Amazon.com versus Barnes & Noble: The Battle of the Bookstores and the Future of Electronic Commerce

The recent romantic comedy You've Got Mail pits scrappy independent bookseller Meg Ryan against mega store operator Tom Hanks, using the characters' commercial rivalry as a backdrop for their blossoming affection. But in the real world, the joke may be on both of them: Internet-based commerce, which requires no physical retail outlets of any size, is changing the shape of the bookselling industry.

Amazon.com and Barnes & Noble compete fiercely for shares of the book retail market. Amazon.com, founded by CEO Jeff Bezos in 1994 in his Seattle garage, never owned a single retail store; all its sales from day 1 have taken place from its Internet storefront. Barnes & Noble was a century-old storefront on New York's Fifth Avenue until entrepreneur Leonard Riggio bought it in 1971; today it's a retail giant with more than 1000 stores, plans to open 500 more stores in the next decade—and a new Internet arm of its own, barnesandnoble.com.

Two completely different business models, each with advantages and disadvantages, are going head-to-head for the same consumer dollars. Will one prevail? Can both survive?

Amazon.com is widely regarded as the first significantly successful enterprise to sell traditional consumer goods over the Internet and the epitome of retail electronic commerce. According to analyst Lauren Cooks Levitan, "when you think of Web shopping, you think of Amazon.com first."

Customers shop by visiting www.Amazon.com, a World Wide Web site where they can search among more than 3 million book titles and purchase ones they like by entering a shipping address, credit card number, and other information. After the first purchase, the customer's shipping and credit card information are stored securely in Amazon.com's information system. The next time, it only takes a single mouse click to complete an order. Amazon.com makes it very easy to buy a book on-line.

Making the customer's on-line experience warm and pleasant is a key Amazon.com strategy. The site retains information on each customer and even uses an information technology called collaborative filtering to recommend books based on the past purchases of buyers with similar histories. In addition to the personalization afforded each shopper, the site allows readers to post their own reviews of books, offers profiles of authors, and includes staff recommendations. The result has been a perception among customers that they share a relationship with the company—one they value so highly that in February, 1999, when it was revealed Amazon.com accepted payment from publishers to have books placed on recommended lists, widespread protests led the company to include disclaimers on the site and to broaden its merchandise return policy.

Not only does Amazon.com lack a physical bookstore; it almost lacks books. Only a fraction of the titles available on its Web site are actually on shelves in one of its two warehouses. Most of the time, Amazon.com doesn't order a particular book from a distributor until after a consumer has ordered it from Amazon.com. One advantage to this structure is that Amazon.com could avoid the overhead and carrying charges associated with a large inventory. In its first few years of operation, the company could turn its inventory over about 26 times a year. But a more important advantage lies in the way this arrangement affects Amazon.com's cash flow. Amazon.com charges a customer's credit card as soon as it ships that customer's book, and the credit card companies usually pay Amazon.com within a day. Amazon.com, however, takes an average of a month and a half to pay the book distributor for the book. Whereas most companies have to pay to finance sales, Amazon.com's negative operating cycle lets it profit from the use of its customers' money. Amazon.com has counted on earning about $25 million each year from the float, enough to cover many of its operating expenses.

Physical bookstores such as Barnes & Noble, in contrast, must stock up to 160 days of inventory to provide enough selection to satisfy customers. The bookseller must pay distributors and publishers 45 to 90 days after it purchases the books, carrying the costs of those books for up to four months.

However, because Amazon.com has no stores for people to walk into, it has to invest large sums in advertising in order to generate virtual foot traffic, or visits to its Web site. One-way Amazon.com works to attract visitors is through links from other Web sites, a technique that traditional brick-and-mortar outlets cannot duplicate. Soon after its launch, Amazon.com introduced a standing offer: Any Web site that gave Amazon.com a link (a button on its site that would connect users directly to Amazon.com) so customers could shop for books related to the site's subject matter would receive up to 15 percent of the sales that resulted from use of the link. Today this Associates Program boasts more than 140,000 participants. Still, Amazon.com has to pay for advertising space on popular Web sites, and it jockeys with its competition to forge exclusive arrangements with some of those sites. One Barnes & Noble executive compared Amazon.com's marketing costs to the premium a brick-and-mortar store pays for a good location that will generate foot traffic.

Amazon.com's operation would be impossible without sophisticated information systems, many of which have been created in-house. (Wal-Mart sued the bookseller in October 1998, claiming that it had raided Wal-Mart's executives to steal its computerized distribution secrets.) In addition to the collaborative filtering system that enables Amazon.com to make individualized recommendations to its customers and the database that supports it, the company relies on sophisticated inventory, shipping, and billing systems. Although information technology has been Amazon.com's strength, it has also given the company a weakness that brick-and-mortar stores don't face: Twice in 1998, inadequate backup systems put Amazon.com out of action for as long as nine hours at a time.

Having made a name for itself in the book business, Amazon.com has moved aggressively into selling other product categories, including CDs, electronics, software, toys, videos, tools and hardware, lawn and patio, and kitchen goods. In late March 1999, Amazon began offering on-line auctions to compete with eBay, a popular on-line auction house. Some of these new product categories offer tie-in possibilities with Amazon.com's established book business and with each other. However, they operate on very low profit margins and require Amazon.com to keep a larger inventory on hand, which has eroded some of the advantage of its on-line structure.

In addition to retail sales, Amazon.com generates revenue from its customer base by selling publishers and others preferred access to its customers and by earning a commission for directing its customers to other on-line retailers through its Web site. The Amazon.com Web site provides a special portal to many small independent retailers through its ZShops.

In large part because of its marketing expenses, Amazon.com has never shown a profit. Since its launch in 1995, the company has lost nearly $1.2 billion. Amazon.com founder Bezos says he is able to tolerate the company's severely low ledger because he views the conditions behind it as temporary. His chief operating principle has been to get big fast—to establish market dominance quickly, even at a high cost, to set up the company for long-term success. "Our advantage is that we know more about e-commerce than anybody else," Bezos said. "We've been doing it longer, and we've already levelled the playing field."

But industry analysts question his wisdom. Amazon's losses have come not only from heavy investments in marketing and expansion plans but from the costs of each sale. When costs such as product development, warehousing, and fulfilment are added to marketing, the total has been greater than the total amount of revenue generated from Amazon's sales. Amazon has had to build distribution centres for much of its inventory, slowing down inventory turnover

Like Amazon.com, Barnes & Noble prides itself on offering customers a pleasant shopping experience. Under the direction of the iconoclastic Riggio, the chain's superstores have become "modern village greens" where people are encouraged to spend time, peruse a book over some coffee, or attend a reading or children's story time. Cathedral ceilings and hand-lettered signs are calculated to soften the feel of visiting a bookstore, which Riggio says, has traditionally been "elitist and stand-offish."

Despite innovations in presentation, Barnes & Noble still faces the challenges that any physical store must overcome—and that Amazon.com avoids. It must carry huge inventories, and it uses information systems to track sales of individual titles so that nonperforming ones can be removed from shelves in as little as 120 days. Its array of more than 1000 stores requires an army of personnel, more than 27,000 employees. Amazon.com employs only about 7600, of which 1600 are for its book sales. The physical plant of each Barnes & Noble store represents an expense as well.

Barnes & Noble's size shapes the way it does business—enabling it to command discounts from book distributors and offer them to customers—and the way it is perceived. The chain's hallmark, the stand-alone superstore with as many as 10 times more titles than at a traditional bookstore, was introduced in 1991, but controversy over Barnes & Noble's influence did not begin there. When the chain bought B. Dalton in 1996 to become the nation's largest bookseller, critics in the literary world feared that too great a concentration of the retail book market in one company's hands would spur a focus on best-sellers at the expense of small publishers and their often obscure titles. "The day I bought B. Dalton is the day I became a common enemy," Riggio said. He later added the Scribner and Doubleday & Co. mall chains to Barnes & Noble, only fuelling complaints about his hold on the nation's book market. "Leonard Riggio wields immense power over the long-term health of our culture," Todd Gitlin, culture professor of New York University, said recently.

However, best sellers made up only 3 percent of Barnes & Noble's total sales in 1997, which is similar to the figures reported by other bookstores, and some small publishers have acknowledged that Barnes & Noble's huge shelf space (typically 150,000 titles) leaves room for more diversity than at smaller stores. Barnes & Noble's share of the U.S. book market has grown to about 25 percent, more than double its 1991 share, and only 35 buyers choose books to be sold in the chain's stores. The ABA sued Barnes & Noble and competitor Borders in April 1998, claiming that the chains illegally coerced distributors to give them secret discounts and other advantages.

In mid-1997, with Amazon.com already three years out of the gate, Barnes & Noble joined the Internet fray with the launch of barnesandnoble.com. The imprimatur of the nation's largest traditional bookseller and the parent company's deep pockets were unquestionable assets, but the coming battle would be on Amazon.com's turf. "Amazon.com stole its major market position by acting faster, and now Barnes &

Noble is playing catch-up ball," consultant John Hyland of McFarland Dewey & Co. said. And Renaissance IPO Fund analyst Linda Killian said the venerable book giant was entering the e-market from a position of weakness, not strength: "Barnes & Noble has a mindset of a bricks-and-mortar bookseller, and in some ways that's retarded their development." Bbarnesandnoble.com's customer base is much smaller than Amazon.com's book customer base, and Amazon.com remained far ahead in its number of links with other Internet sites.

However, Barnes & Noble has made some powerful alliances in its bid to catch up. In December 1998, it teamed up with Microsoft to become the exclusive bookseller for users who click the book-shopping category on the MSN network. (By previous arrangements, Amazon.com's paid ad/links will still appear on some Microsoft pages, and Amazon.com has a similar deal with Microsoft to remain its exclusive music seller.)

More significant, though less visible to the consumer, is barnesandnoble.com's October, 1998, sale of a 50 percent stake to the German publishing giant Bertelsmann AG—right after Amazon.com's Bezos had spurned Bertelsmann's offer of a similar partnership with him. "This venture has one purpose—to compete with Amazon.com in the U.S.," said Bertelsmann CEO Thomas Middelhof. Bertelsmann owns Random House and other publishers, which may enable barnesandnoble.com to offer price war discounts on titles from those houses. Barnes & Noble expects its partnership with Bertelsmann to help it expand into European markets and is also hoping that as Amazon.com expands into more areas of retailing, it will leave key sections of the book market open to a more specialized company.

Retailing is a business with very thin profit margins, leading some analysts to question whether Amazon.com will ever be profitable. If Amazon.com keeps moving into new markets, costs will continue to escalate. Analysts estimate that Amazon.com spent nearly $200 million in marketing in 1999, 50 percent more than a year earlier. While Amazon.com has never made a profit, Barnes & Noble has been solidly profitable.

On average on-line retailers have spent $26 per sale in advertising and marketing, whereas their physical counterparts spent only $2.50. Until Amazon.com and other retailers figure out a way to attract and retain customers without such enormous outlays, they will have a hard time making any money. As Merrill Lynch analyst Jonathan Cohen put it, Amazon.com has shown that "it can sell lots of books for less without making money and now it has shown that it can sell lots of music for less without making money."

Moreover, as Amazon.com moves into new markets, it will face traditional retailers that are starting to sell on the Web, many quite successfully. In other areas besides books and entertainment products, Amazon.com may have trouble creating meaningful brand recognition.

However, if Amazon.com and other Internet retailers have enough customers and sales to pay off their marketing and technology investments, any additional revenue will register as profits, and those could be enormous. It is this hope that Amazon.com's business model will eventually win big that has fuelled its highly valued stock price.

If, as Bezos claims, his upstart Amazon.com has "levelled the playing field" against the mighty Barnes & Noble, the battle is likely to boil down to Amazon.com's superior grasp of Internet commerce versus Barnes & Noble's superior purchasing power. However, a key characteristic of electronic commerce is the ephemeral nature of any advantage. Unless the balance shifts decisively because of some unforeseen innovation or a change in alliances, razor-thin margins will make it difficult for both sides to sustain the pitched battle indefinitely.

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1. Analyse both Amazon.com and Barnes & Noble using the value chain and competitive forces models.
2. Compare and evaluate the business models used by Amazon.com and Barnes & Noble. What are their core competencies? What role does the Internet play in each of these business models?
3. How viable is each business model? Explain your answer
4. Which company will dominate the book retailing industry? Explain your answer.

Can Boeing Fly High Again?

The Boeing Company of Seattle is the single largest exporter in the United States and the number one commercial aircraft producer in the world, with at least 55 to 60 percent of the world market since the 1970s. Recently, it acquired new muscle in military and defense production when it purchased its longtime archrival, the McDonnell Douglas Corporation, and the aerospace and defense operations of Rockwell International. A few years ago, company profits started to nosedive, but it responded with two efforts. This case looks at the role played by information systems in both those efforts: the design process for the 777 line of commercial aircraft; and Boeing's attempt to modernize its aircraft production.

For years, Boeing had no serious competitors. Then Airbus Industrie entered the commercial airplane market, and by 1994 it commanded 28 percent of the market. The competition has become fierce. Boeing and Airbus agree that air traffic will triple over the next 20 years, and Airbus has made jumbo jets the main focus of its current and future strategy. Airbus management believes that jumbo jets are a key to the future because they will be needed to fly the increased mass of passengers. They project that few new airports will be built over the next several decades, despite the expected explosion in air traffic. Moreover, they foresee increasingly stringent environmental restrictions that will require fewer planes. In addition Airbus believes that operational costs are key and that a newly designed jumbo jet will greatly reduce those costs. Therefore the company's strategy has been to develop its new jumbo A3XX-100. While the Boeing 747-400 jumbo has a seating capacity of 420, a range of 8300 miles, and a length of 231 feet, Airbus's A3XX-100 will be virtually the same length, 232 feet, and will fly 8400 miles. However its seating capacity is 550 or more. Moreover, Airbus expects that its operation costs will be nearly 20 percent less than those of the 747-400.

Boeing has a very different vision. Its management concludes that the passenger expansion will require smaller, longer-range planes. Boeing believes most travelers prefer to fly from their own city directly to their destination, for example, Detroit-to-Shanghai rather than Detroit-to-Tokyo-to-Shanghai. Such flights do not need jumbo jets. Quite the contrary, Boeing management believes passengers do not want to fly in planes with more than 400 passengers due to the long waits for boarding, deplaning, and customs processing. The company's strategy is to continue building smaller, long-range planes like its new 777, discussed below. Who is correct? Even the major airlines cannot agree. United Airlines prefers jumbo jets but American Airlines owns no 747s.

Boeing management committed itself to holding Airbus to no more than 40 percent of the market, which Airbus achieved in the mid-1990s. The two companies operate under very different conditions, and those conditions have favored Airbus in recent years. Production costs at Airbus are lower than at Boeing. As important, Airbus is government-subsidized. The company is actually a consortium of state-run European aerospace companies, and it has been treated as a vehicle to generate European jobs and prestige rather than for profit. In the past Boeing's innovation and quality gave it a crucial advantage. However, aircraft are now viewed more like commodities-the airlines no longer feel they must turn to Boeing for the best and most advanced.

Unfortunately for Boeing, its production process has been very inefficient. By competing on price, Boeing's profit margins have been cut very sharply. Its problems became most visible when Airbus's market share reached 45 percent in 1997.

Boeing began to address its problems early in the 1990s when orders for new planes had dropped. Boeing reduced its workforce by one-third while also moving to make design changes so that new planes would be significantly cheaper to purchase and operate than older ones. Management established a goal of reducing production costs by 25 percent and defects by 50 percent by 1998. They also set a goal to radically reduce the time needed to build a plane, for example, lowering the production time of 747s and 767s from 18 months in 1992 down to 8 months in 1996.

Why was Boeing so inefficient? Mainly because it has been making airplanes with the same World War II-era production process used to produce its famous B-17 and B-29 bombers. Over the following decades, Boeing had no competition and met no pressure requiring it to become more efficient. The Pentagon, a major customer, put no price pressure on Boeing because it had unlimited budgets due to the Cold War. The United States airline industry had been regulated for decades and their profits were protected, so they too put no price pressure on Boeing. All of this changed in the early 1990s with the end of the Cold War, airline deregulation, and the emergence of Airbus.

The WWII system worked well when Boeing was building 10,000 identical bombers, but it became a major headache when airlines wanted different configurations for each of their new aircraft. Today, every order for a plane or group of planes is customized according to the customer's requirement. So, for example, the seating arrangements and the electronic equipment will differ from order to order. In fact customers are given literally thousands of choices on each aircraft. Some are meaningful, such as the choice of engines, but others are meaningless, such as the location of emergency flashlight holders. Boeing offered far too many choices of colors, including 109 shades of white alone.

Boeing's production process was paper-intensive, with a final design of the Boeing 747 consisting of approximately 75,000 paper engineering drawings. Boeing designers long ago realized they would save much production time if they reused existing designs rather than designing each aircraft from scratch. However, the process of design customization was manual and took more than 1000 engineers a year of full-time work to complete. For every customization choice on every airplane built, hundreds of pages of detailed drawings needed to be drawn manually. To reuse old paper-aircraft configurations and parts designs, the engineers first needed to search through an immense number of paper drawings to find appropriate designs to reuse for the specific configuration. They then laboriously copied the old designs to use for the new plane. Inevitably, errors crept into the new designs-large numbers of errors, given the large numbers of design sheets-because of unavoidable copying mistakes.

For example, the bulkhead configuration affects the placement of 2550 parts, and 990 pages of manual drawings. Each drawing had to be manually tabbed for every configuration used. To make the problem worse, the alphanumeric code used on the tabs is so mysterious that it took an employee two years to learn. Thirty percent of these engineering drawings have been found to have coding errors and must be redrawn. And yet these drawings are used by the procurement department to know which parts to order and by manufacturing to determine how to assemble the parts. If a customer wanted to change the cockpit thrust-reverse lever from aluminum to titanium, Boeing employees would need to spend 200 hours on design changes and another 480 hours retabbing the drawings with customer identification codes. Planes were built in fits and starts, filling warehouses with piles of paper and years' worth of wasted byproducts. The process was so complex that Robert Hammer, Boeing's vice president in charge of production process reform, exclaimed: "You know the Baldrige prize for the best manufacturing processes? Well, if there was a prize for the opposite, this system would win it hands down."

Production did include the use of computers. However, it took 800 computers to manage the coordination of engineering and manufacturing and many of these did not communicate directly with each other. The list of parts produced by engineering for a given airplane was configured differently from the lists used by manufacturing and customer service. Ultimately the parts list had to be broken down, converted, and recomputed up to 13 times during the production of a single plane.

Another problem with manual design was that the staff needed to create life-size mock-ups in plywood and plastic to ensure that everything fit and that the pipes and wires that run through the plane are placed properly and do not interfere with other necessary equipment. They were also needed to verify the accuracy of part specifications. Building mock-ups was a slow, expensive, laborious process. At production time, errors would again occur when part numbers of specifications were manually copied and at times miscopied onto order sheets, resulting in many wrong or mis-sized parts arriving.

Engineers worked in separate fiefdoms based on their field of specialization. Some engineers designed the plane's parts, others assembled them, and others designed the parts' packing crates. They rarely compared notes. If production engineers discovered a part that didn't fit, they sent a complaint back to the designers located in another plant. The designers then pulled out their drawings, reconfigured the part to make it match drawings of the surrounding parts, and sent the new design back to the plant. Warehouses were filled with paper.

Boeing also had a massive supply chain problem. Five-to-six million parts are required for its large twin-aisle airplanes alone. Inventory of these parts has been handled manually, and the production sites became infamous for the large piles of parts not being used. Not surprisingly, Boeing inventory turned over only two to three times per year compared to 12 times a year in an efficient manufacturing operation. Needed parts often arrived late. Boeing had to assign about 300 materials planners in different plants just to find needed parts on the shop floor.

Boeing's first action to cut costs and make planes cheaper to fly was a decision early in the 1990s to computerize the design and production of its planned new Boeing 777. This new aircraft line was meant to dominate the twin-engine wide-body long-distance market that was just opening. The 777 aircraft carries 300 to 440 passengers. It is designed to fly with only two pilots, thus reducing operating costs. Also, using only two engines saves on fuel, maintenance, and spare parts. Among other new technology, the planes use a new electronic method of controlling elevators, rudder ailerons, and flaps which is easier to construct, weighs less, and requires fewer spare parts and less maintenance. With lighter materials and fewer engines, a 777 weighs 500,000 pounds, about 38 percent less than a 747. With other savings designed into the 777, Boeing claimed that it could reduce operational costs by 25 percent compared to other Boeing models. In addition the 777 was designed to please passengers. Ceilings are higher, coach seats are the widest available, and aisles are broader.

