting a traditional sales force in the field.<sup>142</sup> Even using such cost-saving measures, getting Dell products in front of large institutional buyers would be an expensive proposition. In addition to hiring and training a larger sales group, Dell had to augment its on-site service and product-support efforts.

Dell also had to convince large corporations that purchasing computers through the mail was as safe as buying them from an IBM representative or authorized dealer. Toward this end, Dell sales people were trained to provide an abundance of relevant information to prospective customers. Each representative was required to complete a five-week program covering a range of subjects from the latest PC technology to Dell product lines. As they advanced in the organization, sales reps received additional training in specific skills such as creating new sales territories and handling large accounts.<sup>143</sup> Dell sales people were also expected to participate in a variety of hands-on exercises designed to enhance their customer service skills. They were required, for example, to unpack their own PCs from cartons and set their machines up. Most sales people, Dell speculated, "probably didn't enjoy it, but it gave them and us a real sense of what the uneducated customer would go through to set up his system and it helped them develop a more intimate understanding of the products they were selling."<sup>144</sup>

Sales representatives were also expected to encourage corporate and government users to tour Dell's Austin plant. "The threshold issue for us," Dell explained in 1987, "is to get the customer into our factory and let them see our automated manufacturing system, show them we've got a professional operation here. If they see that, we've got a customer."<sup>145</sup>

Winning prominent corporate accounts also entailed new risks for the company's young brand. For most of its first three years, Dell had received significant media attention. By 1987, several national business magazines were charting the firm's performance. Most of this coverage had been favorable, enhancing the Dell brand at little cost to the company. But this same visibility would become a significant liability if Dell failed to satisfy large institutional customers. Yet, Michael Dell and his executive believed targeting large institutions was critical to the company's future growth.<sup>146</sup> They knew that they had to take great care to minimize the chances of disappointing a major client and thereby damaging the Dell brand, but they were confident that their organization could meet or exceed new customers' expectations.

### *Moving Abroad*

Dell and his executive team made the equally important strategic decision to seek out international markets. By the late 1980s, nearly half of worldwide sales of personal computers were outside the United States.<sup>147</sup> Most of this demand was concentrated in Europe and Asia, particularly in Japan. Excepting the United States, Japan was the single largest national market for personal computers.<sup>148</sup> But Dell realized that competing there "was more of a longer-term dream. The investment we'd need to enter a market that was then dominated by entrenched Japanese companies was more than we could handle."<sup>149</sup>

British and other European markets were more open and expanding rapidly, and total PC sales in Europe were expected to exceed \$7.5 billion by 1990.<sup>150</sup> A number of companies were selling PCs in European markets in the late 1980s at prices competitive with Dell's. But Michael Dell perceived most of these products to be neither as well made nor as reliable as those his company made. Moreover, few of the players in European markets effectively serviced their machines, and none provided free after-sales support. Dell was confident that his company's products, services, and, eventually, brand would appeal to European consumers.

Dell had become interested in the British market in 1984 when he and his family had traveled to London during his spring break from university. "I observed the same high markup/lousy service phenomenon in the United Kingdom as I had in the United States," he recalled.<sup>151</sup> These shortcomings, as Dell recognized, presented strategic opportunities, and three years later, he and his colleagues decided to exploit them.

Among other advantages to starting in Britain and Ireland were the absence of a language barrier and the presence of large numbers of knowledgeable business users who might become interested in the Dell brand. The United Kingdom, moreover, looked to be an excellent beachhead for future European expansion.

In June 1987, Dell's first international subsidiary opened in the United Kingdom, following the same broad strategies as its parent company. Telemarketing sales reps backed by a national advertising campaign contacted potential customers and took orders for customized computers. A small sales force in the field targeted large institutional buyers in Britain and Ireland.<sup>152</sup>

Dell's overseas sales grew rapidly and the subsidiary was profitable within seven months. By April 1988 the London-based telemarketing group was retailing \$4 million in computers per month.<sup>153</sup>

Revenues increased more than 60% in the subsidiary's second year of operation.<sup>154</sup> Much of this business came from *The Financial Times Top 1000* companies and from large public sector organizations.<sup>155</sup> Building on this initial success, Dell quickly established subsidiaries in Germany, France, Sweden, and Canada. Less than three years after its first foray into international markets, almost a quarter of Dell's annual sales was earned outside the United States.<sup>156</sup>

### *Sustaining Growth*

By early 1988, Dell's annual sales had climbed to \$159 million, a 129% increase over the previous fiscal year.<sup>157</sup> To keep pace with this kind of expansion, the company needed additional manufacturing, warehouse, and office facilities as well as more people. Senior management expected employment, which stood at 650 in 1988, to increase by at least 60% over the coming year.<sup>158</sup>

Collectively, these requirements occasioned a need for a considerable infusion of capital. To fund new investments and satisfy working capital needs, senior management hoped to raise \$38 million in 1988.<sup>159</sup> In May of that year, 23-year-old Michael Dell announced that he and his colleagues would take the company public. Reactions among financial analysts and business reporters were mixed. Most were impressed with Dell's meteoric rise, but many doubted that the company could continue to grow rapidly *and* profitably. "Dell has just about tapped out the mail-order business," asserted the editor of *Technologic PC Letter*.<sup>160</sup> Other writers predicted that the company's recent initiative to offer Dell computers through value-added resellers would force it to change its entire operating strategy.<sup>161</sup> Moreover, despite the involvement of Walker and other experienced executives, some questioned Dell's ability to share control, citing the recent departures of several top managers.<sup>162</sup>

Dell nevertheless raised in excess of \$34 million when it went public in June 1988. The company sold about a quarter of its outstanding stock, some 4 million shares, at an average price of \$8.50 per share. In its first six months on the NASDAQ, the company's stock price fluctuated between 7 3/4 and 12 5/8.<sup>163</sup> Dell employees were eligible to receive incentive stock options, but Dell himself owned more than half the company's equity.<sup>164</sup>

Dell Computer's expansion accelerated in the late 1980s and early 1990s. Sales in fiscal 1991 exceeded \$546 million, and net income totaled \$27 million.<sup>165</sup> During the preceding four years, sales and profits had each grown at compound annual rates of more than 65%. Measured by market share, Dell Computer was now the sixth largest player in the American PC industry, up from number 22 just two years earlier.<sup>166</sup> But it was not a leader in world markets. In 1991, the largest shares of the global market were held by IBM, Apple, NEC, Compaq, and Fujitsu, which together accounted for 52% of worldwide sales.<sup>167</sup>

But Dell's market presence and brand recognition continued to develop as its strategy of targeting large institutional consumers bore fruit. Nearly half of Dell's sales in fiscal year 1991 were to major corporate, government, and educational customers. Small and medium-sized business accounted for 40% of sales, individual consumers for the remaining 12%.<sup>168</sup> Moreover, more than two-thirds of Dell's customers were repeat purchasers.<sup>169</sup> Dell earned the top ranking for customer satisfaction among business users in J. D. Powers and Associates' first annual survey of personal computer consumers in early 1991. Other organizations, such as *PCWeek*, also awarded the company high marks for pleasing customers.<sup>170</sup>

## Learning from Mistakes

Dell Computer had enjoyed tremendous growth during its first seven years. But in the intensely competitive PC market, characterized by rapid-fire technological advances, past achievements hardly guaranteed future success. In the late 1980s and early 1990s, graphics and network applications as well as microprocessing capacity continued to expand quickly. PC manufacturers strove to assimilate all this innovation. Leading companies such as IBM, Compaq, Apple, Tandy, and Zenith relied on their research and experience to assess the operating efficiencies, commercial viability, user appeal, and profitability of a never-ending stream of new product possibilities, many of which displaced or rendered obsolete earlier offerings.<sup>171</sup>

PC makers competed not only on how well they brokered technological innovation coming from all sides, but also on product quality, brand equity, and, of course, price, which fell precipitously during this period, driven down by technological advances and a nationwide recession. As sales dampened, a price war broke out. Between 1987 and 1992, the average selling price of a personal computer declined from \$2,760 to \$2,309, a 32% decrease (adjusted for price changes).<sup>172</sup> Falling prices squeezed industry profitability, motivated most players to reduce operating costs, and forced some companies, such as Wang, out of the PC business altogether. One industry consultant described participation in the PC industry as akin to operating “inside a tornado,” a metaphor that captured the speed and ruthlessness of rivalry in the business.<sup>173</sup> (Exhibit 4 traces leading manufacturers’ PC sales.) Dell and other low-cost manufacturers such as Packard Bell and AST more than survived the price war. For most of the period, Dell’s sales and net income growth outpaced industry averages.<sup>174</sup>

Dell’s generally strong financial performance and increasing market share in desktop PCs were hard won. Senior managers made two significant missteps as they strove to expand the firm’s product lines, customer base, and market presence as swiftly as possible. Both mistakes posed potentially serious threats to the company’s reputation and relationship with consumers and had lasting consequences for the brand, organization, and Michael Dell himself.