To develop the 777 faster and at a lower cost, Boeing management decided to move to paperless design by using a CAD system. The system also supported a team approach. The system is gigantic, employing nine IBM mainframes, a Cray supercomputer, and 2200 workstations. It stores 3500 billion bits of information. The system enables engineers to call up any of the 777's millions of parts, modify them, fit them into the surrounding structure, and put them back into the plane's "electronic box" so that other engineers can make their own adjustments. Boeing assembled a single parts list that can be used by every division without modification and without tabbing. In addition management established designÐproduction teams that brought together designers and fabricators from a range of specialties throughout the whole process. In this way changes needed for production were being made during design, thus saving time and money.

Ultimately the airplane was designed entirely on the computer screen and was initially assembled without expensive mock-ups. The CAD system proved to be more accurate than could have been done by hand. Moreover, the company reports that it exceeded its goal of cutting overall engineering design errors by 50 percent while designing and building a 777 in 10 months. Total cost to design and bring the 777 to production was $4 billion. Boeing made its first delivery of 777s on time to United Airlines on May 15, 1995, and the 777 commenced commercial service the following month.

Although computerizing the design of new aircraft proved a success, it did not solve all of Boeing's problems. Analysts agree that Boeing will not be designing other new airplanes for a long time so they will not have the opportunity to repeat the process. Production of other Boeing aircraft remained painfully inefficient. What Boeing needed was more efficient ways to manufacture its 737s, 747s, and other existing aircraft. The problem became a crisis when, after a commercial airline profit slump ended in the mid-1990s, demand for new aircraft jumped. Boeing took all orders it could to prevent them from going to Airbus, even though Boeing's production capabilities were insufficient for fulfilling the orders. The company determined it had to increase its passenger aircraft production from 18.5 planes per month in 1996 to 43 per month in 1997, more than doubling output in one year.

In 1994 Boeing had initiated a process improvement program known as Define and Control Airplane Configuration/Manufacturing Resource Management (DCAC/MRM) to streamline and simplify the processes of configuring and producing airplanes. Management quickly decided to limit customer configuration choices to a finite number of options packages. Special requests would be fulfilled, but only at an additional price. In addition they realized they were using 400 software production programs, each with its own independent database, to support production. The management team decided to replace these 400 programs with four interconnected, off-the-shelf software packages, one each for configuration, manufacturing, purchasing, and inventory control. This would enable everyone to work from the same database, offering data integrity and coordination. Each airplane was assigned its own unique identification number that could be used to identify all the parts required by that plane. Each airplane would have only one parts list, and it would be updated electronically during the production cycle. Management estimated that the project would cost $1 billion and would require more than 1000 employees but would pay for itself within two years. The project was implemented in stages to be fully operational by the year 2000.

Boeing decided to purchase enterprise resource processing (ERP) software. The team selected the Baan IV finance, manufacturing, and distribution modules from the Baan Co., of Putten, Netherlands. They selected Baan because it could be used to control the flow of parts, because it was based upon client/server architecture, and because it was considered particularly well suited for companies with multi-site hybrid manufacturing processes such as Boeing. The software also includes EDI links with external suppliers and database links for internal suppliers. "As soon as our ERP system determines we don't have enough of a certain part in the assembly line to satisfy an airplane," explained one production manager, "we can identify which supplier we need and where that supplier's part needs to be delivered." Boeing's goal was that 45,000 persons would use the system at 70 plants to coordinate commercial airplane manufacturing around the Baan system. Rollout completion was targeted for the end of 1997.

In addition to Baan's software, Boeing selected forecasting software from i2 Technologies, factory floor process planning software from CimLinc, product data management software from Structural Dynamics Research, and a product configuration system from Trilogy.

The biggest challenge for the project was selling process changes to the lines of business. Therefore, the project started with an emphasis upon training. Boeing offered an eight-week knowledge transfer course on the new systems. Due to the past culture of independence and isolation of each department, the company also offered cross-functional training. The goals were to reduce the isolation of each of the various areas such as finance and engineering, and to help each understand the impact of any change made by one department on the other departments. On the assembly line, the goal was to change to lean manufacturing. Employees attended five-day "accelerated improvement workshops" where they brainstormed on ways to do their jobs more efficiently. Job changes included transforming the materials expediters into buyers who order raw materials from suppliers, letting the parts tracking be done by the new system.

The overall project was complex and sweeping, and so it should not be a surprise that the results have been mixed. One key question has been the viability of the ERP system. Baan was a relatively small company, with 1996 sales of $388 million compared to sales of $2.39 billion for SAP, the ERP leader. Baan set itself a goal of catching up with SAP. To modernize the software, the company migrated its software to Windows NT and linked its applications to the Internet. However, analysts generally believe the company was trying to do too much too fast.

Boeing's project also ran into internal problems. Due to the jump in demand of the mid-1990s, it hired 38,000 workers from late 1995 through the end of 1997. Such a large new staff required much training due to the complex nature of the airplanes being built. Speeding up the intricate production process with so many new workers triggered many mistakes, causing delays. At the end of 1997, Boeing announced it would reduce its workforce by 12,000 during the second half of 1998, once its assembly lines were running more smoothly.

Although new orders were rising, many observers believe management was not focused on production. CEO Philip Condit's goal for Boeing was to transform it from the largest producer of commercial jet aircraft to the world's biggest aerospace company, forcing management to focus on swallowing McDonnell Douglas and Rockwell. "This company is trying to do so much at the same time-increase production, make its manufacturing lean, and deal with mergers," states Gordon Bethune, the CEO of Continental Airlines and a former Boeing executive and a supporter of Condit. In addition, according to Boeing's new CFO, Deborah Hopkins, senior management didn't understand the profit margins in selling jetliners. She has recently begun educating them on this and other key financial issues.

In 1997 Boeing was hit by the Asian economic crisis just as it was expanding its production and trying to reform its production process. Close to one-third of Boeing's backlog was from Asian customers, and most Asian airlines reported significantly reduced profits or losses. The crisis had a particularly negative effect on widebody orders. The Asian economic crisis proved to be much deeper and more prolonged than Boeing had first estimated.

The seriousness of the problems became public when Boeing announced its first loss in 50 years in 1997 as a result of production problems. In October the company halted production on two major assembly lines for a month. The main cause was late shipment of parts, preventing workers from installing components in the correct order. To catch up, extra work was required causing a huge increase in overtime and a jump of up to 30 percent in labor costs. In late 1997, Boeing also warned that production problems would reduce its 1998 earnings by $1 billion. By the spring of 1998 Boeing's backlog of 737s was 850 aircraft.

Production problems also affected Boeing customers. For example Gary Kelly, Southwest Airlines' CFO, told reporters in April 1998 that some of Southwest Air's expansion plans had to be postponed due to delayed delivery. Boeing had to compensate Southwest with millions of dollars for the delayed delivery.

In 1998 Boeing delivered 560 jetliners-a record. However, on December 1, 1998, Boeing announced a new round of production cutbacks extending into late 2000. Cutbacks were also announced for 757, 767, and 777 production. Job cutbacks at Boeing were increased to 48,000 for 1999. A staff cut of 10,000 was also announced for 2000. Boeing has also indicated it is having transition problems. "Right now, part of the company is in the new system, and part is in the old," explained Hammer. "So we constantly have to translate data from one to the other. We're in the worst of all worlds."

Nonetheless, Boeing management believes progress can be seen. By the end of 1998, the new ERP software was already running in four plants with 5000 users. By the end of 1998 CimLinc was rolled out to 19 parts plants. Plans call for rolling it out to engineering and sales employees by summer 1999. Production machines were changed and new tools were designed. In addition the whole company is now working from a single source for product data. A factory that builds wings for 737s and 747s has reduced production time from 56 to 28 days while eliminating unnecessary inventory. Another plant has shown an 80 percent reduction in cycle time for part flow. One machine fabrication plant in Auburn, Washington, reports it has reduced costs by 25 percent (its target), and 85 to 90 percent of the time it is delivering sales orders ahead of schedule (up from 65Ð75 percent under old methods). Alan Mulally, the president of Boeing's Commercial Airplane Group, in late 1998 said, "We delivered our planned 62 airplanes in November and we are on target to deliver 550 airplanes in 1998."

All of this demonstrates how Boeing has been whipsawed-expensive ramping up production to record levels due to great increases in orders, followed by sudden cutbacks due to world economic problems. It is interesting to note that Airbus has indicated it is not being affected by the Asian crisis and expects to maintain its planned 30 percent increase in production. Airbus is expanding its A320 production (rival to the 737), and observers note that the two expansions will result in a glut of this type of plane in a few years.

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1. Analyze Boeing’s competitive position using the competitive forces and value chain models.

2. What management, organization, and technology problems did Boeing have? How did they prevent Boeing from executing its business strategy?

3. How did Boeing redesign its airplane production process and information systems to support its strategy? How helpful were information systems in helping Boeing pursue this strategy?

4. What role does knowledge work systems play in Boeing’s business strategy? Evaluate the significance of that role.

5. What management, organization, and technology problems do you think Boeing encountered in building the 777 and redesigning its production process? What steps do you think they did take, or should have taken, to deal with these problems?

6. How successful has Boeing been in pursuing its strategy? In what ways do you consider its strategy sound? Risky?

Boo.com: Poster Child for Dot.Com Failure?

Boo.com arrived on the Internet scene promising its investors and online shoppers the treat of a profitable Web site and of high-quality, stylish, designer sportswear purchased easily from their office or home. Thanks to advanced widespread publicity, Boo.com became perhaps the most eagerly awaited Internet IPO (initial public offering of stock) of its time. However, the company declared bankruptcy only six months after its Web site had been launched and before the company could ever undertake an IPO. Investors lost an estimated $185 million while shoppers faced a system too difficult for most to use. Many people are still wondering how it could have all gone so wrong so swiftly.

The idea for Boo.com came from two 28-year old Swedish friends, Ernst Malmsten and Kajsa Leander, who had already established and later sold Bokus.com which was the world's third-largest online bookstore after Amazon.com and Barnes & Noble. The two were joined by Patrik Hedelin, an investment banker at HSBC Holdings. Boo planned to sell trendy fashion products over the Web, offering such brands as North Face, Adidas, Fila, Vans, Cosmic Girl and Donna Karan. The Boo business model differed from other Internet startups in that its products would be sold at full retail price rather than at discount. Malmsten labeled his target group as "cash-rich, time-poor."

The Boo Web site enabled shoppers to view every product in full color 3-D images. Visitors could zoom in to individual products, rotating them 360 degrees so visitors could view them from any angle. The site's advanced search engine allowed customers to search for items by color, brand, price, style, and even sport. The site featured a universal sizing system based on size variations between brands and countries. Visitors were able to question Miss Boo, an animated figure offering fashion advice based on locale or on the specific activity (such as trekking in Nepal). Boo.com also made available a telephone customer service advice line. In addition, Boo was to feature an independently run fashion magazine to report on global fashion trends. Future plans included expansion into Asia and a site targeted at young teenagers. Those who purchased products from Boo.com earned "loyalty points" which they could use to obtain discounts on future purchases.

The company offered free delivery within one week and also free returns for dissatisfied customers. The Web site was fluent in seven languages (two of which, American and British English, were extremely different). Local currencies were accepted from the 18 original countries, and in those countries national taxes were also calculated and collected. Taxation was particularly complex because so many countries could be involved in one transaction. "Boo.com will revolutionize the way we shop…It's a completely new lifestyle proposition, " Ms. Leander proclaimed. The founders planned to advertise its site broadly both prior to launching and after. "We are building a very strong brand name for Boo.com," stated Malmsten. "We want to be the style editors for people with the best selection of products. We decided from day one that we would want to create a global brand name."

Although many important financial giants rejected investment in Boo.com, J.P. Morgan & Co., an old-line investment bank, decided to back the project even though it had done no startups for many decades. According to The New York Times Morgan liked the concept "because Boo wouldn't undercut traditional retailers with cut-rate pricing as many e-retailers do." The Morgan bankers were also impressed by the two founders who had previously successfully launched an Internet company

(Bokus.com). Moreover, they were impressed by promised rewards of "55% gross margins and profitability within two years," according to the Times. Morgan found other early-stage investors, including Alessandro Benetton (son of CEO of Benetton), Bain Capital (a Boston high-tech venture capital company), Bernard Arnault (who has made a fortune in luxury goods), Goldman Sachs, and the very wealthy Hariri family of Lebanon.

With startup funds in hand, Malmsten and Leander set a target date of May 1999 for launching the Web site. Boo planned to develop both its complex Internet platform and customer-fulfillment systems from scratch. Management originally planned to launch in the United States and five European countries simultaneously, but soon expanded the number of countries to 18. It also wanted a system that would handle 100 million Web visitors at once. When the launch date began to loom close, management committed $25 million to an advertising budget, a huge sum for a startup. The company chose to advertise in expensive but trendy fashion magazines such as Vanity Fair as well as on cable television and the Internet. Malmsten and Leander even managed to appear on the cover of Fortune magazine before the Website had been launched.

With so much technical development to be accomplished, the company moved the target date back to June 21. As June approached management decided to open satellite offices in Munich, Paris, New York and Amsterdam. Several hundred people were hired to take orders from these offices once the site went live. However, the launch date had to be postponed again because of incomplete development, resulting in so many of the staff sitting idle for months. "With all those trophy offices, Boo looked more like a 1950s multinational than an Internet start-up," claimed Marina Galanti, a Boo marketing director.

By September the company had spent $70 million and so Boo undertook more fund-raising. With the pre-launch advertising campaign over months earlier, the Web site was finally launched in early November. The promised mass marketing blitz never materialized. With the original advertising campaign long over, observers commented that by raising people's interest while delaying the opening resulted in many disappointed and alienated potential customers. Moreover, the site reviews were terrible. At launch time, 40 percent of the site's visitors could not even gain access. The site was full of errors, even causing visitor computers to freeze. The site design, which had been advertised as revolutionary, was slow and very difficult to use. Only one in four attempts to make a purchase worked. Users of Macintosh computers could not even log on because Boo.com was incompatible with them. Users without high-speed Internet connections found that navigating the site was painfully slow because the flashy graphics and interactive features took so long to load. Angry customers jammed Boo.com's customer support lines. Malmsten indicated that the company actually wanted the negative press stories about usability problems in order to draw more attention to Boo.com. "We know the game and how to play it. If we didn't want to be in the press we wouldn't," he said. Sales in first three months amounted to only about $880,000 while expenses heavily topped $1 million per month. The Boo plan quickly began unraveling.

In December J.P. Morgan's representative on Boo.com's board of directors resigned, leaving no one from Morgan to advise the company. In late December with sales lagging badly and the company running out of cash, Malmsten was unable to raise enough additional investment, causing Boo to begin selling its clothing at a 40% discount. This changed Boo's public image and its target audience. However, Boo's advertising did not change to reflect this strategy shift. During December finance director and partner Patrik Hedelin left Boo's London headquarters to return to Stockholm permanently. This departure was not made public until late in January 2000. Rumors then spread that Hedelin had real differences with his two partners.

On January 25 Boo.com announced a layoff of 70 employees, starting its decline from a reported high of about 450 persons, a huge number for a startup. In late February J.P. Morgan resigned as a Boo.com advisor. According to reports it feared being sued by angry investors. In March, when sales reached $1.1 million, Boo was still spending far more than its income. In April, Boo's finance director Dean Hawkins resigned to take another Internet job. In that month Internet stocks plunged on the stock market, and plans for a Boo IPO were shelved. On May 4 Boo.com confirmed that the company had been unsuccessfully looking for further financing. Finally on May 17 Malmsten hired a firm to liquidate the company, announcing his decision the next day. He also indicated that the company had many outstanding bills it could not pay.

One problem leading to Boo.com's bankruptcy was its lack of overall project development planning and of management control—it just didn't exist. "When you strip away the sexy dot-com aspect and the technology out of it, these are still businesses that need the fundamentals—budgeting, planning, and execution," observed Jim Rose, CEO of QXL.com PLC, an online auction house. "To roll out in 18 countries simultaneously, I don't think even the biggest global companies like IBM or General Motors would take that on." None did. Boo, a startup, was the first to try such a feat. Noah Yasskin, an analyst with Jupiter Communications, said, "[Boo.com] had very little spending restraint to put it mildly." An example of its free spending mentality was its offices, which were rented in high-priced areas. For instance its London offices were located on Carnaby Street and in New York they were located in the West Village, both trendy, expensive neighborhoods. Numerous reports surfaced of employees flying first class and staying in five star hotels. Reports even surfaced that communications that could have gone by regular mail were routinely sent by Federal Express.

Many in the financial community noted the lack of oversight by the board. Management controlled most of the board seats, with only four being allocated to investors. However, those four investor representatives rarely attended board meetings. Moreover none had any significant retail or Internet experience. The board failed to offer management the supervision it clearly needed.

Serious technical problems contributed as well. Developing its own software proved slow and expensive. The plan required rich, complex graphics so visitors could view products from any angle. The technicians also had to develop a complex virtual inventory system because Boo maintained very little inventory of its own. Boo's order basket was particularly intricate because items were actually ordered from the manufacturer not from Boo, so that one customer might have a basket containing items coming from four or five different sources. The site also had to enable its customers to communicate in any one of seven languages and to convert 18 different currencies, a problem which the euro would only have somewhat reduced a year later. It also had to calculate taxes from 18 different countries. Developing all this complex software in-house caused one prospective investor to observe "It was like they were trying to build a Mercedes-Benz by hand."

Industry analysts observed that 99 percent of European and 98 percent of U.S. homes lack the high-capacity Internet connections required to easily access the graphics and animation on the Boo.com site. No Apple Macintosh computer could access the site. Navigating the site presented visitors special problems. Web pages existed that did nothing, such as the one visitors reported that displayed only a the strange message that “Nothing happens on this page—except that you may want to bookmark it.” Product descriptions were displayed in tiny one square inch windows, making descriptions not only difficult to read but also to scroll through. Boo developed its own, very unorthodox, scrolling method that people found unfamiliar and difficult to use. Moreover interface navigation was too complex. The Boo hierarchical menus required precise accuracy because visitors making a wrong choice had no alternative but to return to the top to start over again. Moreover, the icons were miniscule. One annoying aspect of the site was the constant presence of Miss Boo. While she was developed to give style advice to browsers and buyers, she was constantly injected whether the visitor desired her or not. Many visitors reacted as they might have if they were shopping in a brick and mortar store and had a live clerk hovering over them, commenting without stop.

On June 18 Fashionmall.com purchased the most of remnants of Boo.com, including its brand name, Web address, advertising materials and online content. (Bright Station PLC purchased the company’s software for taking orders in multiple languages to market to other online businesses that want to sell to consumers in other countries.) “What we really bought is a brand that has phenomenal awareness world-wide,” explained Kate Buggeln, the president of Fashionmall.com’s Boo division. The company plans to use the Boo brand name to add a high-end site similar to its long-existing clothing site. The new Boo.com was launched on October 30 with a shoestring $1 million budget. The site is much less ambitious than its earlier incarnation, acting primarily as a portal and does not own any inventory. It features about 250 items for sale ferreted out by a network of fashion scouts. Rather than getting bogged down in taking orders and shipping goods, Boo will direct customers to the Web sites that sell the merchandise they wish to purchase. Buggeln is optimistic about the Boo.com’s chances of success this time around. Boo has managed to attract a huge number of visitors, 558,000 in April 2000 alone compared with 208,000 for Fashionmall.com. Even when Boo.com was inactive, about 35,000 people visited the Web site each week.

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1. Analyze Boo.com's business model. How did it differ from more conventional retail Web site strategies? Why do you think the founders and investors of Boo were drawn to this unusual strategy?

2. What problems did Boo.com encounter trying to implement its business model? What management, organization, and technology factors contributed to these problems?

3. What could Boo.com have done differently that might have made the project successful?

DaimlerChrysler and GM: Organization Technology and Business Processes in the U.S. Auto Industry

This case illustrates how two giant automobile corporations, DaimlerChrysler and General Motors, have tried to use information technology to combat foreign and domestic competitors. The case explores the relationship between each firm's management strategy, organizational characteristics, business processes, and information systems. It poses the following question: How has information technology addressed the problems confronting the U.S. automobile industry?

On October 26, 1992 Robert C. Stempel resigned as chairman and CEO of the General Motors Corporation because he had not moved quickly enough to make the changes required to ensure the automotive giant's survival. To counter massive financial losses and plummeting market share, Stempel had announced 10 months earlier that GM would have to close 21 of its North American plants and cut 74,000 of its 370,000 employees over three years. Stempel was replaced by a more youthful and determined management team headed by Jack Smith.

GM's plight reflected the depths of the decline of the once vigorous American automobile industry in the late 1980s. Year after year, as Americans came to view American-made cars as low in quality or not stylish, car buyers purchased fewer and fewer American cars, replacing them mostly with Japanese models.

Ironically, at about the same time, the Chrysler Corporation announced strong earnings and looked forward to a new period of strength and prosperity. During the 1980s, Chrysler had struggled with rising costs and declining sales of mass-market cars. However, demand was strong for its minivans and the hot Jeep Grand Cherokee. A stringent cost-cutting crusade eliminated $4 billion in operating costs in only three years.

Ten years before, Chrysler had been battling bankruptcy and GM was flush with cash. Had Chrysler finally turned itself around? Was this the beginning of the end for the world's largest automobile maker? What is the role of information systems in this tale of two automakers and in the future of the U.S. automobile industry?

GENERAL MOTORS

General Motors is still the world's largest automaker, with employees in 35 countries. In the early 1990s, GM's U.S. auto business accounted for about 1.5 percent of the U.S. economy, down from 5 percent in the 1950s. Its sheer size has proved to be one of GM's greatest burdens. For 70 years, GM operated along the lines laid down by CEO Alfred Sloan, who rescued the firm from bankruptcy in the 1920s. Sloan separated the firm into five separate operating groups and divisions (Chevrolet, Pontiac, Oldsmobile, Buick, and Cadillac). Each division functioned as a semiautonomous company with its own marketing operations. GM's management was a welter of bureaucracies.

GM covered the market with low-end Chevys and high-end Caddies. At the outset, this amalgam of top-down control and decentralized execution enabled GM to build cars at lower cost than its rivals; but it could also charge more for the quality and popularity of its models. By the 1960s, GM started having trouble building smaller cars to compete with imports and started eliminating differences among divisions. By the mid-1980s, GM had reduced differences among the divisions to the point that customers could not tell a Cadillac from a Chevrolet; the engines in low-end Chevys were also found in high-end Oldsmobiles. Its own brands started to compete with each other. Under Roger Smith, CEO from 1981 to 1990, GM moved boldly, but often in the wrong direction. GM remained a far-flung vertically integrated corporation that at one time manufactured up to 70 percent of its own parts. Its costs were much higher than either its U.S. or Japanese competitors. Like many large manufacturing firms, its organizational culture resisted change. GM has made steady improvements in car quality, but its selection and styling have lagged behind its U.S. and Japanese rivals. GM's market share plunged from a peak of 52 percent in the early 1960s to just 29 percent today. In 1979, GM's market share was 46 percent.

GM created an entirely new Saturn automobile with a totally new division, labour force, and production system based on the Japanese "lean production" model. Saturn workers and managers share information, authority, and decision-making. The Saturn car was a market triumph. But Saturn took seven years to roll out the first model and drained $5 billion from other car projects. GM had been selling Saturn at a loss to build up market share.

CHRYSLER

In auto industry downturns, Chrysler was always the weakest of Detroit's Big Three auto makers (GM, Ford, and Chrysler). Founded in the 1930s by Walter P. Chrysler through a series of mergers with smaller companies such as Dodge and DeSoto, Chrysler prided itself on superior engineering, especially in engines and suspensions. In the 1940s and 1950s, Chrysler grew into a small, highly centralized firm with very little vertical integration. Unlike Ford and GM, Chrysler relied on external suppliers for 70 percent of its major components and subassemblies, becoming more an auto assembler than a huge vertically integrated manufacturer such as GM. Although Chrysler did not develop a global market for its cars to cushion domestic downturns, its centralized and smaller firm could potentially move faster and be more innovative than its larger competitors.

During the late 1980s, Chrysler lost several hundred thousand units of sales annually because it did not make improvements in engine development and in its mass-market cars—the small subcompacts and large rear-wheel drive vehicles. There was no new family of mid-priced, mid-sized cars to rival Ford's Taurus or Honda's Accord. Customers could not distinguish Chrysler's key car models and brands from each other, and thus migrated to other brands. By the early 1990s, fierce price-cutting had upped Chrysler's breakeven point (the number of cars the firm had to sell to start making a profit) to 1.9 million units, up from 1.4 million.

GM's Information Systems Strategy

Despite heavy investment in information technology, GM's information systems were virtually archaic. It had more than 100 mainframes and 34 computer centres but had no centralized system to link computer operations or to coordinate operations from one department to another. Each division and group had its own hardware and software so that the design group could not interact with production engineers via computer. GM adopted a "shotgun" approach, pursuing several high-technology paths simultaneously in the hope that one or all of them would pay off. GM also believed it could overwhelm competitors by outspending them. GM also tried to use information technology to totally overhaul the way it ran its business.

Recognizing the continuing power of the divisions and the vast differences among them, Roger Smith, CEO of GM from 1981 to 1990, sought to integrate the manufacturing and administrative information systems by purchasing Electronic Data Systems (EDS) of Dallas for $2.5 billion. EDS has supplied GM's data processing and communications services. EDS and its talented system designers were charged with conquering the administrative chaos in the divisions: more than 16 different electronic mail systems, 28 different word processing systems, and a jumble of factory floor systems that could not communicate with management. Even worse, most of these systems were running on completely incompatible equipment.

EDS consolidated its 5 computing centres and GM's 34 computing centres into 21 uniform information processing centres for GM and EDS work. EDS replaced the hundred different networks that served GM with the world's largest private digital telecommunications network. In 1993, EDS launched the Consistent Office Environment project to replace its hodgepodge of desktop models, network operating systems, and application development tools with standard hardware and software for its office technology.

GM started to replace 30 different materials and scheduling systems with one integrated system to handle inventory, manufacturing, and financial data. Factory managers can receive orders from the car divisions for the number and type of vehicles to build and then can create an estimated 20-week manufacturing schedule for GM and its suppliers. The system also sends suppliers schedules each morning on what materials need to be delivered to what docks at what hour during that manufacturing day.

Smith earmarked $40 billion for new plants and automation, but not all investments were fruitful. He spent heavily on robots to paint cars and install windshields, hoping to reduce GM's unionised work force. At first, however, the robots accidentally painted themselves and dropped windshields onto the front seats. Although a number of these problems were corrected, some robots stand unused today. The highly automated equipment never did what was promised because GM did not train workers properly to use it and did not design its car models for easy robot assembly. Instead of reducing its work force, GM had workers stay on the line because of frequent robotic breakdowns.

Chrysler's Information Systems Strategy

In 1980, with $2.8 billion in debt, Chrysler seemed headed for bankruptcy. Its financial crisis galvanized its management to find new ways to cut costs, increase inventory turnover, and improve quality. Its new management team led by Lee Iacocca instituted an aggressive policy to bring its computer-based systems under management control. Chrysler didn't have the money to invest in several high-technology paths at once. It adopted a "rifle" approach to systems: Build what was absolutely essential, and build what would produce the biggest returns. Chrysler focused on building common systems—systems that would work in 6000 dealer showrooms, 25 zone offices, 22 parts depots, and all of its manufacturing plants.

Chrysler built integrated systems. When an order is captured electronically at the dealer, the same order is tied to production, schedules, invoices, parts forecasts, projections, parts and inventory management, and so forth. Chrysler's low degree of vertical integration put the company in a better position to concentrate on only a few technologies. Because it was more of an auto assembler and distributor than a manufacturer, it had less need for expensive manufacturing technologies such as vision systems, programmable controllers, and robotics, all of which are far more important to GM and Ford.

Chrysler directed most of its information systems budget to corporate-wide communications systems and just-in-time inventory management. Just-in-time (JIT) inventory management is obviously critical to a company that has 70 percent of its parts made by outside suppliers. (JIT supplies needed parts to the production line on a last-minute basis. This keeps factory inventory levels as low as possible and holds down production costs.) During the 1980s, Chrysler achieved a 9 percent reduction in inventory and an increase in average quarterly inventory turnover from 6.38 times to 13.9 times. A single corporation-wide network connects Chrysler's large and mid-sized computers from various vendors and gives engineering workstations access to the large computers. This makes it easier to move data from one system, stage of production, or plant to another and facilitates just-in-time inventory management.

Chrysler had decided it needed a centralized pool of computerized CAD specifications that was accessible to all stages of production. In 1981, it installed a system to provide managers in all work areas and in all nine Chrysler plants with the same current design specifications. Tooling and design can access these data concurrently, so that a last-minute change in design can be immediately conveyed to tooling and manufacturing engineers. Chrysler created centralized business files for inventory, shipping, marketing, and a host of other related activities.

All this centralized management information makes scheduling and inventory control much easier to coordinate. Chrysler's cars and trucks share many of the same parts. Chrysler set up electronic links between its computers and those of its suppliers, such as the Budd Company of Rochester, Michigan, which supplies U.S. auto companies with sheet metal parts, wheel products, and frames. Budd can extract manufacturing releases electronically through terminals installed in all work areas and can deliver the parts exactly when Chrysler needs them. A new enhancement verifies the accuracy of advanced shipping notices electronically transmitted by suppliers and helps Chrysler track inventory levels and payment schedules more closely.

Learning from the Japanese

In the mid-1980s, MIT researchers found that the Toyota Motor Corporation's production system represented a sharp departure from Henry Ford's mass-production techniques. In "lean manufacturing," Japanese auto makers focused on minimizing waste and inventory and utilizing workers' ideas. The emphasis is on maximizing reliability and quality, and minimizing waste. The ideal "lean" factory has parts built just as they are needed and has a level of quality so high that inspection is virtually redundant. After studying Honda Motor Company, Chrysler started to cut $1 billion a year in operating costs and began to rethink virtually everything it did, from designing engines to reporting financial results. Chrysler overhauled its top-down autocratic management structure. It replaced its traditional rigid departments, such as the engine division, with nimble Honda-like "cross-functional platform teams." The teams combined experts from diverse areas such as design, manufacturing, marketing, and purchasing together in one location and were given the power to make basic decisions ranging from styling to choice of suppliers.

The platform teams work with suppliers early in the design process and give them more responsibilities. More than 300 resident engineers from supplier firms work side by side with Chrysler employees. A single supplier is held accountable for the design prototypes and production of a specific system or part, including responsibility for cost, quality, and on-time delivery. In the past, Chrysler chose suppliers on the basis of competitive bids. Development time was stretched because suppliers were not chosen until after designs were finalized. Chrysler spent 12 to 18 months sending out bids for quotations, analysing bids, and negotiating contracts with suppliers before suppliers were selected. Additional time would be wasted correcting problems with the suppliers' parts or systems that were discovered during manufacturing. Under this new collaborative relationship, Chrysler has reduced the number of suppliers by over 50 percent and shortened the production cycle.

Chrysler has asked suppliers to suggest operational changes that it could make to reduce its own costs as well as those of suppliers. Suppliers can use an on-line system to submit suggestions for making improvements. Chrysler and its suppliers can communicate using a common e-mail system. Nearly all suppliers have purchased Catia, Chrysler's preferred CAD/CAM software, to further coordinate their work. Chrysler now has five separate platform teams to design its large cars, small cars, jeeps, minivans, and trucks. Hourly workers provide input to help Chrysler eliminate wasted steps in the assembly process. Toyota cut waste by diagramming every step of its assembly process. It moved tools closer to the workers and eliminated unnecessary motions. Chrysler is now redesigning its assembly lines to be more like those of Toyota. Ten years ago, it took 6000 workers to build 1000 cars a day. Now Chrysler can achieve the same output with half that many workers.

Involving suppliers early in the design process, along with the platform team approach, has cut product development time by 20 to 40 percent while increasing quality. For example, Chrysler was able to develop its Durango utility vehicle in only 24 months. The Dodge Viper sports car was designed in only 36 months, a process that traditionally had taken Chrysler 4.5 years. Consequently, Chrysler's profit per vehicle leaped from an average of $250 in the 1980s to $2110 in 1994.

To support its new approach to product development, Chrysler built a new 3.5-million-square-foot Chrysler Technology Centre (CTC) 30 miles north of Detroit in Auburn Hills, Michigan. Chrysler leaders expect the CTC to further enhance productivity by providing the technology that will enable Chrysler to engineer things only once and not repeat them. For instance, a failed crash test in the past might have left engineers scratching their heads. Now they can compare crash data from a test with theoretical predictions, moving closer to a solution with each successive prediction cycle. Only when they need to test a solution would they actually have to crash another car. Because hand-built prototypes cost $250,000 to $400,000, avoiding a few crash tests has a large payoff. Using this approach, engineers designed the LH car so that it passed its crash test the first time out.

Every room in the CTC has eight-inch raised floors covering a total of 10,000 fiber-optic cables that can transmit massive volumes of data at high speed. These cables link CTC's buildings to its main data centre. The CTC itself is scheduled to house 10 mainframe computers, 2 supercomputers, and control systems for all the centre’s data and computer networks. A total of 7000 people work there.

GM similarly revamped its approach to production and product development. The company is moving away from traditional assembly lines into smaller working units called cells, in which workers have more opportunity to design their own processes and improve output. To combat GM's old culture of fiefdoms and interdivisional fighting that stifled innovation, Jack Smith replaced the old committee system with a single strategy board on which GM's top executives from manufacturing, engineering, sales and marketing, finance, human resources, logistics, purchasing, and communications work together on common goals. Every new GM car or truck must be explicitly targeted to 1 of 26 precisely defined market segments, such as small sporty cars or full-size pickup trucks. No two vehicles are allowed to overlap. A new launch centre at GM's engineering headquarters north of Detroit acts as a filter for all design ideas. Teams of engineers, designers, and marketers evaluate car and truck proposals for cost, marketability, and compatibility with other GM products. But unlike Chrysler and Japanese automakers, GM's teams are not empowered to make the important product development decisions. The power of the functional departments such as engineering and purchasing is still maintained.

Jack Smith has put even more emphasis than his predecessors on standardizing GM's business processes and parts, along with its information systems. He called for reducing the number of basic car platforms from 12 to 5. In the past, GM cars were built in plants dedicated to a single model; they seldom ran at full capacity. By reducing the potential variations of each model, GM can now build several models in the same plant; with fewer parts per car, the cars are much easier to assemble. With fewer platforms, GM can operate with fewer engineers, simpler more flexible factories, smaller inventories, more common parts, and greater economies of scale. The company is also adopting standard software that integrates computer-aided design and manufacturing processes.

Before Stempel stepped down, he initiated efforts to make GM's high parts costs more competitive. GM consolidated 27 worldwide purchasing operations into one at Detroit. GM required its company-owned suppliers to bid against outside suppliers, while pressuring outside suppliers for price reductions of up to 50 percent. In 1992, about 40 percent of GM parts were coming from outside suppliers versus 70 percent of the parts in Chrysler and 50 percent at Ford.

All these efforts have translated into more efficient and quality-driven production and lower costs. From 1991 until the beginning of 1994, GM removed $2800 in costs, before taxes, for every vehicle it manufactured. Assembly time for the Chevrolet Cavalier and the Pontiac Sunfire takes 40 percent less than the models they replaced. The number of parts for these vehicles has been cut by 29 percent.

Under Jack Smith, GM's earnings have continued to improve. The company has benefited from strong and diverse overseas operations and gradual reductions in labour and manufacturing costs in North America. More significantly, GM earned an average of $1000 for each car and light truck sold in North America, up from $500 per vehicle a year earlier. It sold relatively more high-profit vehicles.

Yet GM is still less efficient than its competitors. It still takes GM longer to make a Cavalier than it does Ford to make cars at its most efficient plants. It takes 46.5 hours to produce a GM vehicle, compared with 34.7 hours at Ford and 27.6 hours at Nissan. Production costs remain high because GM still buys a smaller proportion of its parts from outside suppliers than its competitors. (Ford earns $500 more per vehicle and Chrysler $900 more per vehicle than GM for this reason.) Even after strengthening its brand images, it still has too many models and too few the public actually wants, and an infrastructure of poorly located dealerships and under-utilised outdated factories. However, engineering problems and parts shortages have crimped production. Implementing new programs and flexible manufacturing, combined with stringent cost cutting, has proved extremely difficult. GM has yet to show that it can once again become an auto-making star.

From near collapse, Chrysler has emerged as a highly profitable cash machine. It continues to dominate the minivan market, and has launched successful new models such as the Jeep Grand Cherokee, the Chrysler Neon, the Chrysler Concorde, and Eagle Vision. One in six vehicles sold in the United States comes from Chrysler, up from one in seven in 1995.

Mergers and the Internet

On May 8, 1998, Chrysler and Daimler-Benz announced a merger of the two automobile companies, a merger that was completed during the autumn of that year. Together the two companies recorded $131 billion in sales in 1997. The new company, DaimlerChrysler AG, will maintain two headquarters, one in Michigan, and one in Stuttgart, Germany. The two companies have complementary strengths, making the rationale for the merger rather clear. Chrysler's presence in the United States is strong but in Europe is very limited, whereas Daimler's sales are focused heavily in Europe. By combining, both will have access to established, successful marketing organizations in the two largest automobile markets in the world. Moreover, the two companies offer very different, complementary lines of automobiles. Chrysler focuses on automobiles priced from $11,000 to $40,000. Daimler's luxury automobiles are much higher priced, starting about $30,000 and ranging up to $135,000. The merger also gives both greater access to each other's manufacturing facilities in various parts of the world, increasing their flexibility to move production to the best location depending upon cost and other key factors. Chrysler's ability to design and bring new automobiles to market rapidly should also be a great help to the Daimler portion of the new company.

Observers believe the biggest challenge in the merger is the culture clash. Germans and Americans tend to view business differently, and those differences will have to be overcome. For example, one company thinks in terms of luxury cars, the other in terms of mass sales—Daimler sold 726,000 vehicles in 1997 whereas Chrysler sold 2.3 million. Information systems problems seem to be limited. Years of integration effort have been avoided by the serendipitous fact that both companies use the same computer-aided design (CAD) system, and both also use SAP AG financial applications. The immediate challenges seem to be the need to build an integrated, robust communications infrastructure that will serve to unite the two organizations and to include suppliers and dealers. The newly formed company is also looking to cut $1.4 billion in IS costs during the first year and $3 billion more over the following three to five years. Most of the savings will come from personnel reductions and from cancelling previously planned application development.

As Detroit's automakers approach the twenty-first century, they face major changes in economic conditions and in the way cars are bought and sold. Today, at least one-fourth of all new car buyers use the Internet to research car purchases and shop for the best price, and that number is expected to reach 50 percent in a few years. A growing percentage are turning to on-line auto buying services where they can select a car and even take delivery at home without ever setting foot in a dealership. To compete with the on-line car buying services, DaimlerChrysler, GM, and Ford all have established Web sites where shoppers can select options, obtain price quotes, and even order their cars online. GM further enhanced its site to offer proprietary information such as special incentives on cars and dealers' actual inventory and to provide offers from other GM services such as home mortgages. The car buying sites are fighting back by offering financing and insurance on-line and by providing additional services to their users, such as e-mail notification of service reminders or manufacturers' recall announcements. In the hope of cutting costs, DaimlerChrysler, GM, and Ford have also teamed up to create an online purchasing system where they would obtain nearly $250 billion of the parts and other goods they need each year. All of these changes bring new challenges to U.S. auto companies as they look toward the future.

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1. Compare the roles played by information systems at Chrysler and GM. How did they affect the structure of the automobile industry itself?

2. How much did information systems contribute to GM’s and Chrysler’s success or failure?

3. What management, organization, and technology issues explain the differences in the way Chrysler and GM used information systems?

4. What management, organization, and technology factors were responsible for Chrysler’s and GM’s problems?

5. How did GM and Chrysler redesign their business processes to compete more effectively?

6. How important are information systems in solving the problems of the American automobile industry? What are some of the problems that technology cannot address?