### *Managing Inventory*

Between 1984 and 1988, Dell’s sales rose at a compound annual rate of more than 250%.<sup>175</sup> To keep pace with this dizzying growth, company managers invested in large quantities of semiconductors, PC disk drives, memory chips, and other components. When memory chips were projected to be in short supply by late 1989, the company bought as many as possible.

Dell and his colleagues discovered that they had purchased many more memory chips than needed—at high prices. “And then prices plunged,” Dell recalled. “To make matters worse, we also got caught ‘crossing the street’ technologically, as memory chip capacity went from 256K to 1 megabyte almost overnight.”<sup>176</sup> The company found itself holding millions of dollars of memory chips that were rapidly becoming obsolete.<sup>177</sup> “Inventory,” Dell continued, “is the worst thing to own in an industry in which the value of the materials or information declines quickly. . . . As one of my colleagues in this industry likes to say, inventory has the shelf life of lettuce.”<sup>178</sup>

It took Dell Computer nearly a year to sell off its inventory of memory chips at prices much lower than it had paid for them. The resulting losses prompted the company to postpone the launch of new international market initiatives and contributed to a drop in its net income, which fell to \$5 million in fiscal 1990 from \$14 million a year earlier.<sup>179</sup> To preserve overall profit margins, Dell executives raised product prices, which, in turn, dampened consumer demand. Dell’s troubles led some journalists and financial analysts to express doubts about the viability of its direct model.<sup>180</sup> “For the first time in the

company's history," Dell recalled "we didn't deliver. To our stunned disbelief, we had quickly become known as the company with the inventory problem."<sup>181</sup>

It was the company's biggest mistake to date, and its lessons were not lost on Dell and his colleagues. Senior managers recommitted their efforts and resources to one of the firm's original operating principles—to minimize inventory. They devised new methods to monitor the speed with which inputs flowed through the factory. As the company grew in the early and mid-1990s and its influence with vendors increased, Dell was able to negotiate agreements that called for components to be delivered on the day they were to be used. The company also improved its ability to predict future demand. By the late-1990s, Dell had achieved lower inventories—an average of about 11 days—than most rival firms. Leaner inventories not only freed up financial resources for other uses, but also helped the company respond quickly to changes on both the demand and supply side of product markets. "If I've got 11 days of inventory," Dell explained, "and my competitor has 80, and Intel comes out with a new 450-megahertz chip, that means I am going to get to market 69 days sooner."<sup>182</sup>

### *Recommitting to Direct Sales*

In 1990, Dell executives stumbled again. They decided to begin selling PCs in traditional retail outlets, a controversial decision for a business born of its founder's skepticism of third-party dealers and their role in the personal computer market. Some managers, echoing Dell's own earlier thoughts, doubted that mass merchandisers could deliver the service and support consumers had come to associate with the Dell brand. Others worried that retailers' markups would force the company to either raise prices or watch its profit margins shrink.

Senior managers weighed these potential problems against the possibility of reaching new consumer segments such as small office and household users and thereby expanding overall demand for Dell products. In particular, they hoped to capitalize on the recent growth in PC sales through discount retailers and superstores such as Sam's Club and PriceClub. Sales at such stores had climbed from \$600 million in 1987 to \$1.6 billion in 1990.<sup>183</sup> Reluctant to ignore these opportunities for growth, Dell executives signed an agreement with CompUSA to sell PCs and peripheral equipment. Over the next two years Dell products were also made available in Staples stores and PriceClub warehouse outlets. Brisk sales through these retailers helped fuel record increases in Dell's gross revenues, which climbed from \$546 million in fiscal 1991 to more than \$2 billion two years later.<sup>184</sup>

Yet, as Michael Dell and his senior team came to realize, selling in the traditional retail channel was not very profitable for the company. Dealers' markups, returns of unsold products, and the administrative costs of dealing with additional actors sandwiched between the manufacturer and its customers reduced Dell's income. Equally important, the PC maker had no direct line of communication with buyers who purchased computers through retailers, and this prevented Dell from gathering market intelligence about consumers' preferences and user feedback about product performance. Company executives became increasingly concerned that they were diluting the firm's brand equity by relying on sales people and technicians whom it did not hire, train, or manage.

Dell stopped distributing its products through mass merchandisers and superstores in late 1993. Both internally and externally the company was criticized for strategic vacillation. Some financial analysts and journalists expressed skepticism about the company's future prospects.<sup>185</sup> It could not have been easy for Michael Dell to reverse course in 1993. At age 28, his track record in understanding consumer wants and needs and how to meet them had been a stream of virtually uninterrupted successes. Yet on this important issue, he and his top executives had made another serious mistake.

But Michael Dell was a fast learner. During the mid-1990s, with renewed appreciation for the direct sales model, he and his colleagues recommitted the company to building and maintaining strong, unfiltered connections with consumers. Senior managers also began investigating ways to broaden its customer base without resorting to third parties.

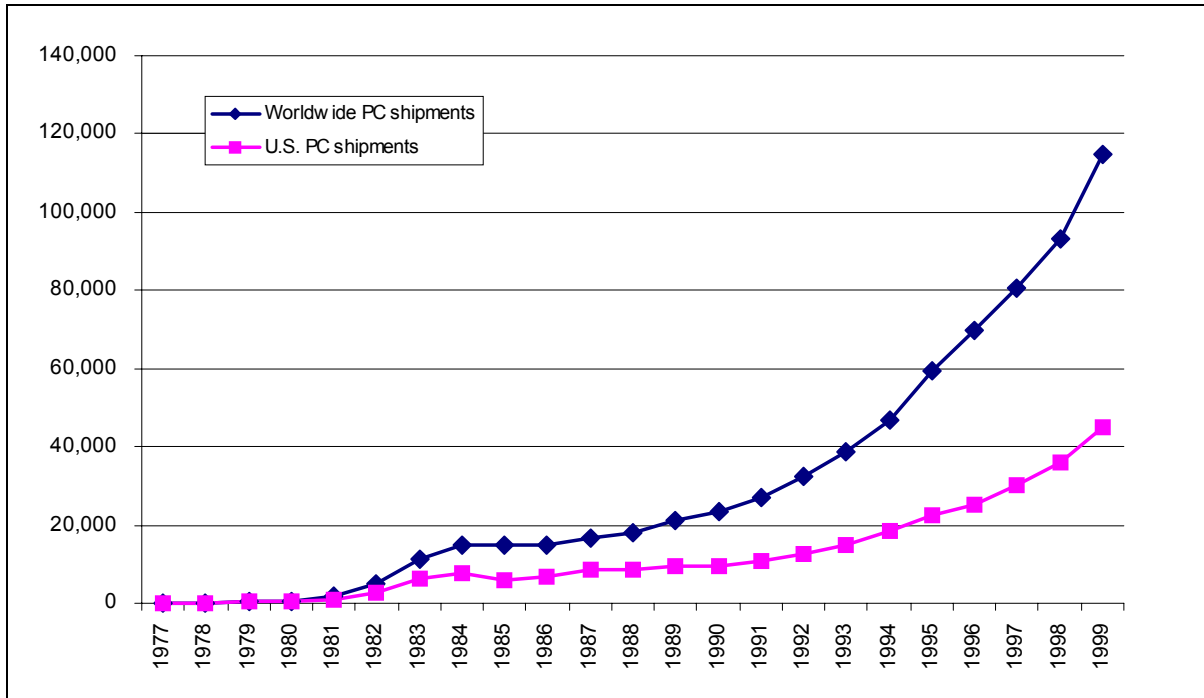
One of these avenues was the Internet. Dell had been attracted to the possibilities of reaching consumers over the Internet in the early 1990s, envisioning such communication as a powerful extension of the company's direct model. In 1995, he charged a small team of managers to explore how Dell might use the Internet to connect with customers, deliver information, and sell products.<sup>186</sup> Impressed with the growth of Internet access—especially among business users—in the United States, its potential synergies with Dell's existing customer relationships, and the projected increase in electronic commerce, team members began in late 1995 to plan an online technical interface and retail store.<sup>187</sup>