Did the FAA Fly Off Course?

The Federal Aviation Administration (FAA), through its air traffic controllers, controls all commercial planes in the air in the United States. With many thousands of flights daily, the airspace of the United States is very crowded. The controllers give permission for landings and takeoffs, they approve flight paths, and they monitor all airplanes in flight. With so many airplanes, computer systems are vital to the success of the controllers.

The FAA has over 250 separate computer systems to manage. Before a flight, pilots file their flight plans, which are then entered into a computer. Once in the air, each plane continually transmits data to computers, including its flight number, location, and altitude. The computers also continually receive data from radar stations around the country and data from weather computers. The system keeps track of all planes in U.S. airspace, displaying their locations on a screen. These systems also have specialty functions, such as issuing warnings when two planes are coming too close or are flying too low. In today's world, controllers could not manage airplane traffic without these computers.

Controller applications are divided into two major types of systems. The airport control systems at all commercial airports control all aircraft when they are within 20--30 miles of the airport. The others, the Air Route Traffic Control (en-route) systems, operate at 20 centres around the country and control the high-altitude planes that are flying between their point-of-origin and their destination.

Many FAA computers were very old, particularly those used at the Air Route Traffic Control centres. Some even went back to the 1950s and were still using vacuum tubes. Until very recently, of the 20 en-route control sites, only New York, Chicago, Washington, Fort Worth, and Cleveland had modern ES/9121 mainframes. All the other 15 sites had IBM 3083 large computers that were at least 17 years old and had not even been produced or sold by IBM for 10 years.

These old computers have presented many problems. Despite their huge size, the old mainframes have less power than today's desktops. Spare parts were hard to obtain. Fewer and fewer technicians were available to keep these computers running. Being so old, these computers suffered many breakdowns. For example, from September 1994 to September 1995, 11 major breakdowns occurred. Small outages occur nearly every day at one site or another. To make matters worse, the FAA employs 5000 fewer computer technicians today than nine or ten years ago, despite the growing number of failures as the equipment ages. In addition to the age of the hardware, much of the software is 30 years old. Outdated software often cannot be updated due to the computers' age. Newer, more sophisticated software could make air travel much safer.

The FAA had backup systems, but they did not have many of the more sophisticated functions, such as the warnings when airplanes are too close or too low. Many were just as old as the front-line systems. In addition, the controllers' training in these systems is very limited. When the backups also fail, the controllers must switch to working with pilots while using slips of paper to keep track of each flight, an impossible task given the number of flights. At those times, many flights are not allowed to take off at the affected airports and flights due into those airports must be put into a holding pattern or diverted to other airports. This situation has cost airlines hundreds of millions of dollars yearly, and it cost passengers major delays and inconvenience.

Air traffic controllers suffer major stress under the best of circumstances. Many feel that the workload on controllers has been too heavy, partially due to all the manual processing the old systems require. Peter Neumann, a specialist in computer reliability and safety, said that "Controllers are under enormous pressure, and anything that goes slightly wrong makes their job inordinately harder."

The FAA, recognizing it had potential problems, began planning for upgrading in 1983. The project, labeled AAS (Advanced Automation System), called for a complete overhaul of its computers, software, radar units, and communications network. Its original goals were to lower operating costs, to improve systems reliability and efficiency, and to make flying safer. In 1988, the AAS contract was awarded to IBM. The projected was budgeted at $4.8 billion, and completion was targeted for 1994.

The project did not go well. In December 1990, IBM announced that the project was 19 months behind schedule. By late 1992, IBM announced that the project was now 33 months late, and it estimated that the cost had risen to $5.1 billion. The project was scaled back. In December 1993, the estimated cost of the now smaller project rose to $5.9 billion. In April 1994, an independent study commissioned by the FAA concluded that the project design has "a high risk of failure."

In June 1994, the FAA announced further major changes. The contract was shifted from IBM to Lockheed Martin Corp. In addition, major parts of the project were dropped, including a project to combine the two major controller systems; and another to replace the hardware and software that controls aircraft near the airports. The plan to replace control tower equipment at the 150 largest airports was downsized to include only the 70 largest airports. The estimated cost of the slimmed-down project was $6 billion and the planned completion date was postponed to the year 2000.

Meanwhile, signs of system aging were multiplying. For example, in June 1995 a computer outage at Washington Air Route Traffic Control Centre lasted 41 hours, while one in Chicago a year later lasted 122 hours. In August 1998 the Nashua, New Hampshire, centre, which is responsible for all of New England and part of New York, went down for 37 minutes. Even before this outage, there were many complaints of frozen radar screens and minor outages.

In September 1996 Lockheed announced a new project, the Standard Terminal Automation Replacement System (STARS). This announcement marked the end of AAS. Estimates of the cost of AAS ranged from $7.6 billion to $23 billion, and yet it failed to improve much of the FAA's IT infrastructure. STARS was planned to bring together flight-plan data, air-traffic automation systems, terminal-control facilities, and radar systems around the United States. The prime contractor this time was changed to Raytheon Co., of Lexington, Massachusetts.

STARS was targeted to replace the 22-year-old systems used by air traffic controllers to control flights near the airports. Its goals were to improve safety and reduce flight delays. It was to be installed at 317 airports and military bases, with installation beginning at Boston's Logan Airport in 1998. The project was scheduled to be completed in 2007 at an estimated cost of about $11 billion through 2003. The new system was supposed to have four computers at each site: one primary, one backup of the primary, and a second pair that mirrors the first (redundancy).

The FAA has been able to replace some of its old mainframe computers with newer ones and install colour radar display screens. The system crashes that used to force controllers to track planes on slips of paper are now rare. But serious problems remain. The FAA's modernization program continued to drag on. Expenditures for this program were expected to cost $40 billion through 2004 with no end in sight. The FAA's "new" mainframe computers are IBM models built in the 1990s that have already gone out of production. The FAA could not purchase the newest IBM computers because they would not run Jovial, a programming language from the 1960's used in the FAA's software. The FAA plans to switch to a more modern programming language but the conversion of its old software is very complex and will take some years to complete.

The FAA is in the process of rolling out a series of systems that that supposedly would improve the efficiency of takeoffs and landings at busy airports and allow some airplanes to fly more direct routes. However, these improvements did not address all of the air traffic control problems facing the FAA as air traffic continues to grow.

In early 2001, the FAA decided the updating of the long distance computer systems had even further delays and cost overruns. The FAA decided it should replace Raytheon on the project and return it to Lockheed Martin. The FAA claimed Lockheed Martin would be able to complete the contract by 2004 and would save the government at least $500 million. When the planned change became public opposition immediately emerged. Raytheon protested and said it wanted to make a new bid to be considered as well, but the decision to give the contract to Lockheed Martin had been made without competitive bidding. While the FAA was exempt from standard government rules for awarding contracts, in March 2001 an administrative judge ruled that the FAA decision was premature because it had "no rational basis." Others also objected because Transportation Secretary Norman Minetta had been a Lockheed vice president while a former Lockheed executive was expected to become Minetta's deputy.

Why did the FAA have so many problems upgrading its computers? One specific issue is the lack of a FAA systems architecture. The FAA did develop a logical architecture, titled the National Airspace System (NAS). This architecture document describes FAA's services and functions and then outlines the systems needed for both air traffic management and navigation systems. It even includes a systems plan through the year 2015. Thus, it gives a high-level overview of the business functions and the systems needed to serve them, including the interconnection between the various systems. However, the FAA did not then go on to translate this plan into the required physical or technical architecture. The FAA's air traffic control development work was assigned to one of the project's 10 teams, and the lack of a technical architecture has left all 10 teams to determine their own specific standards for developing the software, hardware, communications, data management, security, and performance characteristics.

Let's look at the results of the lack of standards. Of the 10 development teams, seven have no technical architecture at all. The other three developed their own architectures, and they are not the same. One result is the systems that feed the main computers use several different communications protocols and data formats. Of the three teams with standards, one architecture specifies Ethernet for networking while another specifies Fiber Distributed Data Interface (the two are incompatible). Two of the architectures specify writing programs in C and C++ whereas the third one specifies Ada. Altogether the 10 teams developed 54 air traffic control system applications using 53 different languages. Incompatibility is one result. Staffs are forced to spend time (and money) creating complex interfaces which also then must be supported. These translation programs also increase the possibility of data errors. Moreover, the use of multiple standards greatly increases staff training costs. The

February 1998 GAO report said that the result of the lack of an FAA uniform architecture is that "the FAA permits and perpetuates" inconsistencies and incompatibilities. It stresses that any organization must implement a technical architecture before it replaces an old computer system.

The FAA agreed that the report reflected a problem, but they pointed out that the FAA does have an informal architecture control system in place. "We don't envision having a complete document of technical specifications that we would publish," stated Steven Zaidman, FAA's director of system architecture. He added, "We're light-years ahead of where we were. We have learned from our past failures."

Congressional observers have severely criticized the culture of the FAA, characterizing its employees as being unwilling to face up to its problems. Rona B. Stillman, then the GAO's chief scientist for computers, stated that the "FAA has a culture that is averse to change and has entrenched autonomous organizations that tend not to respond to change."

Another issue appears to be the organization of the information systems function within the agency. As described, with 10 independent development organizations, the FAA lacks needed central control. Regionalized management appears not to work well. The 1997 GAO report concluded, "No FAA organizational entity is responsible for developing and maintaining the technical Air Traffic Control architecture." In its opinion, this leaves the agency "at risk of making ill-informed decisions on critical multimillion-dollar, even billion-dollar, air-traffic-control systems." The same report, in referring to the failure of the AAS project, determined that the "FAA did not recognize the technical complexity of the effort, realistically estimate the resources required, adequately oversee its contractors' activities, or effectively control system requirements."

The IT Management Reform Act of 1996, known also as the Clinger-Cohen Act, mandates major information technology (IT) reforms in government agencies, including a requirement that federal agencies have CIOs. The reason that the FAA has no such centralized management is that the agency successfully lobbied to have itself exempted from the act.

Yet another problem, cited by several labour representatives of the controllers' union, was the communications gap between the FAA management and the users of the traffic control systems. Management claimed positive results on the STARS project while the controllers apparently disagreed. Controllers have often spoken out in meetings, saying that STARS is cumbersome, that the controls are complex, and the terminal displays are unclear.

Related to the upgrade projects, airline security also became an important issue early in 2000. At the end of 1999 The General Accounting Office (GAO) discovered that the FAA had hired a number of foreigners to work on its computer upgrade projects, including Chinese, Pakistani, Ukrainian, British and Ethiopian nationals. This issue went before the U.S. House Committee on Science that then issued a statement that "The FAA has had real problems with computer security." Concern over this issue mushroomed when the September 11 attacks on the World Trade Centre and the Pentagon occurred. The Department of Transportation (DOT) recommended that airline reservation systems be updated to red flag suspected terrorists. That turned out to be a major problem because of the age of the systems, although it would have been relatively easy if these systems had been based on relational databases. But the old systems are very complex to update. Making the issue even more difficult to address, the airline reservation systems would have to be able to communicate with the FAA systems, an immensely complex technological problem. For example the reservation systems would have to be able to communicate with new avionics (aviation electronics) systems to be installed on commercial aircraft. While the FAA already had a system of that type, it was designed to handle about 3,500 aircraft flights daily, while in 2001 35,000 to 40,000 commercial airline flights occur daily. Moreover, these numbers are expected to grow rapidly over the next decade or two, making the task even more complex.

Still another problem has now emerged. In 1981 an air traffic controllers' strike occurred and ended when President Reagan fired over 11,000 controllers. Air traffic controllers usually retire after 20 years of service, and so many are beginning to retire as this case study is being written. The FAA indicates that perhaps 15,000 controllers will retire in the next year or two. So the FAA is faced not only with aging software and hardware but also with the aging of its controllers. Many problems must be faced with more success if the FAA's role in safeguarding the security of America's commercial passengers is to continue to be successful.

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1. List and explain the control weaknesses in the FAA and its air traffic control systems

2. What management, organization, and technology factors were responsible for the FAA's control weaknesses?

3. How effectively did the FAA deal with its control weaknesses? Evaluate the importance of the AAS and STARS projects for the FAA, for the air traffic controllers, and for the flying public.

4. Design a complete set of controls for the FAA to deal effectively with its control problems and the management of the FAA's information systems projects.

Ford and Firestone's Tire Recall: The Costliest Information Gap in History

On August 9, 2000, Bridgestone/Firestone Inc. announced it would recall more than 6.5 million tires, most of which had been mounted as original equipment on Ford Motor Co. Explorers and other Ford light trucks. Bridgestone/Firestone had become the subject of an intense federal investigation of 46 deaths and more than 300 incidents where Firestone tires allegedly shredded on the highway. The Firestone tires affected were 15-inch Radial ATX and Radial ATX II tires produced in North America and certain Wilderness AT tires manufactured at the firm's Decatur, Illinois, plant. This tire recall was the second biggest in history, behind only Firestone's recall of 14.5 million radial tires in 1978. The 1978 tire recall financially crippled the company for years to come and the August 2000 recall threatened to do the same. Consumers, the federal government, and the press wanted to know: Why didn't Ford and Firestone recognize this problem sooner? Let us look at the series of events surrounding the tire recall and the role of information management.

1988---Financially weakened from its 1978 tire recall, Firestone agreed to be acquired by Bridgestone Tires, a Japanese firm. To increase its sales, Firestone became a supplier of tires for Ford Motors' new sport-utility vehicle (SUV), the Explorer.

March 11, 1999---In response to a Ford concern about tire separations on the Explorer, Bridgestone/Firestone (Firestone) sent a confidential memo to Ford claiming that less than 0.1 percent of all Wilderness tires (which are used on the Explorer) had been returned under warranty for all kinds of problems. The note did not list tire separations separately but did say this "rate of return is extremely low and substantiates [Firestone's] belief that this tire performs exceptionally well in the U.S. market."

August 1999---Ford Motors announced a recall in 16 foreign countries of all tires that had shown a tendency to fail mainly because of a problem of tread separation. The failures were primarily on the Ford Explorer, and the largest number of tires recalled was in Saudi Arabia. Firestone produced most of the tires. (A year earlier, Ford had noted problems with tread separation on Firestone tires mounted on Explorers in Venezuela and had sent samples of the failed tires to Bridgestone for analysis.) Ford did not report the recall to U.S. safety regulators because such reporting was not required.

May 2, 2000---Three days after another fatal accident involving Firestone/Ford Explorer tread separations, the National Highway Transportation Safety Administration (NHTSA) opened a full investigation into possible defects with the Firestone ATX, ATX II, and Wilderness tires. The agency listed 90 complaints nationwide, including 34 crashes and 24 injuries or deaths. NHTSA also learned of the foreign recalls.

August 2000

August 9---At a news conference, Firestone announced that it would recall about 6.5 million tires that were then on light trucks and SUVs because they had been implicated in more than 40 fatalities. The company said it would replace all listed tires on any vehicle regardless of their condition or age. Firestone said it continued to stand by the tires. One Japanese analyst estimated the recall would cost the company as much as $500 million.

Firestone emphasized the importance of maintaining proper inflation pressure. Firestone recommended a pressure of 30 pounds-per-square-inch (psi), whereas Ford recommended a range of 26 to 30 psi. Ford claimed its tests showed the tire performed well at 26 psi and that the lower pressure made for a smoother ride. However, Firestone claimed underinflation could put too much pressure on the tire, contributing to a higher temperature and causing the belts to separate. Ford pointed out that, although NHTSA had not closed its investigation, the two companies did not want to wait to act. NHTSA had by now received 270 complaints, including 46 deaths and 80 injuries, about these tires peeling off their casings when Ford SUVs and some trucks traveled at high speeds.

August 10---Press reports asked why Ford did not act within the United States when it took action to replace tires on more than 46,000 Explorers sold overseas.

August 13---The *Washington Post* reported that the Decatur, Illinois, Firestone plant, the source of many of the recalled tires, "was rife with quality-control problems in the mid-1990s." It said, "workers [were] using questionable tactics to speed production and managers [were] giving short shrift to inspections." The article cited former employees who were giving testimony in lawsuits against Firestone.

August 15---The NHTSA announced it had now linked 62 deaths to the recalled Firestone tires. It also had received more than 750 complaints on these tires.

September 2000

September 4---The U.S. Congress opened hearings on the Firestone and Ford tire separation problem. Congressional investigators released a memo from Firestone to Ford dated March 12, 1999, in which Firestone expressed "major reservations" about a Ford plan to replace Firestone tires overseas. A Ford representative at the hearing argued it had no need to report the replacement program because it was addressing a customer satisfaction problem and not a safety issue. The spokesperson added, "We are under no statutory obligations [to report overseas recalls] on tire actions."

Ford CEO Nasser testified before a joint congressional hearing that "this is clearly a tire issue and not a vehicle issue." He pointed out that "there are almost 3 million Goodyear tires on Ford Explorers that have not had a tread separation problem. So we know that this is a Firestone tire issue." However, he offered to work with the tire industry to develop and implement an "early warning system" to detect signs of tire defects earlier, and he expressed confidence this would happen. He said, "This new system will require that tire manufacturers provide comprehensive real world data on a timely basis." He also said that in the future his company would advise U.S. authorities of safety actions taken in overseas markets and vice versa.
Nasser said his company did not know of the problem until a few days prior to the announcement of the recall because "tires are the only component of a vehicle that are separately warranted." He said his company had "virtually pried the claims data from Firestone's hands and analyzed it." Ford had not obtained warranty data on tires the same way it did for brakes, transmissions, or any other part of a vehicle. It was

Firestone that had collected the tire warranty data. Ford thus lacked a database that could be used to determine whether reports of incidents with one type of tire could indicate a special problem relative to tires on other Ford vehicles. Ford only obtained the tire warranty data from Firestone on July 28. A Ford team with representatives of the legal, purchasing, and communication departments; safety experts; and Ford's truck group worked intensively with experts from Firestone to try to find a pattern in the tire incident reports. They finally determined that the problem tires originated in a Decatur, Illinois, plant during a specific period of production and that the bulk of tire separation incidents had occurred in Arizona, California, Texas, and Florida, all hot weather states. This correlated with the circumstances surrounding tire separations overseas.

Firestone's database on damage claims had been moved to Bridgestone's American headquarters in Nashville in 1988 after Firestone was acquired by Bridgestone. The firm's database in warranty adjustments, which was regularly used by Firestone safety staff, remained at Firestone's former headquarters in Akron, Ohio.

After the 1999 tire recalls in Saudi Arabia and other countries, Nasser asked Firestone to review data on U.S. customers. Firestone assured Ford "that there was no problem in this country," and, Nasser added, "our data, as well as government safety data, didn't show anything either." Nasser said Ford only became concerned when it "saw Firestone's confidential claims data." He added, "If I have one regret, it is that we did not ask Firestone the right questions sooner."

September 8--The *New York Times* released its own analysis of the Department of Transportation's Fatality Analysis Reporting System (FARS). FARS is one of the few tools available to government to independently track defects that cause fatal accidents. The *Times* found "that fatal crashes involving Ford Explorers were almost three times as likely to be tire related as fatal crashes involving other sport utility vehicles." The newspaper's analysis also said, "The federal data shows no tire-related fatalities involving Explorers from 1991 to 1993 and a steadily increasing number thereafter which may reflect that tread separation becomes more common as tires age."

Their analysis brought to light difficulties in finding patterns in the data that would have alerted various organizations to a problem earlier. Ford and Firestone said they had not detected such a pattern in the data, and the NHTSA said they had looked at a variety of databases without finding the tire flaw pattern. According to the *Times*, without having a clear idea of what one is looking for makes it much harder to find the problem. The *Times* did have the advantage of hindsight when it analyzed the data.

The Department of Transportation databases independently track defects that contribute to fatal accidents, with data on about 40,000 fatalities each year. However, they no longer contain anecdotal evidence from garages and body shops because they no longer have the funding to gather this information. They only have information on the type of vehicle, not the type of tire, involved in a fatality. Tire involvement in fatal accidents is common because tires, in the normal course of their life, will contribute to accidents as they age, so that accidents where tires may be a factor are usually not noteworthy. In comparison, Sue Bailey, the administrator of highway safety, pointed out that accidents with seat belt failures stand out because seat belts should never fail. Safety experts note that very little data is collected on accidents resulting only in nonfatal injuries even though there are six-to-eight times more such accidents than fatal accidents. Experts also note that no data is collected on the even more common accidents with only property damage. If more data were collected, the *Times* concluded, "trends could be obvious sooner." Until Firestone announced its tire recall in August 2000, NHTSA had received only five complaints per year concerning Firestone's ATX, ATX II, and Wilderness AT tires out of 50,000 complaints of all kinds about vehicles.