The following year Dell launched its online website, [www.dell.com](http://www.dell.com). Industry analysts and journalists applauded the initiative, emphasizing the advantages of the Internet over third-part distribution networks. "Dell has been positioned for something like this since its beginning," observed one reporter. "They can migrate what they do in the real world to the Web easily without upsetting any of these existing sales channels."<sup>188</sup> In its first four years, Dell's online initiative proved highly successful, helping the company better understand user priorities and further customize service and product support offerings. [WWW.dell.com](http://WWW.dell.com) quickly became a dynamic marketplace; by the early twenty-first century the company's web sales averaged more than \$40 million a day.<sup>189</sup>

## Conclusion

By the beginning of the twenty-first century, Dell Computer's yearly sales exceeded \$25 billion. Measured by annual revenues, Dell was the second largest personal computer-systems company in the world. Its PC sales exceeded those of Apple and IBM, two of the industry's early leaders.<sup>190</sup> Many industry observers credited Dell's success to a range of supply-side initiatives: including rigorous quality control, lean inventories, close relationships with suppliers, and efficient cash-flow management. Michael Dell had long recognized that producing quality goods at reasonable prices was essential to competing effectively in the Information Revolution.

But he also realized that such success depended on more than well-organized manufacturing. Sustained business achievement also rested on a number of important demand-side capabilities. Since 1984, he had worked to understand what consumers wanted and needed in IT products. He used this understanding to build strong connections with consumers, a powerful brand and business model, and the organizational capabilities to support these critical resources.

**Exhibit 1** Total Worldwide and U.S. Personal Computer Shipments, 1977-1999 (thousands of units)

Sources: Courtesy of Leslie Robbins, GartnerGroup/Dataquest; Dan Balaban, "All Systems Go: Global Top Eight Regions by Mobile Commerce Market Size by Sales in U.S. Dollars Forecast for 2005," *Card Technology* (April 2000), p. 59 and Doug Olenick, "Dell Takes Over First Place; Compaq Slips to Two," *TWICE* (March 13, 2000), p. 20.

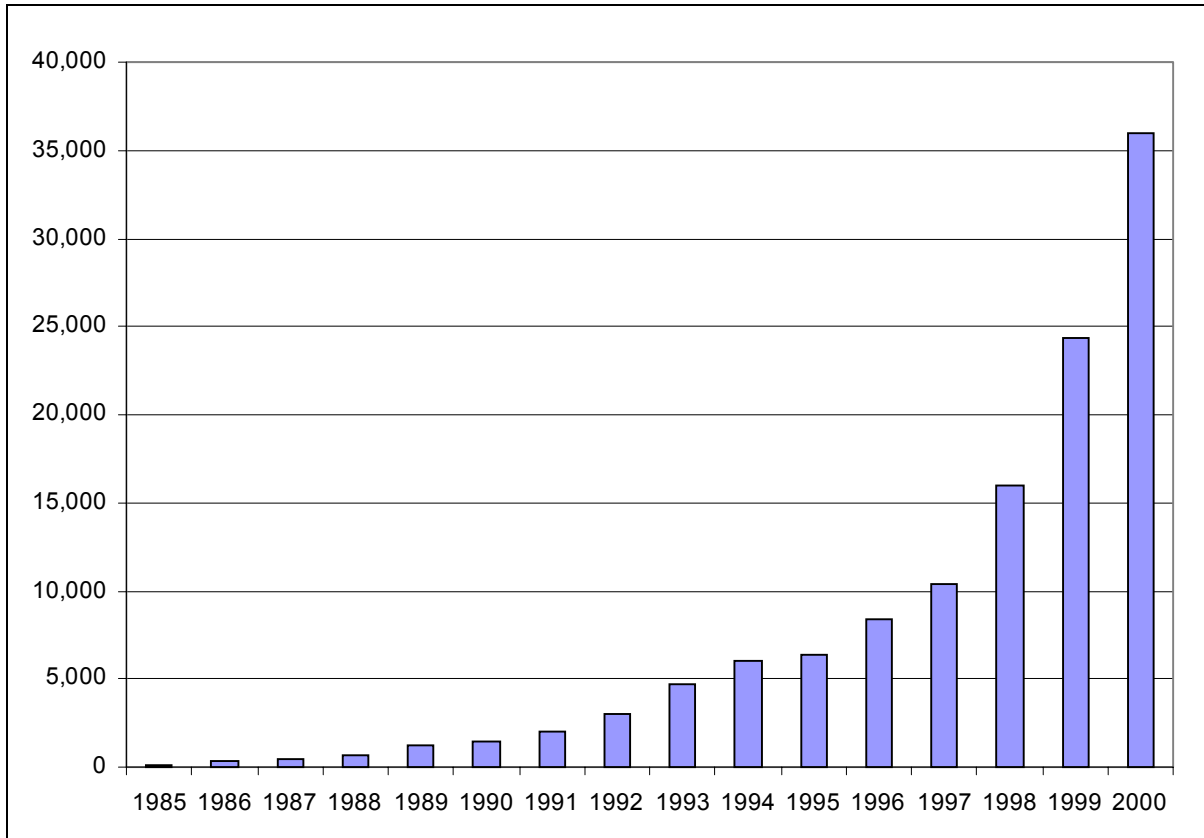
Note: According to industry convention, PC shipments are counted with reference to the end market. "U.S. Shipments" refers to products shipped into or within the United States and then sold within the United States."

**Exhibit 2** Dell Computer Corporation  
Sales, 1985-2000 (millions of dollars)

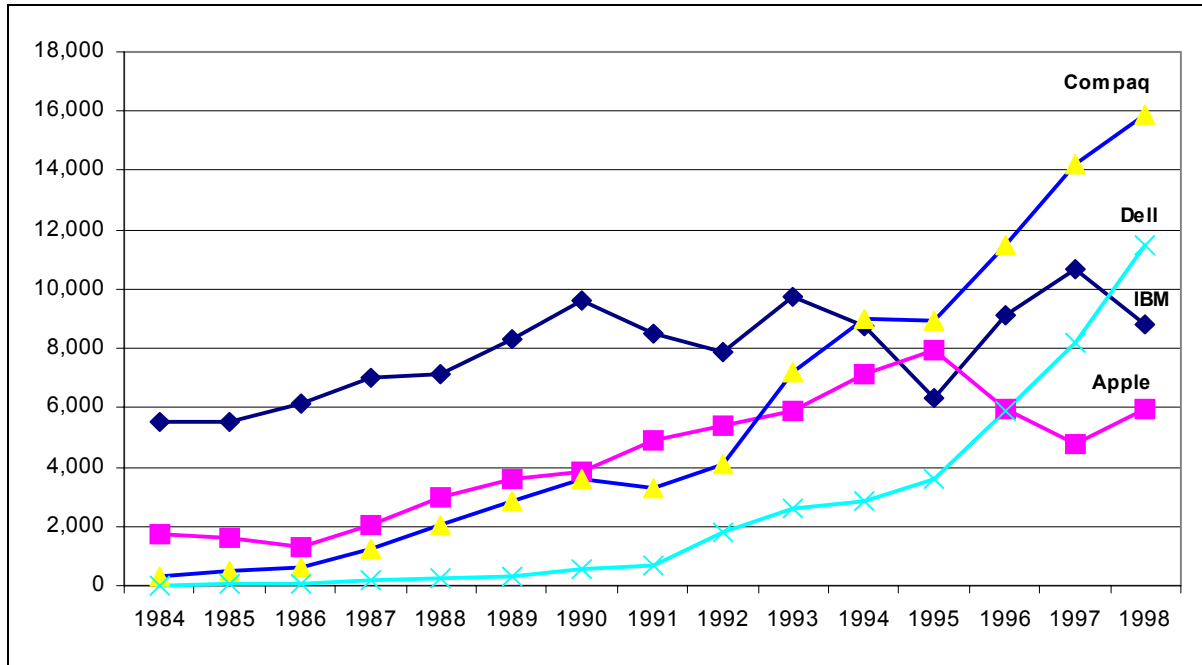
| Year | Total Sales |
|------|-------------|
| 1985 | 6           |
| 1986 | 34          |
| 1987 | 70          |
| 1988 | 159         |
| 1989 | 258         |
| 1990 | 389         |
| 1991 | 546         |
| 1992 | 890         |
| 1993 | 2,014       |
| 1994 | 2,873       |
| 1995 | 3,475       |
| 1996 | 5,296       |
| 1997 | 7,759       |
| 1998 | 12,327      |
| 1999 | 18,243      |
| 2000 | 25,265      |

Sources: Dell Computer Corporation, *Annual Reports* 1989, p. 21; 1991, p. 15; 1993, p. 1; 1998, p. 2; 1999, p. 20; 2000, p. 20.

Note: These figures are for fiscal, not calendar years. The Dell fiscal year ends January 31.

**Exhibit 3** Number of Dell Computer Corporation Employees, 1985-2000

Sources: Dell Computer Corporation, *Annual Report 1989*, p. 6; *Form 10Ks 1990*, p. 9; 1991, p. 12; 1992, p. 9; 1993, p. 10; 1994, p. 8; 1995, p. 10; 1996, p. 8; 1997, p. 8; 1998, p. 8; 1999, p. 9; Kimberly N. Hunt and AnnaMarie L. Sheldon, eds., *Notable Corporate Chronologies*, vol. 1, A-K, (Detroit, MI: Gale Research, 1999), p. 531; Thomas C. Hayes, "Is Austin the Next Silicon Valley?" *New York Times* (Jan. 13, 1988), p. D6.

**Exhibit 4** Selected Manufacturers' PC Sales, 1984-1998 (millions of dollars)

Sources: *Datamation Special Issues* (June 15, 1986), p. 45; (June 15, 1988), p. 160; (June 15, 1990), p. 184; (June 15, 1992), p. 26; (June 15, 1994), p. 55; (June 15, 1995), p. 62; *Computer Reseller News* (June 2, 1997), p. 122; (April 20, 1998), p. 112; (May 17, 1999), p. 94; and Peter Burrows, et al, "A Baby Mac Attack," *Business Week* (August 10, 1998), p. 30.

Note: This information reflects calendar year, not fiscal year, results. 1998 sales for Apple Computer are the company's net sales for the year, including related software and peripherals.

## Endnotes

<sup>1</sup> Michael A. Hiltzik and Thomas S. Mulligan, "Market Sell-Off," *Los Angeles Times* (October 28, 1997), p. A1.

<sup>2</sup> In 1998, about 27% of retail trading by individuals in stocks and mutual funds shares was done on line. For stocks alone, on-line brokerages accounted for almost 40% of all retail trading, Lynnley Browning, "The Rise of E-Wall Street," *Boston Globe* (March 7, 1999), pp. G1, G5.

<sup>3</sup> Dell Computer Corporation, *Annual Report 1998*, p. 15.

<sup>4</sup> Quoted in Marcia Stepanek, "What Does No. 1 Do for an Encore," *Business Week* (November 2, 1998), p. 112.

<sup>5</sup> Ronald Alsop, ed., *The Wall Street Journal Almanac* (New York, 1997), p. 483; Doug Lenick, "Dell Takes Over First Place; Compaq Slips to Two," *TWICE* (March 13, 2000), p. 20.

<sup>6</sup> Dell Computer Corporation, *Annual Report 1990*, p. 1; Dell Computer Corporation, *Annual Report 1998*, p. 2; Richard Murphy, "Michael Dell's Billion-Dollar Secret," *Success* 46, no. 1 (January 1999), p. 50.

<sup>7</sup> Dell Computer Corporation, *Form 10-K 1999*, p. 19.

<sup>8</sup> <http://www.dell.com/html/us/corporate/annualreports/report00/statistical/index.htm>; Dell Computer Corporation, *Annual Report 1998*, p. 2; and Murphy, "Michael Dell's Billion-Dollar Secret," p. 52.

<sup>9</sup> Eryn Brown, "America's Most Admired Companies," *Fortune* (March 1, 1999), p. 70; <http://www.dell.com/html/us/corporate/annualreports/report00/statistical/index.htm>; "Internet Stocks Drove Record Year of IPOs, Led Market in '99," *Los Angeles Times* (January 1, 2000), p. C1.

<sup>10</sup> Jody Brennan, et. al. "The Forbes Four Hundred: The Richest People in America," *Forbes* (October 21, 1991), p. 264.

<sup>11</sup> Peter Newcomb, "The Forbes Four Hundred: The Richest People in America," *Forbes* (October 12, 1998), pp. 176-177.

<sup>12</sup> Melanie Warner, "The Young and the Loaded," *Fortune* (September 27, 1999), pp. 79-88; Michael Borden and Suzanne Koudsi, "America's Forty Richest Under 40," *Fortune* (September 27, 1999), pp. 90-95.

<sup>13</sup> Quoted in Michael Dell with Catherine Fredman, *Direct from Dell: Strategies that Revolutionized an Industry* (New York, 1999), jacket endorsement. See also Gary McWilliams and Joseph B. White, "Others Want to Figure Out How to Adopt Dell Model," *Wall Street Journal Interactive Edition* (December 1, 1999); and Gregory L. White, "How GM, Ford Think the Internet Can Make Splash in Their Factories," *Wall Street Journal Interactive Edition* (December 3, 1999).

<sup>14</sup> Dell and Fredman, *Direct from Dell*, p. 10.

<sup>15</sup> McWilliams and White, "Others Want to Figure Out How to Adopt Dell Model;" Gregory L. White, "How GM, Ford Think the Internet Can Make Splash in Their Factories."

<sup>16</sup> Thomas K. McCraw, *American Business, 1920-2000: How It Worked* (Wheeling, IL, 2000), p. 200.

<sup>17</sup> By 1971, 2,300 transistors could be packed on a chip the size of a thumbtack. In 1993, this number had climbed to 35 million. Chip memory capacity grew even faster. In 1971, Intel's cutting-edge DRAM (dynamic random access memory) chip held 1,024 bits of data. At the end of the twentieth century, capacity was 250 million bits. Processing speed also accelerated dramatically. Microprocessors in the late 1990s were more than 550 times faster than those available in 1972. Manuel Castells, *The Rise of the Network Society* (Oxford, 1996), pp. 42-43.

<sup>18</sup> By the 1990s, microprocessors served many of the potential applications that developers in the 1960s and 1970s had envisioned for the technology. In the years immediately following the microprocessor's invention, however,

many had been skeptical about the innovation's use in computers. Instead, some Intel executives and developers initially believed that microprocessors would find their most important commercial uses in automobiles and household appliances. In the early 1970s, for example, programmers approached Intel head Robert Noyce about using the microprocessor to create a simple computer game. He dismissed the suggestion, saying the chip's future lay elsewhere. "It's in watches," he said. Paul Freiberger and Michael Swaine, *Fire in the Valley: The Making of the Personal Computer Industry* (Berkeley, CA, 1984), p. 138.

<sup>19</sup> According to Castells, Roberts chose the name because his daughter liked a Star Trek character called Altair. *Rise of the Network Society*, p. 44.

<sup>20</sup> The Altair measured 17" x 18" x 7." Peggy A. Kidwell and Paul Ceruzzi, *Landmarks in Digital Computing* (Washington, D.C., 1994), p. 95.

<sup>21</sup> Das Narayandas and V. Kasturi Rangan, "Dell Computer Corporation," HBS Case no. 9-596-058 (Boston,, 1996), p. 1.

<sup>22</sup> In early 1975, *Popular Electronics* ran a cover story on the Altair. The article ran under the headline "The Most Powerful Minicomputer Project Ever Presented" and proclaimed the product the "first minicomputer kit to rival commercial models." Edward H. Roberts and William Yates, "Exclusive! Altair 8800: The Most Powerful Minicomputer Project Ever Presented—Can Be Built for Under \$400," *Popular Electronics* 7, no. 1, (January 1975), pp. 33-38. See also Kidwell and Ceruzzi, *Landmarks in Digital Computing*, p. 94.