Although Firestone executives had just testified that Firestone's warranty claim data did not show a problem with the tires, Firestone documents made public by congressional investigators showed that in February Firestone officials were already concerned with rising warranty costs for the now-recalled tires.

September 19---USA Today reported that in more than 80 tire lawsuits against Firestone since 1991, internal Firestone documents and sworn testimony had been kept secret as part of the Firestone settlements. Observers noted that had these documents been made public at the time, many of the recent deaths might have been avoided.

September 22---The Firestone tires that were at the center of the recalled tires passed all U. S. government--required tests, causing NHTSA head Sue Bailey to say, "Our testing is clearly outdated."

During September, both Bridgestone and Firestone announced they would install supply chain information systems to prevent anything similar happening in the future. Firestone started spending heavily to make its claims database more usable for safety analysis.

January 2001 Yoichiro Kaizaki, the president and chief executive of the Bridgestone Corporation, resigned.

May 22, 2001---Bridgestone/Firestone ended its 100-year relationship as a supplier to Ford, accusing the automaker of refusing to acknowledge safety problems with the Explorer.

June 23, 2001---Sean Kane, a leading a traffic safety consultant and a group of personal injury lawyers disclosed that in 1996 they had identified a pattern of failures of Firestone ATX tires on Ford Explorers but did not report the pattern to government safety regulators for four years. They did not inform the NHTSA, fearing a government investigation would prevent them from winning suits against Bridgestone/Firestone brought by their clients. Professor Geoffrey C. Hazard, Jr., a leading expert on legal ethics, said the lawyers had "a civic responsibility" to make their findings known but had not broken any laws by withholding this information.

June 27, 2001---Bridgestone/Firestone announced it planned to close its Decatur, Illinois, factory where many of the tires with quality problems had been produced.

October 4, 2001-Firestone announced it would replace an additional 3.5 million Wilderness AT tires made before 1998.

May 2, 2002 - A federal appeals court in Chicago denied the right of plaintiffs nationwide the join in a single lawsuit against both Bridgestone/Firestone and Ford over faulty tires. The court explained that such a suit would be too complex to be manageable. This ruling did not affect the hundreds of wrongful death and personal injury that were already being prosecuted. Settlements began when on December 21, 2002, Ford announced to pay state governments $51.5 million, accepting the charge that they had misled consumers about the safety of its SUVs and had failed to disclose the known tire risks. However, Ford did deny any wrongdoing. The settlement did not affect private claims. Ford also pointed out that it had already spent about $2 billion to replace millions of Firestone tires suspected of being faulty.

Both companies ran into sales problems after the SUV tire debacle. The companies spent about $2 billion each just to replace tires, and lawsuits have been expensive for both, although the size of the settlements has not been revealed. As if all of that was not enough, they had to face the same problems that hit most other companies during the economic decline after the September 11, 2001 terrorist attacks. Firestone had problems beyond its tire manufacturing. It is also a major retail service company, and many of its service customers did not distinguish between the two sides of the company, resulting in a decline in that business also. The service unit turned to NuEdge CRM software to identify existing customers who had not returned for eight months or more and offered them special incentives depending upon their past frequency of visits, the amount spent and their distance from a service unit.

Ford also ran into trouble, particularly a decline in sales. Its U.S. market share fell from 25.4% in 1996 to only 21.8% in 2001 and sales of less than 21% expected for 2002. Ford's Explorer sales plummeted, losing about 60% of its pre-scandal market share. The company had to close five plants, lay off 35,000 workers (10% of its workforce), and eliminate four car lines, including the previously successful Mercury Cougar and the Lincoln Continental. In late 2001, Ford pushed out Chairman and CEO Jacques Nasser, replacing him with Bill Ford, the great grandson of Henry Ford.

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1. Briefly summarize the problems and major issues in this case. To what extent was this crisis an information management problem? What role did databases and data management play?

2. Explain why the growing trend of deaths was not spotted for a very long time. Why do you think it took so long for the issue to come to the attention of the general public?

3. List the different databases the parties had at their disposal as the problem grew, and list the data elements in those databases that were key to finding the tread separation problem earlier. Ignoring for the moment all other data problems, what critical data elements were these organizations not storing? For each one, why do you think it was critical and why it was not being stored?

4. Make a list of useful questions that these organizations might have asked of the databases but did not. Discuss why you think they did not ask these questions.

Hershey's Enterprise System Creates Halloween Tricks

When someone says "chocolate," many of us think of Hershey's---their chocolate bars, their Kisses, their many other candies. Hershey Foods Corp. of Hershey, Pennsylvania was founded in 1894 and recorded $4.4 billion in sales in 1998, including its other brands such as Reese's Peanut Butter Cups, Milk Duds, and Good and Plenty. Altogether the company sells approximately 3,300 candy products including variations in sizes and shapes. Candy is a very seasonal product, with Halloween and Christmas recording about 40% of annual candy sales, making the fourth quarter calendar crucial to Hershey's profitability. Hershey's largest continuous challenge may be that it must rack up its multibillion dollars in sales of 50 cents or one dollar at a time, requiring huge numbers of its products to be sold. Such quantities means Hershey must have very reliable logistics systems.

Traditionally the food and beverage industry has had a very low ratio of information technology (IT) spending to total revenue, ranging between 1.1% and 1.5%, according to Fred Parker, senior vice-president of IS at Schreiber Foods Inc. in Green Bay, Wisconsin. The last great technology advance in the industry was the bar-code scanner, which arrived about 1980. Parker believes the reason for the low IT spending ratio is the very low profit margin in the industry. However, the industry's stingy approach to IT began to change as the year 2000 approached. Many companies chose to solve their Year 2000 (Y2K) problems by replacing their legacy systems rather than spending a lot of money to retain them by fixing the Y2K problems within them.

According to Hershey vice-president of information systems, Rick Bentz, Hershey began to modernize its software and hardware in early 1996. The project, dubbed Enterprise 21, was scheduled to take four years (until early 2000). Enterprise 21 had several goals, including upgrading and standardizing the company's hardware, and moving from a mainframe-based network to a client-server environment. The company replaced 5,000 desktop computers and also moved to TCP/IP networking based on newly installed network hardware. Bentz noted that benchmark studies by the Grocery Manufacturers of America show that Hershey's IT spending trailed that of most of its industrial peers. The study concluded that Hershey needed to be able to use and share its data much more efficiently. More and more retailers were demanding that suppliers such as Hershey fine-tune their deliveries so that they could lower their inventory costs.

Hershey's information systems management set as a goal a move to an ERP system using software from SAP AG of Walldorf, Germany. SAP was to be complemented with software from Manugistics Group Inc. of Rockville, Maryland. Manugistics would support production forecasting and scheduling, as well as transportation management. In addition, the company decided to install software from Siebel Systems Inc. of San Mateo, California. Siebel's software would aid Hershey in managing customer relations and in tracking the effectiveness of its marketing activities. Management believed that Enterprise 21 would help Hershey better execute its business strategy of emphasizing its core mass-market candy business.

A necessary piece of Enterprise 21 was the installation of bar-coding systems at all six U.S. production plants in 1999. Bar coding was necessary so the company could track all incoming and outgoing materials. In that way it would be able to improve logistics management while controlling production costs. Enterprise 21 was later modified and called for Hershey to switch over to the new SAP system and its associated software in April of 1999, an annual period of low sales. This new target meant the company had 39 months to complete the project instead of the original 48 months. Although some SAP modules were actually been put into production in January, the project ran behind the aggressive schedule, and the full system did not come online until mid-July. Included in the delayed conversion were SAP's critical order processing and billing systems, along with the Siebel and Manugistics systems. The timing meant that Hershey would be facing a major problem because Halloween orders were already arriving by mid-July. The information systems staff chose to convert all these new systems using the direct cutover strategy in which the whole system goes live all at once. While this strategy is generally considered to be the most risky, were it to be successful it could save the company time and money while enabling Hershey to fill its Halloween orders on schedule. By the time of the conversion, the whole project had cost Hershey $112 million.

Problems arose for Hershey when the cutover strategy did not work because serious problems emerged immediately. As a result, many Hershey customers found their shelves empty as Halloween approached. Bruce Steinke, the candy buyer for Great North Foods, a regional distributor in Alpena, Michigan, had placed an order for 20,000 pounds of Hershey's candy and found his warehouse short just prior to Halloween. As a result, 100 of Great North's 700 customers had no Hershey candy when Halloween arrived. The shortage meant not only a drop in Hershey's sales but Great North (and other Hershey distributors) also lost credibility as their retail customers found it hard to believe that Hershey itself could be the problem.

The shortages also meant the loss of precious, highly contested shelf space. For example, Randall King, the candy buyer for the Winston-Salem, North Carolina-based Lowes Foods chain, faced the shortage problem. As a result, he told his 81 supermarkets to fill their empty Hershey candies shelves with other candies, and he even suggested that they turn to Mars brand candies. Retailers predicted that Hershey's lost shelf space would be hard to win back. Ron Coppel, a vice president of business development at Eby- Brown Co., a Naperville, Illinois candy distributor, observed that "If you don't have my toothpaste, I'm walking out of the store, but," he added, "for a chocolate bar, I'll pick another one. [Customers are] not likely to walk out of a store because there was no Hershey's bar." So Hershey long-range sales were also being placed at risk by the logistics failures.

Hershey itself did not publicly acknowledge the problem until mid-September when it announced that something was wrong with its new computer systems. It did indicate that Hershey employees were having trouble entering new orders into the system. In addition, once in the system, the company stated that order details were not being properly transmitted to the warehouses where they could be filled. Hershey did announce that it expected the problem to be solved in time for Christmas shipments. However, industry analysts, such as William Leach of Donaldson, Lufkin & Jenrette, were quick to note that should the company fail to make that deadline, the problems would likely seriously cut into not only Christmas sales but also Valentine's Day and perhaps Easter shipments, two other crucial candy sales holidays.

As soon as the admission of problems was made, questions immediately arose as to the causes of those problems. Kevin McKay, the CEO of SAP in the United States, denied any problems with SAP's systems, saying, "If it was a system issue, I'd point directly to a system issue." He also made it clear that SAP was operating smoothly for Hershey's much smaller Canadian unit. Tom Crawford, the general manager of SAP America's consumer products business unit, verified that his consultants were at Hershey sites to help resolve the problems. But, he made clear, "There are really no software issues per se." Crawford explained that his consultants "are just making sure they [Hershey employees] are using the business processes (built into the software) correctly." Manugistics also said it was working with Hershey on "business process improvements." Paul Wahl, president of Siebel, concluded "It [their system] may have turned out with the big bang [direct cutover] kind of installation, they were maxed out there." Brian Doyle, an IBM spokesperson, pointed to "the business process transformation under way at Hershey" as a possible cause which, he said, "is an enormously complex undertaking." He noted major changes in the way Hershey employees were doing their job, which implied the need for more and different training than Hershey's staff had originally received

It was obvious that the problem was not in candy production. At the time of the cutover Hershey had an eight-day supply of products in its warehouses, a higher than usual supply in anticipation of possible minor problems with the new systems. However, within three weeks of turning on the new systems, shipments were more than two weeks late. Hershey began telling its customers to allow 12 days for delivery (the usual turnaround time was six days). Even that schedule proved to be too aggressive because Hershey could not deliver goods so quickly. Martha Kahler, director of trade relations at Wal-Mart's Temple, Texas store, in describing the incomplete shipments it was receiving, said, "It wasn't any particular [candy] item. It was across the board." Company spokespersons told financial analysts in late October that computer system problems had already reduced sales by $100 million in the third quarter. The actual profit drop was 19%.

When word of these problems became public, Hershey's stock price went into a sharp slide. By late October, its price had fallen to $47.50, down 35% from $74 one year earlier. During the same period the Dow Jones Industrial Average had risen by 25 %. Third quarter earnings dropped from $.74 to $.62. Hershey Chairman and CEO Kenneth L. Wolfe admitted that "third quarter sales and earnings declined primarily as a result of problems encountered since the July start-up of new business processes in the areas of customer service, warehousing and order fulfilment." He added, "These problems resulted in lost sales and significantly increased freight and warehousing costs." Hershey Senior Vice President Michael Pasquale pointed out that "Clearly, our customer relations have been strained." While Wolfe admitted the problems are taking longer to fix than expected, he did state his expectation that fourth quarter sales and earnings would bounce back. In late October, key individuals within Hershey held a two-day meeting to review the new system and produce a list of changes needed. Wolfe demanded that those involved the "need to be tested before we put them in," possibly implying a lack of adequate testing prior to the original cutover.

In early February 2000, Hershey reported an 11% decline in sales and profits for its fourth quarter 1999. Wolfe again pointed to order processing which this time around had caused many retailers to not even place orders. He said that while system changes and increased personnel experience with the new software had reduced the problems, Hershey's has "not yet fully returned to historical customer service levels."

Although Hershey has released very little information on the troubled implementation, observers continue to speculate on the key question: what went wrong? Some point to the pushing forward of the target date---trying to accomplish too much in the allotted time frame. Others have stated their belief that inadequate time and attention was allocated to testing prior to Hershey's new systems going live in July. Still other analysts point to the use of the direct cutover method. "These systems tie together in very intricate ways," stated AMR Research Inc. analyst Jim Shepherd, "and things that work fine in testing can turn out to be a disaster (when you go live)." He called the instant conversion approach "a huge bite to take, given that (processing orders) is the lifeblood of their [Hershey's] business." Finally, some analysts point their finger at training. A. Blanton Godfrey, CEO of the Juran Institute, a consulting firm based in Wilton, Connecticut, says that only 10 to 15 percent of ERP implementations go smoothly. He claims that the difference for them is better training. Some observers draw a distinction between training and education. "Training is the how part of the equation," explained John Conklin, vice president and CIO of World Kitchen, the Elmira, New York producer of Pyrex and Corningware. "Education is the bigger piece of the puzzle. If people don't go through this education, you won't win their hearts and you won't have their minds." Thus, some observers believe that lack of education on the whys of the system and how the many pieces of the full system fit together are possibly the reason order entry difficulties spilled over into warehouse problems.

Hershey's problems were solved in 2000 and company sales and profits did rebound. Its year 2000 third quarter profits jumped 23% from the previous year. The company also took steps to prevent that type of problem occurring again. On December 14, 2000 the company announced the creation of a chief information officer (CIO) position and filled it with George Davis, a former Computer Sciences Corp. executive. Just three days earlier it announced that Hershey's new chief operating officer (COO) was William Christ, the former Hershey's chief financial officer. Davis reports to Christ.

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1. Analyse Hershey's business model using the competitive forces and value chain models. Was an ERP system and related software a good solution to Hershey's problems? Explain your responses
2. Classify and describe the problems with the Enterprise 21 project using the categories described in this chapter on the causes of system failure. What management, organization, and technology factors
3. What role did enterprise software play in the failure? Were Hershey's system problems the fault of the software vendors, Hershey, or both?

4. Who was responsible for the failure of Enterprise 21? Assess the role of Hershey's IT group and its managers
5. Evaluate the risks of the project as seen at its outset, and then outline its key risk factors. Describe the steps you would have taken during the planning stage of the project to control those factors.

Owens Corning's Enterprise System Struggle

In the early 1990s Owens Corning was a United States leader in the production and sale of such building materials as insulation, siding, and roofing, but management wanted the company to grow. The company had only two possible paths to growth: offering a fuller range of building materials, and/or becoming a global force. To increase its range of products Owens Corning decided to acquire other companies. To become a global force, management realized the company would need to become a global enterprise that could coordinate the activities of all of its units in many different countries.

Headquartered in Toledo, Ohio, Owens Corning had been divided along product lines, such as fibreglass insulation, exterior siding, and roofing materials. Each unit operated as a distinct entity with its own set of information systems. (The company had more than 200 archaic, inflexible, and isolated systems.) Each plant had its own product lines, pricing schedules, and trucking carriers. Owens Corning customers had to place separate telephone calls for each product ordered---one each for siding, roofing, and insulation. The company operated like a collection of autonomous fiefdoms.

Owens Corning management believed that implementing an enterprise system could solve these problems. The company selected enterprise software from SAP AG to serve as the foundation for a broad company overall. "The primary intent with SAP was to totally integrate our business systems on a global basis so everyone was operating on the same platform with the same information," answered Dennis Sheets, sourcing manager for the insulation and roofing business. Sheets wanted to centralize purchasing. "Prior to SAP," he said, "we were buying widgets all over the world without any consolidated knowledge of how much we were buying and from whom. Now [using SAP's R/3 software] we can find out how many widgets we're using, where they're being purchased, and how much we paid for them, [allowing] us to consolidate the overall acquisition process." Now, he added, "we can. . . make better business decisions and better buys." Sheets expected the company's material and supply inventories to drop by 25 percent as a result.

However, the project to install SAP's enterprise system would ultimately cost Owens Corning about $100 million and take several years, too expensive and time consuming to be justified only by the reasons given by Sheets. The company hoped that the new system would also enable it to digest acquisitions more easily. Owens Corning wanted to acquire other companies to expand its product line so it could increase sales from $2.9 billion in 1992 to $5 billion within a few years. That meant that Owens Corning would have to digest the archaic, inflexible systems from the companies it purchased. If Owens Corning were to become a global enterprise, it would need a flexible system that would enable the company to access all of its data in an open and consolidated way.

ERP experts point out that simply converting to ERP systems does not solve companies' problems. "Unless a company does a lot of thinking about what its supply chain strategy is and articulating what its business processes are, these tools are going to be of little use," explained Mark Orton, of the New England Supplier Institute in Boston.

Owens Corning's project began with its insulation group, and those on the project team understood this. They undertook a redesign process before implementing SAP's R/3. They set up cross-functional teams because "We had to identify the handoffs and touch points between the various functions," said Moke Morey, the division's ERP implementation project manager. He explained "My team, for example, had accountability for the process that runs from the time we need to buy something through the payment issuance to the supplier. Other areas, such as logistics and accounting, touch this process." The teams also kept in close touch with suppliers who needed to know what Owens Corning would require of them. As a result of the redesign, purchasing decisions were moved from the plants up to a regional level, enabling commodity specialists to use their expertise and the leverage of buying for a larger base to improve Owens Corning's purchasing position. The teams also decided to require that all suppliers have a capability to send the company digital information that could be fed directly into its enterprise system.

How did the first ERP project go? Over a weekend in March 1997 a team of about 60 people transferred legacy data into the SAP system, and on Monday morning the company went live. That morning Domenico Cecere, president of the roofing and asphalt unit, called the manager of his Medina Ohio plant to asked how it was going. "Better than expected," was the report. However, Owens Corning's director of global development, David Johns, later concluded, "When we first went live with SAP, it was a tough time." He said that overall productivity and customer service dropped sharply during the first six months. "When you put in something like SAP, it's not a mere systems change," he said. "You're changing the way people have done their jobs for the past 20 years."

The first problems that surfaced were technical. According to Johns, application response time had increased from seconds before ERP to minutes under the new system. Other technical problems also emerged. For example Johns said, "The functionality wasn't working the way it was supposed to." Johns believes the source of these problems was inadequate testing. "The first week [after going live] we just focused on the technical issues," said Johns. The team further tuned the software and over the next weeks response time reduced to an acceptable speed, and slowly the software began operating smoothly.

However, "after we fixed some of the technical problems, we started peeling back the onion and saw that this was much bigger than a technology problem," explained Johns. "We saw that there were problems in the business, problems with the way people's new roles had been defined, communication and change management issues, and business process issues." For example, the SAP system demanded that the entire corporation adopt a single product list and a single price list. Staff members initially resisted. Owens Corning employees had not been properly trained and they were overwhelmed, resulting in a lot of errors. Johns explained that at Owens Corning "we underestimated the impact that swapping out all our old systems would have on our people." Users had indeed been properly trained on their own functions, but ERP systems are integrated, and the users did not understand the impact their work was having on other departments.