<sup>23</sup> The Altair's popularity stimulated a range of technological innovations, inaugurating the first wave of personal computing. In the mid-1970s, for example, the development of a 5 ¼" disk drive for data storage replaced more cumbersome external cassette tape drives used in mainframes, and scores of manufacturers soon entered the disk-drive business. On the history of the industry, see Clayton M. Chistensen, *The Innovator's Dilemma: When New Technologies Cause Great Firms to Fail* (Boston: Harvard Business School Press, 1997), pp. 4-7.

<sup>24</sup> The invention of VisiCalc, the first computerized spreadsheet, increased the Apple II's value to business customers. Initially coded to run only on the Apple II, the spreadsheet software was a boon to any manager, financial planner, or accountant who worked with dependent calculations. It replaced the tedium and potential mistakes of paper-and-pencil spreadsheets with instant, accurate computations. Recalculations, which had previously involved hours of human scrutiny and careful erasures, became simple. A change in any one variable, such as an interest rate, was immediately reflected in all relevant values. VisiCalc was the personal computer industry's first "killer app." Businesses and governmental agencies that could not previously justify the expense of a desktop computer wanted an Apple II in order to use VisiCalc. On the development of VisiCalc, see Robert X. Cringely, *Accidental Empires: How the Boys of Silicon Valley Make Their Millions, Battle Foreign Competition, and Still Can't Get a Date* (Reading, MA, 1992), pp. 64-72.

<sup>25</sup> Kidwell and Ceruzzi, *Landmarks in Digital Computing*, p. 99. When Apple Computer conducted its initial public offering (IPO) in 1980, the company raised more than \$80 million. At the time, it was the most successful public offering since Ford Motor Company went public in 1956, and one of the largest IPOs to date in Wall Street history. Lee Butcher, *Accidental Millionaire: The Rise and Fall of Steve Jobs at Apple Computer* (New York, 1988), p. 133.

<sup>26</sup> In 1976, for example, Gates wrote an "Open Letter to Hobbyists," that was printed in one of the best-known hobbyist publications, *The Homebrew Computer Club Newsletter*. The letter attacked software piracy, arguing that in order for efficient, state-of-the art software to be produced, developers must be paid for their time and effort. Reprinted in Freiberger and Swaine, *Fire in the Valley*, p. 169. See also Randall Stross, *The Microsoft Way: The Real Story of How the Company Outsmarts Its Competition* (Reading, MA, 1996), pp. 48-52.

<sup>27</sup> "The future," Gates remembered in his autobiography, "was staring us in the face from the cover of a magazine. It wasn't going to wait for us. Getting in on the first stages of the PC revolution looked like the opportunity of a lifetime, and we seized it." Bill Gates with Nathan Myhrvold and Peter Rinearson, *The Road Ahead* (New York, 1995), p. 17.

<sup>28</sup> Venture Development Corporation, *The Personal Computer Industry II: A Strategic Analysis, 1981-1985* (Wellesley, MA, 1981) pp. 58-59. See also John Steffens, *NewGames: Strategic Competition in the PC Revolution* (Oxford, 1994), p. 101.

<sup>29</sup> James Chposky and Ted Leonsis, *Blue Magic: The People, Power and Politics Behind the IBM Personal Computer* (New York, 1988), p. 16.

<sup>30</sup> Freiburger and Swaine, *Fire in the Valley*, p. 193.

<sup>31</sup> Roberts offered prospective retailers a 25% discount on every PC they sold regardless of quantity. In exchange, franchisees agreed to carry only the Altair. *Ibid.*, pp. 188-189.

<sup>32</sup> *Ibid.*, p. 198.

<sup>33</sup> *Ibid.*, p. 195.

<sup>34</sup> Almost 60% of all business users were engineers, systems programmers and analysts, or employed in a computer-oriented occupation. Venture Development Corporation, *The Personal Computer Industry II*, p. 105.

<sup>35</sup> Production numbers reflect units shipped into or within the United States and are from Gartner Group/Dataquest, "Personal Computer History: U.S. Shipments, 1999," courtesy of Lesley Robbins, Senior Business Analyst, Gartner Group/Dataquest. Revenue figures are from Narayandas and Rangan, "Dell Computer Corporation," p. 2. Venture Development Corporation cites total output for 1980 as 391,600 units. The total factory dollar value of these shipments was \$1.2 billion, *The Personal Computer Industry II*, p. 6.

<sup>36</sup> In 1980, mainframe sales totaled \$7.6 billion, minicomputer revenues \$2 billion, Narayandas and Rangan, "Dell Computer Corporation," p. 2. These figures probably represent the factory dollar value of computers shipped.

<sup>37</sup> Narayandas and Rangan, "Dell Computer Corporation," p. 3. In the mid-1970s, DEC, H-P, and IBM had considered producing personal computers. But all three companies rejected the idea because the projected market was too small. Kidwell and Ceruzzi, *Landmarks in Digital Computing*, p. 92.

<sup>38</sup> Alfred D. Chandler, Jr., *Inventing the Electronic Century: The Epic Story of the Consumer Electronics and Computer Industries* (New York, forthcoming), Chapter 1, p. 10.

<sup>39</sup> IBM planners believed that this decision would encourage other companies to build compatible circuit cards and other extensions for the IBM machine. According to Cringely, the expected margins on PC add-ons such as circuit cards were relatively unattractive to the IBM task force. "So the decision was made to leave those crumbs to outsiders. Other companies would have to assume the development and marketing costs of add-on cards, but the existence of such cards would only help sales of IBM PCs." *Accidental Empires*, p. 137.

<sup>40</sup> IBM contracted with Intel to produce the PC's microprocessor, since the Intel 8088 was the best overall fit with other chips already chosen for the IBM machine. It was also compatible with more software than competing Motorola chips. Intel executives were glad to have the new business, but IBM's choice was initially viewed merely as a "small design win," according to Gordon Moore. At the time, it was not seen as any kind of major strategic or financial coup. Charles H. Ferguson and Charles R. Morris, *Computer Wars: How the West Can Win in a Post-IBM World* (New York, 1993), p. 25.

<sup>41</sup> *Ibid.*; Chandler, *Inventing the Electronic Century*, Chapter 1, p. 10.

<sup>42</sup> For personal and strategic reasons, Allen and Gates had moved the company from Albuquerque to Seattle at the end of 1978. On this decision, see Stephen Manes and Paul Andrews, *Gates: How Microsoft's Mogul Reinvented an Industry and Made Himself the Richest Man in America* (New York, 1993), pp. 119-121.

<sup>43</sup> QDOS was also known as SCP-DOS or Seattle Computer Products Operating System. Without revealing IBM's interest, Gates paid \$25,000 for the licensing rights to QDOS. He later purchased exclusive rights for

\$50,000. Seattle Computer Products later sued and won a \$1 million judgment against Microsoft. Freiburger and Swaine, *Fire in the Valley*, p. 276; Ferguson and Morris, *Computer Wars*, p. 26.

<sup>44</sup> Gates with Myhrvold and Rinearson, *The Road Ahead*, p. 54.

<sup>45</sup> Chandler, *Inventing the Electronic Century*, Chapter 1, p. 11. If IBM's PC division had been an independent business in 1984, it would have ranked 74<sup>th</sup> on the Fortune 500 list. Chposky and Leonsis, *Blue Magic*, p. 172; Ferguson and Morris, *Computer Wars*, p. 28.

<sup>46</sup> Gartner Group/ Dataquest, "Personal Computer History: U.S. Shipments, 1999." See also Alsop, *Wall Street Journal Almanac*, p. 483. In 1982, *Time* chose the IBM PC for its cover story on "Man of the Year." "There are some occasions when the most significant force in a year's news is not a single individual, but a process," wrote the magazine's editors. "Time's Man of the Year for 1982, the greatest influence for good and evil is not a man at all. It is a machine, the computer," quoted in Ferguson and Morris, *Computer Wars*, p. 28-29.

<sup>47</sup> In 1985, only 10 percent of the PCs produced were used in homes, Venture Development Corporation, *Venturecasts: The 1985 Consumer Electronics Data Book* (Natick, MA: Venture Development Corporation, 1985), p. 5.

<sup>48</sup> *World Almanac, 1996* (Mahwah, NJ, 1995), p. 171.

<sup>49</sup> Individuals bought 10 percent of PC output in 1985, and educational institutions the remaining 10 percent. Venture Development Corporation, *Venturecasts: The 1985 Consumer Electronics Data Book*, p. 5.

<sup>50</sup> IBM also promoted the development of a network of distributors that targeted small and medium-sized businesses. These dealers were known as value-added resellers, and over time as the network developed, they assumed a range of functions for business customers, including after-sales service and support. Jan W. Rivkin and Michael E. Porter, "Matching Dell," HBS Case no. 9-799-158 (Boston, 1999), p. 2. Sears and other retailers that sold IBM personal computers benefited greatly from the advertising campaign, earning average gross margins of 25% on each machine sold in the rapidly growing market. These returns made computer distribution an attractive opportunity, and in the early 1980s, scores of new dealerships began selling IBM-compatible machines. Narayandas and Rangan, "Dell Computer Corporation," p. 3.

<sup>51</sup> Estimates of the size of IBM's domestic sales force in the early 1980s vary widely. Narayandas and Rangan put this number at 2,500 people. Narayandas and Rangan, "Dell Computer Corporation," p. 3. According to Chposky and Leonsis, IBM had 8,400 people in the field at this time, *Blue Magic*, p. 14. IBM does not disclose the size of past sales forces.

<sup>52</sup> Demand for personal computers grew faster than IBM's ability to meet it. "We missed the preliminary sales forecast by almost 500%," recalled Dan Wilkie, who in the early 1980s was in charge of manufacturing for the IBM PC. "But by the same measure," he continued, "it skewed the bottom line in our favor since, with the volumes going up, the per-unit production costs kept heading down." Quoted in Chposky and Leonsis, *Blue Magic*, p. 113.

<sup>53</sup> Freiburger and Swaine, *Fire in the Valley*, p. 281.

<sup>54</sup> Venture Development Corporation, *Venturecasts: The 1986 Computer Data Book* (Natick, MA, 1986), p. 113. In 1980, Apple was one of the three largest PC producers. In number of units shipped, it ranked second behind Radio Shack. In terms of the factory dollar value of units made, Apple followed Radio Shack and Hewlett-Packard. Venture Development Corporation, *The Personal Computer Industry II*, pp. 85, 92. At the end of the 1990s, Apple's share in the business desktop market was 1.4%. Joe Mullich, "Second Tier Stays Alive," *Information Week* (September 7, 1998), p. 105. On Apple's response to the IBM PC, see Butcher, *Accidental Millionaire*, pp. 147-165.

<sup>55</sup> Charles Boisseau, "The Company That Dell Built—Isn't Finished Yet," *Houston Chronicle Magazine*, (February 25, 1996), pp. 6-10.

<sup>56</sup> Dell and Fredman, *Direct from Dell*, pp. 4-5.

<sup>57</sup> Ibid., p. 4.

<sup>58</sup> Anthony Hallet and Diane Hallett, *Encyclopedia of Entrepreneurs* (New York, 1997), p. 160; Dell and Fredman, *Direct from Dell*, p. 4.

<sup>59</sup> Dell and Fredman, *Direct from Dell*, p. 4.

<sup>60</sup> Ibid.

<sup>61</sup> As part of a high school economics project, Dell was required to file a tax return. When he listed \$18,000, his teacher assumed Michael had misplaced the decimal point. She was even more dismayed, Dell remembered in his autobiography, when she realized that he had written the correct figure. The teenager had made more money that year than the educator. He used some of this money to buy a new white BMW, writing a check for the car. Boisseau, "The Company That Dell Built;" Dell and Fredman, *Direct from Dell*, pp. 5-6.

<sup>62</sup> Dell and Fredman, *Direct from Dell*, p. 6.

<sup>63</sup> Ibid.

<sup>64</sup> Boisseau, "The Company That Dell Built."

<sup>65</sup> In his junior year of high school, Dell took a computer class. His performance, the teacher remembered, was not exceptional: "He's a super person, knows how to make money, and that's what people are interested in, but he didn't turn in super-ordinary work for me." Dell occasionally deviated from class assignments. One day, when students were supposed to be writing programs, Dell's teacher discovered him using the mainframe computer terminal to retrieve stock market information. The older man disconnected the call. Michael "became pretty angry with me," the teacher said. Boisseau, "The Company That Dell Built."

<sup>66</sup> Dell and Fredman, *Direct from Dell*, p. 7.

<sup>67</sup> Ibid.

<sup>68</sup> Ibid.

<sup>69</sup> Stanley W. Angrist, "Entrepreneur in Short Pants," *Forbes* (March 7, 1988), p. 85.

<sup>70</sup> Dell and Fredman, *Direct from Dell*, p. 14.

<sup>71</sup> Ibid.

<sup>72</sup> Quoted in Chposky and Leonsis, *Blue Magic*, p. 115.

<sup>73</sup> Ibid.

<sup>74</sup> Venture Development Corporation, *The Personal Computer Industry II*, pp. 112-113.

<sup>75</sup> Dell and Fredman, *Direct from Dell*, p. 8.

<sup>76</sup> Christopher W. L. Hart, James L. Heskett, and W. Earl Sasser, Jr., "The Profitable Art of Service Recovery," *Harvard Business Review* 68, no. 4 (July-August 1990), p. 151. See also James L. Heskett, W. Earl Sasser, and Leonard A. Schlesinger, "Listening to Customers," video tape (Boston, MA, January 1, 1994).

<sup>77</sup> Dell and Fredman, *Direct from Dell*, p. 8.

<sup>78</sup> Chposky and Leonsis, *Blue Magic*, p. 114.

<sup>79</sup> Andrew E. Serwer, "Michael Dell Turns the PC World Inside Out," *Fortune* (September 8, 1997), p. 80.

<sup>80</sup> Dell and Fredman, *Direct from Dell*, p. 13.

<sup>81</sup> *Ibid.*, p. 10.

<sup>82</sup> *Ibid.*

<sup>83</sup> *Ibid.*, p. 13.

<sup>84</sup> Serwer, "Michael Dell Turns the PC World Inside Out," p. 84.

<sup>85</sup> Geoff Lewis, "The Hottest Little Computer Maker in Texas," *Business Week* (February 2, 1987), p. 72.

<sup>86</sup> Michael Oneal, with Thane Peterson, "25 Executives to Watch," *Business Week* (1992 Business Week 1000), p. 86.

<sup>87</sup> Dell and Fredman, *Direct from Dell*, p. 18.

<sup>88</sup> *Ibid.*, pp. 17-18.

<sup>89</sup> Mark Goldstein, "An Industry Legend—at 21," *Industry Week* 233, no. 2 (April 20, 1987), p. 73.

<sup>90</sup> Today, Intel's 300 megahertz Pentium II processor is about 100 times faster than the 12 megahertz 286 ([www.dell.com/corporate/access/dellstory/page1.htm](http://www.dell.com/corporate/access/dellstory/page1.htm)).

<sup>91</sup> Craig E. Aronoff and John L. Ward, "Michael Dell," in *Profiles of Entrepreneurs and the Businesses They Started: Representing 74 Companies in 30 Industries* (Detroit, 1992), p. 121.

<sup>92</sup> Richard Poe, "It's Not Bragging If You Can Do It," *Venture* 9, no. 7 (July 1987), p. 26; Aronoff and Ward, "Michael Dell," p. 121.

<sup>93</sup> Dell Computer Corporation, *Annual Report 1989*, p. 22.

<sup>94</sup> Dell and Fredman, *Direct from Dell*, p. 12.

<sup>95</sup> As Cringely writes, Compaq's founders realized very soon after the IBM PC's introduction that it was software, not hardware, that determined a particular model's fate. "In order for their computer to be successful, it would have to have a large library of available software right from the start, which meant building a computer that was compatible with some other system. The only 16-bit standard available that qualified under these rules was IBM's, so that was the decision—to make an IBM compatible PC—and make it *damn* compatible—100%. Any program that would run on an IBM PC would run on a Compaq. Any circuit board that would operate in an IBM PC would operate in a Compaq. The key to their success would be leveraging the market's considerable investment in IBM," *Accidental Empires*, p. 172.

<sup>96</sup> Louise Kehoe, "Defying the Analysts' Predictions," *Financial Times* (February 21, 1986), p. 13.

<sup>97</sup> Cringely, *Accidental Empires*, p. 173.