ERP systems are complex and errors ripple throughout the system. When using the old systems, employees had time to correct data entry mistakes, and if they were not caught, they only affected the local function. However, now that they were using R/3, the databases are immediately updated. Thus, for example, the data flows instantly from sales to purchasing, production and logistics systems. Johns offered another example. "If you're at a warehouse, and you don't tell the system when a truck is leaving the dock, the truck can still leave, but the customer will never get an invoice for the goods. Accounting won't find out later because the transaction will never get to them." Such errors can be costly. Users needed to be more careful as they did their jobs. To motivate users to work with more care, they needed to understand the complexities of the system. They had to know how their errors would affect other workers and even company profitability.

To address this problem the company quickly instituted a new training approach. Training now would include information on the larger system and its complexities so users would understand the impact of their work. Under the new training regimen, all employees were denied access to the system until they had passed a test and became certified. Those who failed the test had to return to training until they could pass it. About 20% of Owens Corning employees never passed the test and had to change jobs. This job shifting was massive and time-consuming, causing organizational disruption. Whereas the original project training was budgeted for 7% of overall costs, training eventually consumed 13% of the budget.

Customers also suffered. Owens Corning had been known for its excellent customer service, but the quality of that service declined sharply after the SAP system went live. Many customers were shocked, and some began turning to other suppliers. Owens Corning began losing important customers. The company was forced to devote a great deal of personnel time rebuilding relations with its customers while simultaneously having to repair both its organization and the software installation.

ERP implementation problems of this type are common. According to Barry Wilderman of the Meta Group, ERP projects often result in a negative return-on-investment (ROI) for five or more years. Why? Because ERP systems are so complex. The company may not understand all that needs to be done in preparation. Moreover, these systems are expensive, and testing and training will often get cut for budgetary reasons. Not only do employees need to become accustomed to new ways of doing business, but customers and suppliers may need to change their business processes as well.

How successful was the whole project? Management believes it has been a success. Johns said "We made each mistake only once. Each deployment [in the rollout] got better." For instance, "We do a lot more testing now before we go live," he said, "to make sure that all the different pieces of the system work together." Mike Radcliff pointed out that customers now have a single point of contact for all orders. Moreover, he adds, "With our old system, we didn't know what inventory we had in stock. We would have to check around and get back to the customer." Today, he continues, "We can see what inventory is available, when it will be produced, and who is the lowest-cost carrier. We can commit to the customer before we hang up the phone." He noted, however, that the changes have been massive. He estimates that about 10,000 people were involved with the reengineering effort. "Just about everybody's role in the organization has changed."

The ERP systems rollout was completed in 2000. During those years, Owens Corning acquired and integrated 17 companies, successfully expanding their product offerings. Company sales have reached $5 billion annually. Because of the new system, Owens Corning has been able to reduce its inventory significantly, while centralizing coordination of various functions and divisions. Lot size and machine allocations have become more efficient. The company can perform production planning and control globally because it has one uniform system to work with. The integrated system lets the company leverage common carriers and take advantage of overlapping transportation routes. Managers can use the system to identify its biggest suppliers across the entire company and use that information to negotiate bulk discounts. A customer needs to call only one location to place an order. Factory production managers no longer have to concern themselves with taking customer orders, tracking logistics or after-sales service. Because centralization applied not only to United States operations but also to foreign activities, the corporation has been transformed into a truly globalized enterprise

Organizationally the role of Owens Corning's information systems department has changed dramatically. Prior to the enterprise system project, the information systems department saw its role as limited to technical support. It used to be that if there were problems with the system, the IS staff would check it to see if it was running properly, and if it was, it would throw the problem back to the business units to solve. Since transactions flowing through the enterprise system impact the entire business, the information systems department has become responsible for the entire business problem. However, the information systems department does not try to solve business problems alone. They only act on them if they have the full involvement of the business units.

Unfortunately, Owens Corning is facing a major problem unrelated to its information technology. On Thursday, October 5, 2000, Owens Corning filed a petition for reorganization under Chapter 11 bankruptcy protection. According to Owens Corning, the company "took this action in order to address the growing demands on its cash flow resulting from its multi-billion dollar asbestos liability. The filing will enable the company to refocus on operating its business and serving its customers, while it develops a plan of reorganization that will resolve its asbestos and other liabilities and provide a suitable capital structure for long-term growth." The company claims it will emerge from bankruptcy by 2003. However, Owens Corning has continued to build for the future. For example in December 2001, it purchased Denver Colorado's Wall Technology. Nonetheless, we will be unable to judge its IT success until after it emerges from bankruptcy.

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1. Describe the problems Owens Corning had with its information systems prior to installing its enterprise system. What management, organization, and technology factors were responsible for those problems?

2. What management, organization, and technology problems did Owens Corning face in putting their enterprise system into effect?

3. How did implementing an enterprise system change the way Owens Corning ran its business?

4. Was installing an enterprise system the right solution for Owens Corning? Explain.

Rand McNally Maps Out a Trip into a Digital Future

In 1856, William Rand and Andrew McNally founded a small printing shop in Chicago which they called Rand McNally. The company did not begin printing maps until 1916, but it has been the leader in maps ever since, credited with creating the mapping conventions for our current numbered highway system. In 1924, Rand McNally published its first *Rand McNally Road Atlas*. The various versions of this atlas have sold 150 million copies in the years since, making it the all-time best selling map product from any publisher. Today Rand McNally has 1,200 employees, mostly at its Skokie, Illinois headquarters.

Through the following decades the company continued to develop and maintain its position as the most well-known and respected publisher of geographic and travel information. As recently as 1999 it sold 46 million maps, which accounted for more than half of all printed maps sold in the United States. Of course Rand McNally also produces many other products such as globes, a wide-range of geographic educational materials, travel-planning software, and products for trucking fleet route planning and optimisation. Its products are currently sold through over 46,000 outlets, including 29 of its own retail stores.

As the digital economy developed at the beginning of the 1990s, Rand McNally's strength still resided in its printing technology, and like so many other companies at the time, its management did not understand the full impact of the new Internet and other computer-related developments. The company did respond to changing business conditions by producing travel and address location software it then sold on CD-ROMs. It also established a modest Web site in 1994 in order to support its customer' use of its CDs. However, the Internet soon offered many other opportunities, and Rand McNally failed to maintain its leadership and pioneering spirit. The company had become conservative.

AEA Investors purchased Rand McNally in 1997 in expectation of the company modernizing itself through the use of new technologies such as the Internet. Despite new ownership and leadership, little changed as the company remained staid and unwilling to take risks, apparently due to fear of losing money. "We proposed putting maps online, but senior management was not interested," observed Jim Ferguson who later became director of product management for Rand McNally.com. He added, "Management had not adapted to the new-economy model."

When they realized that nothing was changing, the investors intervened and in July 1999 appointed Richard J. Davis as President and CEO. Davis already had 25 years of experience in management of emerging high-tech companies, including seven years with Donnelley Cartographic Services and GeoSystems. (GeoSystems was the company which established MapQuest, Rand McNally's chief competition in the new online environment.) Davis said his goal was to develop technology solutions and corporate growth rising above the historical 5 to 6 percent range.

Davis immediately brought in Chris Heivly to head up the recently created RandMcNally.com group. Heivly promptly put Rand McNally maps and address-to-address driving directions online. Prior to the arrival of Davis and Heivly, management had feared that putting the company's maps online would undercut the sales of the company's traditional paper maps, something MapQuest, then still known as GeoSystems, had risked doing in 1996.

The most important goal of the new management was to transform Rand McNally from a map company into a travel planning and advisory service so that it would not become obsolete. Management plans included:

- Making Rand McNally's Web site indispensable to travellers.
- Updating map products for the fast-growing Net environment.
- Link the company Web site and products to other services on the Net.
- Generating more brick-and-mortar store business from Web site visitors.
- Remaining overwhelmingly a business-to-consumer company and not try to become a business-to-business company.

To accomplish these objectives, the company had to address two needs that all types of travellers experience: the need for quick information about travel conditions and recommendations on meeting those needs along the way. To accomplish this the Web site must not only help travellers to plan the trip, but travellers must be able to bring the Internet with them as they travel. Travellers need online road maps, detailed driving instructions, and road condition updates while they are on the road, which means they will have to be delivered through wireless technology as soon as it matures. The Rand McNally Web site also needed to work with third parties to provide other travel information such as timely weather and hotel reservations. The site also had to have a very user-friendly interface, one that can be used comfortably by people who are not highly skilled Internet users. Profitability remained a critical goal for both management and the investors. Profitability requires services that are good enough that customers will be willing to pay for them.

Rand McNally's main online competition was MapQuest, whose Web site has been highly successful. In March 2000 the site had 5.5 million visitors who viewed and printed its electronic maps. During the same month Rand McNally had only 255,000 visitors. In addition, MapQuest had partnered with many corporate and Internet business forces whose visitors need to use maps on their sites, for example to locate their stores. These giants include AOL, Excite, Yahoo, Ford, Walmart and many, many others. "We put out more maps in 36 hours than are sold in the United States in a year," proclaimed MapQuest CEO Mike Mulligan. The financial community showed its strong support for the MapQuest model when, at end of 1999, the company was sold to AOL for $1.1 billion.

Davis understood that he needed to shake up the very staid and conservative corporate culture dominating Rand McNally. He wanted to make the company agile again so it would be able to resume its leadership in the digital age. He worked hard for rapid change within Rand McNally and did so in a very personal way, repeatedly demonstrating that he understood how very difficult cultural change can be. He tried to give all employees the feeling that they have a stake in the success of the entire company, both the print and digital arms. In the process, he personally met with more than 900 employees to sell his vision of the company's future. He responded personally to e-mails he received from employees, and as he walked through the halls, he greeted his employees by name. He also continually publicly recognized achievements by many different employees. Although he also made opportunities for long-time employees to join the new Internet group, few took advantage of the opportunity. Davis directly faced the many old-time employees who were disgruntled because they believed that too much money was going into the dot-com group. Ultimately, two of the eight executives who reported to him left over the changes, and he also had to replace the whole management team.

As Rand McNally tried to become a major force on the Internet, its advantages were clear. It was an old, very well known and highly respected name in the field of travel and maps. The company was profitable and therefore had income from existing sales, enabling it to take the necessary time and spend the needed funds to design and develop its new businesses. Some of the technology that Rand McNally wanted to use, such as wireless travel services, was still not well developed, so that no company had yet achieved a genuine lead. Also the need for online maps to aid and orient people was growing extremely rapidly.

Heivly and Davis both also believed that MapQuest had weaknesses, and these too were Rand McNally advantages. They believed that Rand McNally maps are more accurate than those of MapQuest. Moreover, they concluded, MapQuest driving instructions were overly detailed, contained much information that was out of date, and usually did not select the most appropriate route to travel. Nor, in their minds, did MapQuest have the reputation and respect of and the personal relationship with the American people that Rand McNally has. "We've been on the backseat of everyone's car in America," said Heivly. Thus, despite the backing MapQuest recently had gained when it was acquired by America Online, Rand McNally management's outlook was very positive.

Davis reorganized the company into three divisions: RandMcNally.com, a unit that services businesses, and a unit that services consumers. However, the key to the future in the eyes both of management and of the investors was RandMcNally.com. In order to break into the Internet competition and become a force rapidly, Davis decided to create an auto club similar to the American Automobile Association (AAA) with its over 40 million members. Rand McNally's main goal in creating the automobile club was to entice Internet visitors to pay something for their use of the Rand McNally Web site. Management's expectation is that once customers pay for one service, they will become willing to pay for other products and services as well. The auto club was planned to provide standard services, including emergency roadside service and a network of repair shops. Rather than taking on AAA head on, management chose to create affinity groups such as recreational vehicle drivers and Corvette owner clubs. "We want to get people who are not signed up for anything," explained Davis. Management also wanted to create links for users while they were on the road using Net-capable mobile phones, car navigation systems, and other wireless devices when they become mature enough.

The Web site is linked to the RandMcNally.com store where visitors can purchase the more than 3500 products that are sold in the brick-and-mortar stores. Visitors can print customized free maps and address-to-address driving instructions. The "Plan a Trip" section has an improved ability to search out what travellers want on their trips. For example, the site can answer such questions as "name art museums within 25 miles of the trip." Visitors can also store their personalized trip plans and information online. At the time of launching, the site carried information on more than 1,100 U.S. cities, 379 National Parks and 4,000 other points of interest and local events. The site also supplies continuously updated weather information and twice monthly updates on road construction projects that might interfere with travel. Finally, it contains trip-planning checklists as well as a section that offers materials and ideas on travelling with children.

The print products have been affected as well. The Rand McNally Road Atlas has changed its rear cover so that it no longer advertises other company's products. It gave up the revenue in order to advertise its own Web site. A travel atlas for children is one of a number of new print products it has developed growing out of the development of its Web site. Rand McNally has also jumped in to the GPS (global positioning system) market in a big way, selling GPS products to visitors who want to keep track of their current position for various reasons. For example, they sell a device that attaches to the Palm computer and another that attaches to a laptop PC. Both will pinpoint one's current location.

The early experience of Rand McNally is that the Web site is drawing more visitors. Davis was surprised at the impact upon the whole company, saying, "I thought we would be able to create this dot-com entity, and the rest of the company would continue doing what it has always done. But the dot-com group was developing a consumer solution and it impacted right back through the whole company. Consumers attracted to RandMcNally.com have also shown up at the firm's retail stores.

The company took a giant leap in establishing a major presence online when it launched Rand McNally Road Explorers in October 2001. The site allows users to build their own detailed road maps and trip guides. Should customers join the premium services they will also become a member of its travel club and will receive travel services such as discounts and roadside assistance. Heivly believes the site will bring in about $50 million annually by 2006. Rand McNally is catching up with other Web companies although it still has a long way to go to catch up to its more Net-savvy competitors. Has it found the right success formula for the Internet age?

Sources: Margie Semilof, "Rand McNally Leverages Brand Online," *Internet Week*, October 8, 2001. Miguel Helft, "A Rough Road Trip to the Net," *The Industry Standard*, June 5, 2000; Rand McNally press releases, http://www.randmcnally.com/rcm/company/, July 29, 1999, September 6, 2000, September 20, 2000, November 14, 2000.

1. Evaluate Rand McNally using the value chain and competitive forces models
2. What was Rand McNally's business strategy? What were the causes, both internal and external, that caused Rand McNally to change this strategy?
3. What organization, management, and technology issues did the company face in attempting to change its business strategy?
4. Evaluate Rand McNally's new business strategy. Do you think it will prove to be successful?
5. Visit Rand McNally's Web site. How effective is the Web site in supporting the company's new strategy?

Rosenbluth International Travels a Telecommunications Route to Success

The travel-service industry is in trouble. Airlines have capped the commissions they will pay to travel agents, and these commissions have been the main source of their income. Travel agents can no longer afford to pay major corporate clients for the right to handle their travel business. In addition, global competition has forced many corporations to cut back on all expenses, including travel. Finally, the World Wide Web now makes it easy for individuals, whether as private persons or employees, to investigate and book their own travel. Management at Rosenbluth International[http://www.rosenbluth.com] had to face this formidable reality and find a way to thrive.

Rosenbluth, a privately held, family-owned company, is the second largest travel-services firm in the world, with American Express being number one. It has more than $4 billion in annual sales and more than 4900 employees. Headquartered in Philadelphia, Pennsylvania, the company was founded in 1892, and it was a relatively small company when Hal Rosenbluth joined the firm in 1974. In 1984, he obtained a contract to provide all of DuPont Corporation's travel services, and the company's explosive growth began. Rosenbluth was a success with DuPont because he managed to save the company $150 million in travel and entertainment (T&E) expenses.

Hal Rosenbluth believes that by creating a humane working environment, and by genuinely putting employees (called "associates" at Rosenbluth) first, they will give more to the company, resulting in the company offering better service to its customers. "Our only sustainable competitive advantages," Rosenbluth maintains, "are the associates and the environment in which we work." Although his approach remains central to the company, by itself it would not continue to make the company successful in the radically new environment. The strategy that has worked begins with understanding the value that Rosenbluth International can give to its clients by helping them manage costs.

How can Rosenbluth help companies manage T&E costs? The company relies heavily upon cutting-edge information technology. First, at the level of the individual trip, it has lowered airline costs by developing a way to search for the lowest fares that will meet the requirements of the traveller. DACODA is Rosenbluth's yield-management system. Yield management enables airlines to fill its airplanes while obtaining the highest possible price per seat. Yield management often results in people sitting side-by-side paying drastically different prices. DACODA reverses the process, focusing on the client company's optimal air program worldwide. One of its functions is to sort through all the complex airline databases, analysing their pricing and discounting schemes. Travellers are given a list of choices to select from within the time, date and location parameters they have selected. Through its software, Rosenbluth also tracks and manages a series of qualitative preferences that can offer clients a better trip for the same cost. For example, the system combines personal preference information with flight data to enable many travellers to spend less time on the ground between connections. The software also maintains such data as seating preferences for each client, including traveller concerns about placement related to plane wings.

As client employees travel, much of their travel data, both booked and billed, is automatically stored in Rosenbluth's databases, making it very easy for travellers and their employers to record and monitor expenses. VISION is the proprietary Rosenbluth real-time software package that instantly collects client travel data. The traveller is presented with a simple, easy-to-use interface to enter, submit, and track expenses during the trip. This software package even enforces the client company's travel policies for each trip. It integrates the data regardless of where the reservation is made or which airline reservation system is used. This software is the source of management reports that are customized to meet client-specific needs. Thus, management can easily monitor and control all of its corporate travel and entertainment expenses.

Rosenbluth's Global Distribution Network (GDN) is a worldwide telecommunications network through which the airline reservation systems are accessible. All Rosenbluth agents are connected to GDN, as are most of the company's travel software applications. Clients planning trips can either use the network to research and book their travel arrangements, or they can work through a Rosenbluth agent. Moreover, clients can choose to use a local Rosenbluth agent, or they can turn to specific agents of their choice anywhere in the world.

Wal-Mart is a good example of a satisfied customer. Every traveller within the giant retailing company has access to a Rosenbluth reservation through a desktop or laptop computer connected to Wal-Mart's local area network. The company's 7000 frequent travellers book their own hotel, air, and auto-rental reservations by calling up Rosenbluth's reservation system. They enter their name, travel dates, times, and cities of origin, destination, and stopover. Rosenbluth's software creates a grid of flight options that adhere to Wal-Mart travel policies. The employee clicks a few buttons and the reservations are completed. Some other companies accomplish the same thing by having their employees access Rosenbluth software through Rosenbluth's new World Wide Web site. This approach is particularly cost effective for Rosenbluth clients because all the clients need to do is give their employees Web browser software and a connection to the Internet. Business travellers on the go can obtain information from the Web site, such as airline numbers or the location of restaurants and copy centres at their destinations, using a handheld PalmPilot personal digital assistant.

The BOC group is another satisfied customer, one of many companies that have turned to Rosenbluth because of what they offer in this new travel environment. BOC is a British-based company with specialties in gases, vacuum technology, and health care. It is a giant, with sales of more than $6 billion and 40,000 employees in more than 1200 sites within 60 countries. By 1998 Rosenbluth expected to handle all BOC travel throughout the world.

In addition to helping clients, Rosenbluth has been forced to cut its own costs to the bone in order to survive. To accomplish this, they also have relied heavily upon technology. For example, the agents use the same software as clients so that they, too, can easily and quickly locate the lowest fares, book flights, and serve clients quickly. The company also has examined the working methods of their agents in order to find ways for them to work more efficiently. Rosenbluth noticed that his agents typed the same words over and over, so he ordered their computer interface be modified where possible to present prompts that required only "yes" and "no" responses. The developers also changed the programs to display the client company's travel guidelines on the screen so that the agent would not waste time creating options for a client that were outside the company guidelines. As a result of these changes, agents experienced a 75 percent reduction in keystrokes, a significant increase in productivity.

The global network also makes an enormous contribution to reducing Rosenbluth costs. Because of the network, it does not matter where the travel agent is physically located. As a result Rosenbluth has been able to establish a series of centralized reservation centres, known as "intellicenters." These centres are located in North Dakota, Delaware, and Allentown, Pennsylvania, all locations where labour costs are low but the work ethic is high. Costs are low enough in these centres that Rosenbluth is able to offer clients a significant reduction in costs for booking through one of the intellicenters. The network also is managed so that if one reservation centre becomes overloaded, excess calls are immediately and automatically routed to another centre where current volume is lower. For example, during the great East Coast blizzard of January 1996, about 21,000 calls were rerouted without any problem. Customers did not even know they were being rerouted.

Expanding its reliance on technology and customer service, Rosenbluth in August, 1999 announced the acquisition of Biztravel.com, an award-winning Web site for the planning and booking of business travel. Rosenbluth established a new affiliate company called Rosenbluth Interactive to offer full travel service to businesses on the Web. The new organization targets small companies that don't have travel departments, the fast-growing home-office market, and personal travellers. Biztravel uses a patented technology that continually queries the airlines for the lowest possible fares right up to the customer's day of departure. The service includes immediate customer service through e-mail, on-line chat, voice over net, and other technologies in addition to the customers' ability to obtain assistance by telephone. A feature called bizReservations provides travel recommendations based on user preferences.

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Case Study Questions

1. What problems did Rosenbluth Travel face? Analyse the company using the competitive forces and value chain models.
2. What competitive strategy did the company follow to address its problems?
3. How do the DACODA, VISION, Biztravel, and related systems fit in with and contribute to its strategy? What is the significance of the systems being available on a worldwide network? On the Internet? How did these systems change the company’s business processes?
4. What management, organization, and technology issues were addressed when Rosenbluth implemented the DACODA, VISION, and related systems?
5. What management, organization, and technology issues did Rosenbluth address when it acquired Biztravel?
6. What management, organization, and technology issues were addressed when Rosenbluth implemented its Global Distribution Network?

Schneider National Keeps on Trucking with Communications Technology

Schneider National is far-and-away the largest trucking firm in the United States, with about 19,000 employees and a fleet of nearly 15,000 trucks (cabs) and 43,000 trailers. The company is so large that it is $1 billion larger than the next two largest trucking firms combined. Headquartered in Green Bay, Wisconsin, Schneider National services two-thirds of the Fortune 500 corporations, including such major clients as General Motors, Wal-Mart, Kimberly-Clark, Procter & Gamble, Chrysler, Sears Roebuck, and Staples. The company is privately owned and had annual sales in 2000 of about $3.1 billion, a growth of nearly 11 percent from the previous year.

Schneider National was a major trucking firm with Don Schneider as its CEO when the federal government deregulated the trucking industry in the 1980s, revolutionizing the business environment of the industry overnight. Interstate trucking firms no longer had to follow the rules of a regulatory bureaucracy about what kinds of freight to carry and where to take it. These rules had made it difficult for customers to change carriers because only certain trucking firms could meet these regulations. Competition for customers heated up. Schneider National responded to these demands with a multipronged strategy based on the use of information technology, so that computer systems were now playing a powerful role in Schneider National's operations. Moreover, the company also began treating its employees differently, a major step toward democratising the company. The company made a paradigm shift. Several other competitors responded to deregulation by merely lowering rates. They went bankrupt.

CEO Don Schneider's business philosophy emphasizes IT. Basic to his philosophy is Schneider National's communications with its customers. In its giant headquarters building, the ground floor contains its call centre, a full acre in size, where 600 customer service representatives work. Using computers, they have easy access to any customer's history, enabling each customer service representative to answer customers' questions. The result is that the customer is satisfied and the jobs of Schneider National reps are eased. New customer service reps are given 4 to 6 weeks of training, much of it on the use of both the company's computer systems and on the Web.

In 2000, 50 percent of Schneider National's customer orders were received either on the Web or on its electronic data interchange (EDI) system. Through the use of these electronic connections, the orders automatically arrive in Schneider National's computer system, resulting in improved ordering accuracy and higher productivity, thus lowering the cost of the whole ordering operation. Moreover, within 15 to 30 minutes of sending an order electronically, customers know what truck will arrive and when. The system also includes electronic invoicing. The reason electronic orders encompass only 50 percent of the total orders received is because the Web system is new whereas EDI is an older technology, dating from the 1960s, that is very expensive, so the small companies cannot afford it. However, the Web is very inexpensive and easy to use, and Schneider is trying to get all of its customers to use the Web ordering system. In fact the goal for 2001 is to have 60 percent of Schneider orders arrive electronically, with the gain being through the Web.

Schneider's Web site was created by Schneider Logistics, a company spun off from Schneider to provide information technology and supply chain management services to Schneider and other companies. Its concept is for the transactions to be completely paperless. Ultimately, it will enable customers to enter their orders, check the status of their shipments---what truck or railroad car their goods are on, where they are now, and when they are scheduled to arrive---as well as check proof-of-delivery. All future services will be built to execute within a Web browser.

To the information that its customers require available and to plan its pickups, deliveries, and routes, Schneider National must gather a great deal of information about the trucks, both cabs and trailers. "Trucking companies are asset-intensive businesses," explained Donald Broughton, a senior transportation analyst at A. G. Edwards & Sons. He emphasized how crucial the use of the cabs and trailers are when he added, "The guy who has the higher rate of asset utilization wins."

In 1998, Schneider National became the first fleet trucking company to use OmniTracs. OmniTracs is a satellite-based communications and positioning system produced by QualComm, the San Diego-based wireless communications company. Schneider National worked with QualComm in the development of the product. For it to operate, each tractor has a radio frequency identification tag, a computer with keyboard in the cab, and a satellite antenna with a GPS (global positioning system) on the back of the trailer. Using this system, the company knows where every truck is within 300 feet at all times. The driver and headquarters communicate as often as required. The dispatchers can send information to the driver on how to get to the delivery spot (if there is a problem), the location of the next pickup (usually from someplace nearby), directions to the pickup spot, the necessary papers (if any are required), and even traffic and road problems. The driver can respond with approval and raise any questions about the instructions, the truck, or the road. Schneider National sends and receives about four million messages per month.

The cost of OmniTracs system was $30 million. Schneider thought the drivers' response to the system might be negative, but he was wrong. "We thought drivers wouldn't know how to use it or want to use it," he said. "What we found was exactly the opposite," because they were frustrated at having to stop along the road and call headquarters at telephone booths every few hours. In fact, the system has been such a success that by 2001 more than 1,250 fleet trucking companies have started using it.

Schneider National worked with QualComm again to develop SensorTracs in order to collect engine data, such as speed, RPMs, and oil pressure, via satellite. The data not only contribute to better maintenance of the engines but also help drivers to drive more safely and to take better care of the vehicles. It can even increase the drivers' incomes. One element of a driver's monthly bonus is based on staying within certain key factor ranges when operating the vehicle.

Currently, Schneider National is working with QualComm to develop a trailer-tracking system. It too is wireless. Each trailer has a radio frequency identification tag, which is read by devices that are placed at various points along the rail lines and in the rail yards. The data are directly linked to Schneider National's fleet management and logistics systems. They tell the dispatchers and the customer reps if the trailers are empty or full and if they are hooked onto a cab, sitting in a yard, or, rolling on a train. "Ultimately revenue is the measurement of how well we load and move these trailers, " said Paul Mueller, president of Schneider Technology Services, a unit of Schneider Logistics. "It is not uncommon to have to send drivers off-route to get [empty] trailers." When they arrive, the trailer isn't there or it might be loaded." Schneider National sees the new trailer-tracking system as a way to improve customer service through more on-time deliveries and better in-transit knowledge. It should increase drivers' satisfaction by increasing their billable miles and so their earnings. Ultimately it will increase trailer utilization and efficiency. The company does not intend to use it to reduce the number of trailers it owns because its orders are increasing. However, it does want to reduce the number of new trailers it needs to purchase so that it can use the saved funds elsewhere.

Schneider's Global Scheduling System (GSS) helps to optimise the use of both the company drivers and the loads throughout the country. The system processes about 7,000-load assignments daily, looking at all the possible combinations of drivers and loads on any one-day. It accesses more than 7,000 possible combinations of drivers and loads per second, and of course the loads and trucks are at different locations each day. Its primary value is servicing customers by satisfying their requests to move freight. However, the GSS can also save the company money because fuel is expensive, and the system makes it more likely that when the trucker delivers his or her load, the next load to be picked up is close by.

Information technology is also being used to help Schneider retain drivers. There is an industry shortage of 80,000 to 100,000 drivers a year. The company's Touch Home program uses the existing in-cab computer technology to give the drivers e-mail access via satellite. The system thus enables drivers to stay in contact with their families.

The company is forging ahead. For example, currently it is working with *Network Computing* magazine on a Web site, in which the entire logistics transaction will be accomplished electronically, including the order, its acceptance, pickup, delivery, billing, payment, and reporting. "Then order management will be a no-touch process from front to back," declared Steve Matheys, Schneider's vice president for application development. "That's a huge cost-saver and customer satisfaction play."

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1. Analyse Schneider using the value chain and competitive forces models
2. What business strategy did Schneider National adopt? What is the role of telecommunications and information systems in that strategy? How do these systems provide value for Schneider?
3. What organization, management, and technology issues did Schneider National have to address when information technology became so pervasive in its operations?

4. How did Schneider's information systems change its business processes?
5. Has Schneider National's reliance upon information systems been successful? Is the company transforming itself into a digital firm? Why or why not?

Can Sears Reinvent Itself?

Sears, Roebuck and Co. used to be the largest retailer in the United States, with sales representing 1 to 2 percent of the United States gross national product for almost 40 years after World War II. Its legendary Big Book catalogue was considered the primary (and sometimes the only) source for everything from wrenches to bathtubs to underwear. During the 1980s, Sears moved into other businesses, hoping to provide middle-class consumers with almost every type of banking, investment, and real estate service in addition to selling appliances, hardware, clothes, and other goods.

This diversification tore Sears away from its core business, retail sales. Sears has steadily lost ground in retailing, moving from the Number 1 position to Number 3 behind discounters Wal-Mart Stores, Inc. and Kmart Corporation. Sears had been slow to remodel stores, trim costs, and keep pace with current trends in selling and merchandising. Sears could not keep up with the discounters and with specialty retailers such as Toys R Us, Home Depot, Inc., and Circuit City Stores, Inc. that focus on a wide selection of low-price merchandise in a single category. Nor could Sears compete with trend-setting department stores.

Yet Sears has been heavily computerized. At one time it spent more on information technology and networking than other noncomputer firms in the United States except the Boeing Corporation. It was noted its extensive customer databases of 60 million past and present Sears credit card holders, which it used to target groups such as appliance buyers, tool buyers, gardening enthusiasts, and mothers-to-be with special promotions. For example, Sears would mail customers who purchased a washer and dryer a maintenance contract and follow up with annual contract renewal forms.

Why hasn't this translated into competitive advantage? One big problem is Sears' high cost of operations. Nearly 30 percent of each dollar in sales is required to cover overhead (e.g., expenses for salaries, light bills, and advertising) compared to 15 percent for Wal-Mart and about 21 per cent for Kmart.

In 1991, retail operations contributed to 38 percent of the corporate bottom line. The rest of the merchandising group's profits came from the lucrative Sears credit card. Strategies that worked well for competitors fizzled at Sears. J.C. Penney successfully refocused its business to emphasize moderately priced apparel. Everyday low pricing, the pricing strategy used by Wal-Mart and other retailers, bombed at Sears because the firm's cost structure, one of the highest in the industry, did not allow for rock-bottom prices. Everyday low pricing has become "everyday fair pricing" supplemented by frequent sales.

Sears' catalogue sales also stagnated. While the Sears Big Book catalogue, founded in 1887, had the largest revenues of any mail-order business, sales had not been profitable for twenty years; and the catalogue had lost ground to specialty catalogues such as those of L. L. Bean and Lands' End. On January 25, 1993, Sears stopped issuing its famous "big book" catalogues, closed 113 of its stores, and eliminated 50,000 jobs. In order return to its core business and recapture its leadership in retailing, the company also disposed of its Dean Witter securities, Discover credit card, Coldwell Banker real estate, and Allstate insurance subsidiaries.

To help turn Sears around and refocus on retailing, CEO Edward A. Brennan hired executive Arthur C. Martinez away from Saks Fifth Avenue in September 1992, naming Martinez his successor as Sears Chairman and Chief Executive Officer two years later. Martinez ordered the company to combine its half-dozen disparate customer databases to find out who was really shopping at Sears. It turned out that Sears' biggest shoppers were not men looking for Craftsmen tool belts but women aged 25 to 55 with average family incomes of $40,000 who were in the market for everything from skirts to appliances.

Under Martinez, Sears stopped trying to sell everything and started focusing on seven core types of merchandise--men's, women's and children's clothing, home furnishings, home improvement, automotive services and supplies, appliances, and consumer electronics. The company is rearranging its merchandise displays to resemble those of more upscale department stores, with more attention to women's apparel, which is considered a highly profitable segment of merchandising. Sears is also offering special merchandise in each store geared to its local customer base. And it is relieving managers and clerks of some reporting and administrative tasks so they have more time to actually sell. Beginning in 1996 every employee's compensation included a measurement for customer service. Sears realized that it could not compete with discounters such as Wal-Mart Corporation on price alone and focused on building a competitive edge through superior service.

Sears embarked on a $4 billion five-year store renovation program to make Sears stores more efficient, attractive, and convenient by bringing all transactions closer to the sales floor and centralizing every store's general offices, cashiers, customer services, and credit functions. New Point-of-Sale (POS) terminals allow sales staff to issue new charge cards, accept charge card payments, issue gift certificates, and report account information to card holders. The POS devices provide information such as the status of orders and availability of products, allowing associates to order out-of-stock goods directly from the sales floor.

Some stores have installed ATM machines to give customers cash advances against their Sears Discover credit cards. Telephone kiosks have been installed throughout the Sears retail network. Customers can use them to inquire about service, parts, and credit, check the status of their car in the tire and auto centre, or call the manager.

Customer service desks have been largely eliminated. Sales personnel are authorized to handle refunds and returns, eliminating the need for two separate staffs. If a customer forgets his or her charge card, he or she can obtain immediate credit by telling the cashier his or her name and address and presenting identification. Streamlining of patterns of work in back rooms and loading docks also trimmed staff and create savings. These changes also increased the ratio of selling space to nonselling space at Sears, so that an additional 6 million square feet of space could be used to generate revenues.

Sears has been moving its suppliers to an electronic ordering system similar to that described for Baxter Health Care. By linking its computerized ordering system directly to that of each supplier, Sears plans to eliminate paper throughout the order process and hopes to expedite the flow of goods into its stores.

Sears further tightened its grip over the business by building an even larger database for its Sears Credit and Home Services businesses. It consolidates information on 90 million households, 31 million Sears Card users, transaction records, credit status, and related data. Sears hopes to use this information to provide even more finely targeted database marketing. The database houses Sears' Strategic Performance Reporting System (SPRS) helps the company manage pricing and merchandising for its 1950 North American stores.

Until a few years ago, Sears merchandise buyers lacked reliable information on precisely what customers were buying at each store. They could not view anything more specific than each division's daily performance. Management relied on 18 separate systems that often contained conflicting and redundant pricing information. Today, any authorized Sears employee can use SPRS to look up any sales figure by store, by area, by item, right down to the size and colour of a sweater. Sales can be analysed by item or product category, by individual store or company wide. Sales of items advertised in newspapers for a specific day can be tallied so that Sears' 1000 buyers and managers can know what hot-selling merchandise to replenish right away. Buyers can compare current performance of merchandise with that of the previous week or the previous year. The data can be displayed in a number of different ways, including pie charts or graphs.

The Sears charge card, with over 32 million accounts, is the fourth-largest credit card operation in the United States, serving nearly half the households in the United States. Sears' credit card business generates almost half of corporate profits. About half of all purchases made in Sears stores are made with the Sears credit card. Starting in 1993, Sears aggressively courted new credit card customers, doubling the rate at which it issued new credit cards to more than 6 million per year. The increase in credit helped fuel Sears' rising store sales. Although Martinez claims that Sears did not reduce its standards for determining credit-worthy customers, Sears attracted too many high-risk customers, and many of its new credit card customers defaulted on paying their bills. Steve Goldstein, who took charge of Sears Credit in 1996, invested in technology to bring Sears' risk-management systems up to the level leading-edge credit card issuers, such as Citicorp.

Troubles mounted in early 1997. Some cardholders in Massachusetts sued Sears over the intimidating methods it used to persuade bankrupt customers to pay their credit card balance. Sears wound up paying $475 million to settle lawsuits in all 50 states. Later that year, bad-debt charge-offs for uncollectible credit card accounts skyrocketed to over 8% of Sears' receivables, twice the level of two years earlier. Goldstein's group could not properly analyse the delinquent accounts. Although teams of people worked day or night, Sears' computer systems still weren't state of the art and analysis that should have taken a few hours took weeks. Goldstein resigned in December 1997.

To stem the rising loan losses, Sears cut back on new credit accounts to 4.2 million. But as the credit business was reined in, retail sales flattened out. Sales at Sears stores open at least one year only rose 1.1% during 1998, when the retail climate was very strong and competitors posted an average sales increase of 4.4%.

Martinez hoped the Internet could play an important role in Sears' turnaround. Sears set up a separate Internet division with 50 employees on its campus in Hoffman, Illinois. The mission of this group was to make Sears the "definitive source for the home." Consumers can use the Sears Web site to purchase appliances, automotive parts, apparel, house wares, tools, lawn and garden accessories, and other merchandise online. The Web site also features capabilities for customers to arrange for repair service online.

Sears is using Internet technology to develop a system that will let suppliers check the status of their invoices. Sears wants to give vendors access to SPRS so that they can check the sales of their products and provide just-in-time inventory service. It is also working with Sun Microsystems and other technology companies to create home appliances and services that use the Internet.

Sears has acted as if it is showing some progress. In January 2002 the company announced that during that year it would add 15 new stores, so that it would have about 900 nationwide, and it would remodel 50 others. At the same time it announced that it would stop selling and installing carpets to free up more space for more profitable products such as appliances. This action also allowed the company to eliminate 1,500 jobs.

In May 2002 Sears announced it was purchasing catalogue and Web retailer Lands' End, the highly impressive direct-marketing company. In 2001 Lands' End reported a net profit of $66.9 million on sales of $1.6 billion---a margin of 4.3% (compared with Sears' profitability of only 1.8%). Lands' End CEO will manage Sears' online and catalogue businesses, and Sears will gain access to Lands' End's customer file of about 30 million families. Sears also hopes this acquisition will give its apparel products a more stylish look. Sears planned that by the end of 2002 Lands' End good would be sold in 180 of its retail outlets. The two companies have very different cultures in addition to the major differences in their businesses. Lands' End is considered top notch in its customer service. For example its return policies can't be beaten, while the company answers e-mails within four hours. It also is a much younger and more nimble company than is Sears. Many question the ability of the two companies to benefit significantly from the merger. Moody's Investors Service lowered its rating on Sears debt as a result.

In October 2002 Sears warned that its third-quarter profit would be below Wall Street expectations because its credit card business appears to be "losing steam." It is clear that the size of its unpaid credit card debt has been growing rapidly. In October the company also appointed a new CIO, Garry Kelly, who was given the task of addressing Sears' fragmented information technology.

Can the Internet help Sears to turn around? Will Sears be able to prosper without easy credit? After Martinez arrived, Sears had a measure of success in lowering its margins and increasing same-store sales. The question is whether Sears can sustain this momentum. Its operating expenses are still high compared with industry leaders. Market research indicates that Sears continues to be the destination of choice for lawn mowers, wrenches, washing machines, and other "hard" goods -- and its tools and appliance businesses are posting large sales gains. But Sears has not yet secured itself as a place for fashionable women's clothing. It is too early to measure the impact of the acquisition of Lands' End on its apparel business. Some critics believe that future earnings growth will flag once the company completes its remodelling program and that Sears remains vulnerable to aggressive discounters. CEO Alan J. Lacy, who succeeded Martinez, wants to emphasize Sears as a one-stop source of popular consumer brands rather than focus too much on price. Can Sears' reinvention keep the company competitive now and in the future?

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1. Evaluate Sears using the competitive forces and value chain models
2. What management, organization, and technology factors were responsible for Sears' poor performance?
3. Evaluate Sears' new business strategy under Martinez and Lacy. What management, organization, and technology issues are addressed by this strategy?
4. How successful is Sears' new strategy? What role do information systems play in that strategy?
5. To what extent have information systems provided competitive advantage for Sears? Explain
6. How important is the Web in Sears' strategy? How might the Lands' End acquisition help the company? What problems does it present Sears?