<sup>98</sup> Angrist, "Entrepreneur in Short Pants," p. 85.

<sup>99</sup> Alice LaPlante, "Buyers Guide: AT Computers," *InfoWorld* 9, no. 4 (January 26, 1987), p. 40.

<sup>100</sup> Dell and Fredman, *Direct from Dell*, p. 80. See also Joan Magretta, "The Power of Virtual Integration: An Interview with Dell Computer's Michael Dell," *Harvard Business Review* 76, no. 2 (March-April 1998), pp. 75-77.

<sup>101</sup> Dell Computer Corporation, *Annual Report 1989*, p. 21. The Dell fiscal year ends January 31 of the relevant calendar year.

<sup>102</sup> Poe, "It's Not Bragging If You Can Do It," p. 26.

<sup>103</sup> Apple spent heavily on advertising, marketing both the company and its products. The 1984 introduction of the Macintosh, for example, was preceded by a \$15 million media campaign intended to interest business and home users. Financial analysts and some Apple executives worried, however, that the company's advertising was not sufficiently focused on corporate users. In 1984, business users accounted for more two-thirds of PC sales, Butcher, *Accidental Millionaire*, pp. 177-189.

<sup>104</sup> See, for example, LaPlante, "Buyers Guide," p. 40. In 1985, there were hundreds of PC manufacturers that distributed products by mail. One of these was TIPC Network—renamed Gateway 2000 in 1988—which was founded in 1985 in an Iowa farmhouse by Ted Waitt and Michael Hammond. Gateway's strategy was focused on aggressively underselling its rivals. Annual revenues in 1986 were almost \$1million; by \1990, they climbed to \$275 million. Paula Kepos, ed., *International Directory of Corporate Histories* (Washington, D.C., 1995) vol. 10, pp. 307-309.

<sup>105</sup> See, for example, Rivkin and Porter, *Matching Dell*, pp. 1-14.

<sup>106</sup> As Michael Dell said in 1989, "I found the way to differentiate our company was to deliver a greater set of benefits—high performance and other [service-oriented] benefits. That is what has stripped Dell away from the rest of the 800 crowd." Quoted in Mark Brownstein, "Mail Order Arrives," *InfoWorld* 11, no. 39 (September 25, 1989), p. 49.

<sup>107</sup> Quoted in Helen Thorpe, "Michael Dell," *Texas Monthly* (September 1997), p. 177.

<sup>108</sup> According to a 1984 *Washington Post* survey, men accounted for more than 90% of computer users, Michael Schrage, "Computer Sales Lag for Women, Blacks," (July 24, 1984), p. D8. More than 85% of *Personal Computing's* readership was male; and 96% of *PC World's* audience were men, *ibid.*, p. D8.

<sup>109</sup> On the diffusion of new high-tech products among different consumer groups, see Geoffrey Moore, *Crossing the Chasm: Marketing and Selling High-Tech Products to Mainstream Customers* (New York, 1991), pp. 9-25.

<sup>110</sup> [dell.com/corporate/access/dellstory/page2.htm](http://dell.com/corporate/access/dellstory/page2.htm).

<sup>111</sup> In 1987, Dell's on-site support and repair services were provided by Honeywell. Stephen Satchell, "Machine Outspeeds 386 Pack For Surprisingly Low Price Tag," *InfoWorld* 9, no. 31 (August 3, 1987), p. 59. On business consumers' reactions to Dell Computer's service initiatives, see also Alan J. Ryan, "Buyers Skirt Clone Service Woes," *ComputerWorld* 21, no. 50 (December 14, 1987), pp. 35, 41.

<sup>112</sup> Julie Pitta, "Why Dell is a Survivor," *Forbes* (October 12, 1992), p. 84.

<sup>113</sup> Poe, "It's Not Bragging If You Can Do It," p. 27. See also Dell Computer Corporation, *Annual Report 1989*, p. 12.

<sup>114</sup> Joel Kotkin, "The Innovation Upstarts," *Inc.* (January 1989) p. 71. See also Dell Computer Corporation, *Annual Report 1989*, p. 12.

<sup>115</sup> Narayandas and Rangan, "Dell Computer Corporation," p. 6. Poe, "It's Not Bragging If You Can Do It," p. 27. Dell customers within 100 miles of a Honeywell service office received the on-site service contract free the first year, Satchell, "Machine Outspeeds 386 Pack for Surprisingly Low Price Tag," p. 59.

<sup>116</sup> Aronoff and Ward, "Michael Dell," p. 121.

<sup>117</sup> Charles Bermant, "PC's Limited: Making Mail-Order Pay Off," *InfoWorld* 9, no. 4 (January 26, 1987), p. 8. The same year, Compaq's advertising budget for print media was \$10-\$15 million or about 1% of sales, Paula Schorbus, "Business Adds Byte," *Marketing and Media Decisions* 23, no. 1 (January 1988), p. 57.

<sup>118</sup> See, for example, Satchell, "Machine Outspeeds 386 Pack For Surprisingly Low Price Tag," pp. 56-59; Stephen Satchell with David Chalmers and Sally J. Douglas, "The Ten Most Wanted AT Compatibles," *InfoWorld* 10, no. 30 (July 25, 1988), pp. 44-45; John Unger and Stan Miastkowski, "Outclassing the AT," *Byte* 13, no. 7 (July 1988),

pp. 136-137, 139, 142-144; and William Zachmann, "The Price is Right," *ComputerWorld* 21, no. 35 (August 31, 1987), pp. 33-34. In 1988, Dell's System 325, based on the 386 microprocessor, was selected *PC Magazine's* "Editor's Choice," outranking a field of other 25-megahertz systems, including the Compaq Deskpro 386/24, Dell Computer Corporation, *Annual Report 1989*, p. 14.

<sup>119</sup> Goldstein, "An Industry Legend—at 21," p. 74.

<sup>120</sup> Dell and Fredman, *Direct from Dell*, p. 26. Gross profits in 1986 were about 10% of sales, Goldstein, "An Industry Legend—at 21," p. 74.

<sup>121</sup> Bermant, "PC's Limited: Making Mail-Order Pay Off," p. 8. See also Narayandas and Rangan, "Dell Computer Corporation," p. 6; and "Dell Computer Corporation, Private Placement Memorandum," July, 1987, quoted in Dell and Fredman, *Direct from Dell*, p. 30.

<sup>122</sup> "Direct sales gives you fantastic market intelligence, commented one Dell manager." Quoted in Kotkin, "The Innovation Upstarts," p. 71.

<sup>123</sup> V. Kasturi Rangan and Marie Bell, "Dell OnLine," HBS Case 598-116 (Boston: Harvard Business School, 1999) p. 3.

<sup>124</sup> Quoted in Kotkin, "The Innovation Upstarts," p. 73.

<sup>125</sup> Ferguson and Morris, *Computer Wars*, p. 99.

<sup>126</sup> Quoted in Kotkin, "The Innovation Upstarts," p. 72. See also "Dell Computer: It's in the Mail," *Economist* (March 2, 1991), p. 66.

<sup>127</sup> I am grateful to Joseph Maurin, who, in the late 1980s, worked as a staff engineer in Dell's product division for sharing this information.

<sup>128</sup> Dell Computer Corporation, *Annual Report 1989*, p. 22. Net income as a percentage of sales also grew quickly. In fiscal 1985, the company's first year of operations, net income was 0.5% of sales. In 1987, it was 3%.

<sup>129</sup> Poe, "It's Not Bragging If You Can Do It," p. 26.

<sup>130</sup> Aronoff and Ward, "Michael Dell," p. 121.

<sup>131</sup> Poe, "It's Not Bragging If You Can Do It," p. 27.

<sup>132</sup> Dell and Fredman, *Direct from Dell*, p. 32.

<sup>133</sup> *Ibid.*

<sup>134</sup> Dell and Fredman, *Direct from Dell*, p. 21. See also John Gantz, "Tech Street: Dell Computer: Is Success Result of Luck or Vision?" *InfoWorld* 10, no. 25 (June 20, 1988), p. 37.

<sup>135</sup> Quoted in Goldstein, "An Industry Legend—at 21," p. 74.

<sup>136</sup> Quoted in Claire Poole, "The Kid Who Turned Computers Into Commodities," *Forbes* (October 21, 1991), p. 322.

<sup>137</sup> "The Datamation 100," *Datamation* 34, no. 12 (June 15, 1987), p. 31.

<sup>138</sup> Poe, "It's Not Bragging If You Can Do It," p. 26.

<sup>139</sup> See, for example, Rowena Olegario, "IBM and the Two Thomas J. Watsons," in Thomas K. McCraw, ed., *Creating Modern Capitalism: How Entrepreneurs, Companies, and Countries Triumphed in Three Industrial Revolutions* (Cambridge, MA, 1997), pp. 351-393; Emerson W. Pugh, *Building IBM: Shaping an Industry and Its Technology*

(Cambridge, MA, 1995); Emerson W. Pugh, Lyle R. Johnson, and John H. Palmer, *IBM's 360 and Early 370 Systems* (Cambridge, MA, 1991); James W. Cortada, *Before the Computer: IBM, NCR, Burroughs, and Remington Rand and the Industry They Created* (Princeton, 1993).

<sup>140</sup> Venture Development Corporation, *Venturecasts: The 1986 Computer Data Book*, p. 114.

<sup>141</sup> For an economic analysis of these general strategic issues, see Cynthia A. Montgomery and Birger Wernerfelt, "Risk Reduction and Umbrella Branding," *Journal of Business* 65, no. 1 (1992), pp. 31-50.

<sup>142</sup> Pitta, "Why Dell is a Survivor," pp. 86, 91.

<sup>143</sup> Stephanie Anderson Forest, "Customers 'Must be Pleased, Not Satisfied,'" *Business Week* (August 3, 1992), p. 52.

<sup>144</sup> Dell and Fredman, *Direct from Dell*, p. 19.

<sup>145</sup> Poe, "It's Not Bragging If You Can Do It," p. 27.

<sup>146</sup> Dell and Fredman, *Direct from Dell*, p. 27.

<sup>147</sup> Dell Computer Corporation, *Form 10-K 1989*, p. 2.

<sup>148</sup> Venture Development Corporation, *Venturecasts: The 1987 Consumer Electronics Data Book*, p. 10.

<sup>149</sup> Dell and Fredman, *Direct from Dell*, p. 27.

<sup>150</sup> Venture Development Corporation, *Venturecasts: The 1987 Consumer Electronics Data Book*, p. 7. European sales have been adjusted for inflation.

<sup>151</sup> Dell and Fredman, *Direct from Dell*, p. 28.

<sup>152</sup> Dell Computer Corporation, *Form 10-K 1989*, pp. 2-3.

<sup>153</sup> Kevin Kelly, "Michael Dell: The *Enfant Terrible* of Personal Computers," *Business Week* (June 13, 1988), p. 61.

<sup>154</sup> Dell Computer Corporation, *Annual Report 1990*, pp. 8-9.

<sup>155</sup> Dell Computer Corporation, *Annual Report 1989*, p. 20.

<sup>156</sup> Dell Computer Corporation, *Annual Report 1990*, pp. 8-9.

<sup>157</sup> Dell Computer Corporation, *Form 10-K 1989*, p. 13.

<sup>158</sup> By March 1989, Dell had 1,016 full-time employees in the United States and 168 in other countries. *Ibid.*, p. 7.

<sup>159</sup> Kelly, "Michael Dell: The *Enfant Terrible* of Personal Computers," p. 61. See also Dell Computer Corporation *Form 10-K 1989*, p. 6.

<sup>160</sup> Quoted in Kelly, "Michael Dell: The *Enfant Terrible* of Personal Computers," p. 61.

<sup>161</sup> Quoted in *ibid.* See also Gantz, "Tech Street: Dell Computer: Is Success Result of Luck or Vision?" p. 37 and Angrist, "Entrepreneur in Short Pants," p. 85.

<sup>162</sup> Kelly, "Michael Dell: The *Enfant Terrible* of Personal Computers," p. 61. See also Tom Richman, "The Entrepreneur of the Year," *Inc.* (January, 1990), p. 44 and Abby Livingston, "Growing Pains," *Venture* 10, no. 7 (July 1988), p. 96.

<sup>163</sup> Dell Computer Corporation, *Form 10-K 1989*, pp. 9, 13. After paying related fees, the company's net proceeds from the IPO were about \$31 million. Dell Computer Corporation, *Annual Report 1989*, p. 33.

<sup>164</sup> Dell Computer Corporation, *Proxy Statement* (May 5, 1989), p.2.

<sup>165</sup> Dell Computer Corporation, *Annual Report 1991*, p. 22.

<sup>166</sup> Stephanie Anderson Forest, "PC Slump? What PC Slump?" *Business Week* (July 1, 1991), p. 66.

<sup>167</sup> "Global Leaders," *Datamation* 38, no. 12 (June 15, 1992), p. 26.

<sup>168</sup> Dell Computer Corporation, *Annual Report 1991*, p. 7.

<sup>169</sup> *Ibid.*, pp. 3-4.

<sup>170</sup> *Ibid.*, p. 3.

<sup>171</sup> Dell Computer Corporation, *Form 10-K 1989*, p. 7.

<sup>172</sup> Steffens, *New Games*, p. 231. See also pp. 232-236. Price indexes are from Council of Economic Advisors, *Economic Report of the President* (Washington, D. C., 2000), p. 373.

<sup>173</sup> Geoffrey A. Moore, *Inside the Tornado: Marketing Strategies from Silicon Valley's Cutting Edge* (New York, 1995), pp. 6-7.

<sup>174</sup> Between 1985 and 1991, Dell Computer's sales grew at annual rates of almost 75%, almost three times the estimated 20 to 30% annual growth for the PC industry as a whole. See R. Martin, "Dell Computer—Company Report," Prudential Securities (April 12, 1991), p. 9; Steffens, *New Games*, pp. 236-241.

<sup>175</sup> Dell Computer Corporation, *Annual Report 1989*, p. 21.

<sup>176</sup> Dell and Fredman, *Direct from Dell*, p. 36.

<sup>177</sup> In fiscal 1989, Dell inventories increased almost \$80 million, an almost eightfold rise over the increase in inventories in fiscal 1988. By fiscal 1990, Dell inventories had declined \$35.7 million. Dell Computer Corporation, *Annual Report 1990*, p. 26.

<sup>178</sup> Dell and Fredman, *Direct from Dell*, p. 37.

<sup>179</sup> Dell Computer Corporation, *Annual Report 1990*, p. 17.

<sup>180</sup> See, for example, E. C. Zimits "Dell Computer Corporation—Company Report," Rauscher, Pierce, Refsnes, Inc. (October 23, 1989), p. 3; Stephanie Anderson Forest, "The Education of Michael Dell," *Business Week* (March 23, 1993), p. 83.

<sup>181</sup> Dell and Fredman, *Direct from Dell*, p. 37.

<sup>182</sup> Magretta, "The Power of Virtual Integration: An Interview with Dell Computer's Michael Dell," p. 76.

<sup>183</sup> In 1992, PC sales in superstores and big discounters totaled \$2.8 billion. S. L. Eskenazi, "Dell Computer Corporation—Company Report," Alex Brown & Sons (May 8, 1992), p. 5.

<sup>184</sup> Dell Computer Corporation, *Annual Report 1993*, p. 4.

<sup>185</sup> See, for example, Forest, "The Education of Michael Dell;" Peter Burrows and Stephanie Anderson Forest, "Dell Computer Goes Into the Shop," *Business Week* (July 12, 1993), pp. 138-140; and Kidder, Peabody & Co., "Dell Computer Company Report," (June 1, 1993), pp. 1-2.

<sup>186</sup> Rangan and Bell, "Dell Online," p. 10.

<sup>187</sup> *Ibid.*, p. 11.

<sup>188</sup> "Dell Tailors Web for Business," [Inter@ctive](#) Week (June 9, 1997), p. 19.

<sup>189</sup> Dell Computer Corporation, *Annual Report 2000*, p. 2.

<sup>190</sup> Dell Computer Corporation, *Form 10-K 2000*, p. 30; Therese Poletti, "Computer Shipments Take Unexpected Leap," *Toronto Star* (April 26, 1999); "Data Basics: Dell Tops Compaq in U.S. Sales," *Washington Post* (October 28, 1999), p. E6; "Japan: Global PC Shipment Rises 15%—Data Quest," *Reuters English News Service* (April 4, 2000).