System Modernization at the Social Security Administration

The Social Security Administration (SSA) consists of approximately 65,000 employees located in 1300 field offices, 10 regional offices, 7 processing centres, 4 data operations centres, and the Baltimore headquarters. SSA administers the major social insurance programs in the United States, delivering benefits to more than 50 million people each month.

In order to administer these programs, SSA maintains 260 million names in its account number file (enumeration file), 240 million earnings records, and 50 million names on its master beneficiary file. In addition to keeping these files current, SSA annually issues 10 million new Social Security cards, pays out $170 billion, posts 380 million wage items reported by employers, receives 7.5 million new claims, recomputes (because of changes in beneficiary status) 19 million accounts, and handles 120 million bills and queries from private health insurance companies, carriers, and intermediaries. SSA processes more than 25 million transactions per day. Virtually every living American has some relationship with SSA.

In the early 1980s, the long-term funding for Social Security payments in the United States was in serious jeopardy, and SSA's computerized administrative systems were nearing collapse. This was an unusual state of affairs for SSA. As the flagship institution of the New Deal, SSA had developed broad bipartisan support, and there was never any serious question about its long-term financial viability until the late 1970s. In addition, since its inception in 1935, SSA had been one of the leading innovators and implementers of advanced information technology in the United States.

In 1982, SSA announced its Systems Modernization Plan (SMP), which turned into a $1 billion, ten-year effort to completely rebuild its information systems and administrative processes. The SMP was one of the largest civilian information system rebuilding efforts in history. Ten years later, SSA embarked on another ambitious round of technology modernization as it tried to create an information architecture for the twenty-first century.

SSA illustrates many central problems of management, information technology, and organization faced by private and public organizations in a period of rapid technical and social change. Although SSA operates in a unique federal government environment, many large private organizations have exhibited similar problems during this time period. The problems and solutions illustrated in this case are generic.

The case is organized into three sections. Section I describes the overall situation at SSA in the period before SMP, roughly 1972 to 1982. Section II describes the experience of SMP. Section III considers the long-term prospects of SSA.

Section I: Organization, Management, And Systems, 1972-1982

The overall system environment at SSA in 1982 could best be described as a hodgepodge of software programs developed over a 20-year period in four different machine environments. In the history of the agency, no one had ever conducted an information system requirements study to understand the overall requirements of the agency or the specific requirements of its subunits. There had been no planning of the information systems function for more than 20 years. Instead, as in many private organizations, systems drifted along from year to year, with only incremental changes.

Software

SSA software resulted from decades of programming techniques. The enumeration system, which supports the issuance of Social Security numbers, was designed in the late 1950s and had never been changed. The earning system was designed in 1975, the claims processing system was unchanged from the early 1960s, and other systems were also inherited from the late 1960s and 1970s. The software was a product of unplanned patchwork, with no regard given to its deterioration over time.

From the 1950s to the 1980s, there were four major equipment transitions. However, the software was not improved or redesigned at any of these transitions. All of SSA's files and programs were maintained on more than 500,000 reels of magnetic tape, which were susceptible to aging, cracking, and deterioration. Because tape was the storage medium, all data processing was batch sequential.

In summary, there were 76 different software systems making up SSA's basic computer operations. There were more than 1300 computer programs encompassing more than 12 million lines of COBOL and other code. Most of the 12 million lines of code were undocumented. They worked, but few people in the organization knew how or why, which made maintenance extremely complex. In the 1960s and 1970s, Congress and the president made continual changes in the benefit formulas, each of which required extensive maintenance and changes in the underlying software. A change in cost-of-living rates, for instance, required sorting through several large interwoven programs, which took months of work.

Because of the labour-intensive work needed to change undocumented software and the growing operations crisis, software development staff were commonly shifted to manage the operations crisis. The result was little development of new programs.

It did not help matters that few people in Congress, the Office of the President, the Office of Management and Budget, or other responsible parties understood the deleterious impact of program changes on SSA systems capabilities. Unfortunately, SSA did not inform Congress of its own limitation.

Even by the late 1970s, SSA had not begun to make the transition to newer storage technology, file management and database technology, or more modern software techniques. In this respect, SSA was about five years behind private industry in making important technological transitions.

Hardware

By 1982, SSA was operating outdated, unreliable, and inadequate hardware, given its mission. Many of the computers had not been manufactured or marketed for 10 years or more. Eleven IBM 360/65 systems were no longer manufactured or supported. Although more modern equipment might have required $1 million annually for maintenance and operations expenses, SSA was spending more than $4 million to keep these antiquated machines in service.

Because of frequent breakdowns, more than 25 percent of the production jobs ended before completion (abended jobs), and 30 percent of the available computer processing power was idle. As a result of hardware deficiencies, a number of specific program impacts became apparent in 1982:

Earnings enforcement operations, which help detect overpayments, were more than three years behind schedule.

The computation of benefit amounts to give credit for additional earnings after retirement was three years behind schedule.

Supplemental Security Income (SSI) claims and post eligibility redeterminations could be processed only three times a week rather than five times a week. This meant delays of several days or weeks for SSI beneficiaries.

To process cost-of-living increases in 1982 for 42 million individuals, SSA had to suspend all other data processing for one week.

SSA estimated that its gross computing capacity was deficient by more than 2000 CPU hours per month. SSA estimated that it needed 5000 central processing hours per month, but its capacity was only 3000 CPU hours per month.

Telecommunications

SSA depends heavily on telecommunications to perform its mission. Its 1300 field offices need timely access to data stored at the central computer facility in Baltimore. In 1982, however, SSA's telecommunications was the result of an evolving system dating back to 1966. The primary telecommunications system was called the Social Security Administration Data Acquisition and Response System (SSADARS), and it was designed to handle 100,000 transactions per day. One year after it was built in 1975, the system was totally saturated. Each year teleprocessing grew by 100 percent. By 1982 the SSADARS network was frequently breaking down and was obsolete and highly inefficient.

By 1982, there was little remaining CPU telecommunications capacity in the off-peak periods to handle the normal growth of current workloads. Entire streams of communications were frequently lost. At peak times, when most people wanted to use the system, it was simply unavailable. The result was telecommunications backlogs ranging from 10,000 to 100,000 messages at a time.

Database

The word database can be used only in a very loose sense to refer to SSA's 500,000 reels of magnetic tape on which it stored information on clients in major program areas. Each month SSA performed 30,000 production jobs, requiring more than 150,000 tapes to be loaded onto and off of machines. The tapes themselves were disintegrating, and errors in the tapes, along with their physical breakdown, caused very high error rates and forced a number of reruns. More than one-third of the operations staff (200 people) was required simply to handle the tapes.

As in many private organizations, data were organized at SSA by programs, and many of the data elements were repeated from one program to the next. SSA estimated that there were more than 1300 separate programs, each with its own data set. Because there was no data administration function, it was difficult to determine the total number of data elements, or the level of redundancy within the agency as a whole or even within program areas.

Management Information Systems

In 1982, SSA had a woefully inadequate capability in the MIS area. Because the data were stored on magnetic tape and were generally not available to end-user managers throughout the organization, all requests for reports had to be funnelled through the information systems operations area.

But there was a crisis in operations, and this meant delays of up to several years in the production of reports crucial for management decision-making. As long as all data were stored in a format that required professional computer and information systems experts to gain access to them, general management always had to deal with the information systems department. This group had a stranglehold on the organization. Their attitude, as one commentator noted, was summed up in the statement, "Don't bother us or the checks won't go out."

How Could This Happen?

There are two explanations for SSA's fall from a leading-edge systems position to near collapse in the early 1980s. First, there were internal institutional factors involving middle and senior management. Second, a sometimes hostile and rapidly changing environment in the 1970s added to SSA's woes. In the 1970s, Congress had made more than 15 major changes in the Retirement and Survivors Insurance (RSI) program alone. These changes increasingly taxed SSA's systems to the point that systems personnel were working on weekends to make required program changes.

In 1972 Congress passed the Supplemental Security Income (SSI) program, which converted certain state-funded and -administered income maintenance programs into federal programs. SSA suddenly found itself in the welfare arena, which was far removed from that of a social insurance agency. Other programs, such as Medicaid and changes in disability insurance, as well as cost-of-living (COLA) escalators, all severely taxed SSA's systems and personnel capacity. The 1978 COLA required changes in more than 800 SSA computer programs.

The number of clients served by SSA doubled in the 1970s. But because of a growing economic crisis combining low growth and high inflation (stagflation), Congress was unwilling to expand SSA's workforce to meet the demands of new programs. There was growing public and political resistance to expanding federal government employment at the very time when new programs were coming on-line and expectations of service were rising.

SSA management at this time consistently overstated its administrative capacity to Congress and failed to communicate the nature of the growing systems crisis. SSA pleas for additional personnel were consistently turned down or reduced by Congress and the White House. Workloads of employees dramatically increased, and morale and job satisfaction declined. Training was reduced, especially in the systems area, as all resources were diverted to the operations crisis.

Toward the end of the 1970s, the growing conservative movement among Republicans and Democrats interested in reducing the size of all federal programs led to increasing pressure on SSA to reduce employment levels. In the long actuarial funding debate at the beginning of the 1980s, there was talk about "privatising" Social Security and abolishing the agency altogether.

Complicating SSA's environment was the Brooks Act of 1965, which mandated competitive procurement of computing equipment and services. Until 1965, SSA had had a long-standing and beneficial relationship with IBM. Virtually all of SSA's equipment was manufactured by IBM and purchased on a non-competitive basis. IBM provided planning, technical support, software support, and consulting services to SSA as part of this relationship.

By the 1970s this close relationship had ended. IBM shifted its support and marketing efforts away from the federal arena because of the Brooks Act. SSA found itself in a new competitive environment, forced to do all of its own planning, development, and procurement work. As the workload rapidly expanded at SSA in the 1970s, the agency needed a well-planned, closely managed transition to new computing equipment and software. This transition never occurred.

A challenging environment might have been overcome by a focused and dedicated management group. Perhaps the most critical weakness of all in SSA's operation in the 1970s was its inability to gain management control over the information systems function and over the information resource on which the organization itself was based.

Senior management turnover was a critical problem. In its first 38 years, SSA had six commissioners with an average tenure of 6.5 years. Two men led the agency for 27 of its 38 years. But from 1971 to 1981, SSA had seven commissioners or acting commissioners with an average tenure of 1.1 years. None of these commissioners had any experience at SSA. The senior staff of the agency was also repeatedly shaken up in this period. Compared with earlier senior managers, those of the 1970s failed to realize the critical importance of information systems to SSA's operation. Long-range planning of the agency or systems became impossible.

With new senior management came four major reorganizations of the agency. Major SSA programs were broken down into functional parts and redistributed to new functional divisions. Program coherence was lost. Performance measures and management control disappeared as managers and employees struggled to adapt to their new functions.

Efforts at Reform

SSA made several efforts in this period to regain control and direction in the systems area on which its entire operation critically depended. In 1975, SSA created the Office of Advanced Systems (OAS) within the Office of the Commissioner. SSA hoped that this advanced, high-level planning group with direct access to senior management would develop a strategy for change. Unfortunately, this effort failed to reform SSA's manual and batch processes and was opposed by systems operations management and the union. There was no White House support for it and no suggestion from Congress or the White House that needed funding would be forthcoming. In 1979 the OAS was abolished by a new management team.

A second effort at reform began in 1979. This time the idea originated with new senior management. Called partitioning, the new reform effort sought to break SSA's internal operations into major program lines-similar to product lines-so that each program could develop its own systems. This plan was quickly rejected by the White House, Congress, and outside professionals.

A third reform effort also began in 1979. Here SSA sought to replace the aging SSADARS telecommunications network with new, high-speed communications terminals in the district offices and new telecommunications computers in the Baltimore headquarters. After a competitive procurement process, SSA contracted with the Paradyne Corporation for 2000 such terminals. Unfortunately, the first 16 systems failed all operational tests on delivery in 1981. Investigations produced charges of bidding fraud (selling systems to SSA that did not exist, "black boxes with blinking lights"), securities fraud, bribery, bid rigging, perjury, and an inadequate SSA systems requirements definition. By 1983 SSA took delivery of all the terminals, and they did perform for their expected life of eight years. But the procurement scandal further reduced SSA's credibility in Congress and the White House. Senior management turnover, lack of concern, and failed efforts at reform took a severe toll in the systems area. Planning of information systems was either not done or was done at such a low operational level that no major changes in operations could be accomplished.

Section II: The Systems Modernization Plan

As the crisis at SSA became increasingly apparent to Congress, the General Accounting Office, and the President's Office, pressure was placed on SSA to develop a new strategy. In 1981 a new commissioner, John Svahn, a recently appointed former insurance executive with systems experience, began work on a strategic plan to try to move SSA data processing from collapse to a modern system. The result was a five-year plan called the Systems Modernization Plan (SMP). SMP was intended to bring about long-range, tightly integrated changes in software, hardware, telecommunications, and management systems. At $500 million, the original cost estimate in 1982, the SMP was one of the single most expensive information systems projects in history.

SMP Strategy

As a bold effort to secure a total change at SSA, the SMP adopted a conservative strategy. This strategy called for SSA to do the following:

- Achieve modernization through incremental, evolutionary change, given the unacceptable risks of failure.
- Build on the existing systems, selecting short-term, feasible approaches that minimize risks.
- Separate the modernization program from the operations and maintenance programs.
- Use an external system integration contractor to provide continuity to the five-year project.
- Use industry-proven, state-of-the-art systems engineering technology.
- Establish a single organizational body to plan, manage, and control SMP.
- Elevate systems development and operations to the highest levels of the agency.

SMP Implementation

The original plan foresaw a five-year effort broken into three stages: survival, transition, and state of the art. In the survival stage (18 months), SSA would focus on new hardware acquisition to solve immediate problems of capacity shortage. In the transition stage (18 months), SSA would begin rebuilding software, data files, and telecommunications systems. In the final state-of-the-art stage, SSA would finalize and integrate projects to achieve a contemporary level of systems. The SMP involved six interrelated programs.

- **Capacity Upgrade Program (CUP).**
  CUP was developed to reconfigure and consolidate the physical computing sites around central headquarters in Baltimore, to acquire much higher capacity and more modern computers, to eliminate sequentially organized magnetic tape files and switch to direct access devices, and to develop a local computing network for high-speed data transfers.
- **System Operation and Management Program (SOMP).**
  SOMP was intended to provide modern automated tools and procedures for managing and controlling SSA's main computer centre operations in Baltimore. Included were automated job scheduling tools, job station monitoring and submission systems, operational job procedures, training, and a central integrated control facility to ensure that SSA would make a smooth transition to a modern data centre environment.
- **Data Communications Utility Program (DCUP).**

DCUP was designed to reengineer SSA's major telecommunications system (SSADARS). What SSA wanted was a transparent conduit for the transmission of data between and among processing units of different manufacture using a single integrated network. More than 40,000 on-line terminals were to be used in the 1300 field offices.

- **Software Engineering Program (SEP).**
  SEP was designed to upgrade the existing software and retain as much of it as possible so that entirely new code did not have to be written. A critical part of the SEP was a top-down, functional analysis (using the enterprise system planning method) of the Social Security process-all of the business and organizational functions of SSA. Hopefully, this top-down planning effort would provide the framework for the redesign of SSA's total system by establishing the requirements for improvements in existing software. A second key aspect of the software engineering effort was the implementation of new software engineering technology. This involved developing and enforcing programming standards, developing quality controls, and using modern computer-aided software development tools. Special emphasis was placed on the development of modern program documentation, standardization of programs, and conversion to higher-level languages when possible.
- **Database Integration.**
  The database integration project involved four objectives. As a survival tactic, SSA wanted to reduce the current intensive-intensive, error-prone magnetic tape operation by converting all records to high-speed disk, direct access storage devices (DASD). A second goal was to establish a data administration function to control the definition of data elements and files. A third goal was to eliminate the data errors by establishing data controls, validating files, and developing modern storage disk technology. A fourth objective was to integrate the variety of databases, making communication among them transparent.
- **Administrative Management Information Engineering Program (AMIEP).**
  SSA was fundamentally dependent on manual activities to conduct most of its administration. Requests for personnel actions, purchase requisitions, telephone service, travel orders, building modifications, training requests-all these administrative matters-were processed manually. The AMIEP program was designed to integrate MIS with other programmatic modernization activities: to automate and modernize intensive-intensive administrative processes and to develop management MIS to improve the planning and administrative process.

The End of SMP: Success and Failure

SMP had become increasingly controversial: Critics claimed failure whereas the agency's leaders claimed success. By 1988 Dorcas Hardy, the new SSA commissioner, quietly ended SMP and announced a new plan called "2000: A Strategic Plan." What had the SMP accomplished in five years?

For much of the early years of SMP the environment was supportive of and sympathetic to the modernization program. By 1986, however, criticism was beginning to develop over the rising costs and seemingly endless time frame. In large part the critics drew strength from the fact that the SMP project had been extended by SSA for an additional five years (to 1992) and had doubled in expected cost to $1 billion; no major software breakthroughs were apparent to the public or Congress; and the effort to modernize SSA's "backend" or database appeared to stall.

The White House increasingly pressed SSA to make plans for reducing its staff by one-quarter, or 20,000 positions. By the end of 1988, the SSA staff had been reduced by 17,000 workers, from 83,000 to 66,000, mostly by attrition. These reductions were made in anticipation of sharp increases in productivity brought about by the SMP modernization efforts. There was little systematic effort to examine this hope.

The General Accounting Office (GAO), responding to requests from the House Government Operations Committee (Rep. Jack Brooks, Democrat of Texas, chairman), issued many highly critical reports of SSA's procurement policies. In one report issued in 1986, GAO charged that SSA failed to redevelop software or to develop a true database architecture. In another 1987 report, GAO claimed that SSA's new Claims Modernization Software would handle only 2 percent of the workload (merely initial applications for retirement and not the application processing or post entitlement changes)! The report chided SSA for dropping modernization of the post entitlement process, which accounts for 94 percent of daily SSA transactions. SSA management heatedly denied GAO's allegations, but the backsliding in software became a major weapon of SMP opponents. GAO called for a halt in procurements. Hardy refused and began purchasing 40,000 full-colour desktop terminals.

A revie w of SMP by the Office of Technology Assessment (OTA), a congressional research agency, concluded that the White House, Congress, and SSA were all to blame for SSA's failure. The White House was blamed for prematurely seeking huge workforce reductions before the new systems were in place. It was also blamed for continuing political interference in the agency and for failure to support senior management. Congress was blamed for failing to understand the complexity of SSA programs and the long-term nature of total systems change. In addition, OTA blamed new procurement laws for slowing down and complicating the purchase of new hardware.

OTA pointed to a number of faults at SSA. From the very beginning of SMP, SSA failed to rethink its method of doing business. SMP basically sought to automate an organizational structure and a way of doing business established in the 1930s. SSA failed, for instance, to question the role of 1300 field offices-are they really needed in a day of wide area networks and desktop PCs? Should SSA's major data files be centralized in Baltimore? SSA failed to rethink its basic architecture of a centralized mainframe operation in Baltimore serving the entire country. Why not a more decentralized structure? Why not minicomputers in every district office? OTA also pointed to SSA's failure to develop new software on a timely basis and a new database architecture. It was felt these shortcomings, especially in software and database, would ultimately come to haunt SSA thereafter. In general, SMP lacked a vision for the future around which it could build a powerful new information architecture.[1]

GAO, OTA, and labour critics believed that whatever increases in productivity occurred from 1982 to 1988 resulted largely from workforce reduction, deterioration in service, and asking the remaining employees to work harder, rather than any result of technology per se. Although public surveys published by SSA showed the general public thought SSA did a fine job, surveys of field office employees and managers with direct knowledge of the situation showed declining service quality, employee performance, and morale.

As employee levels dropped, managers complained in interviews that the "work load is oppressive," recalling days in the 1960s when lines of clients surrounded SSA offices. Although managers praised the new claims modernization software, teleservice centres, and preinterviewing techniques that permit clericals to answer questions of clients using on-line queries, the overall reduction in labour force put a "crushing load on District Office personnel." Employees and managers reported many of the most capable managers and claims representatives were leaving SSA for the private sector or other government jobs as working conditions deteriorated.[2]

For the critics, SSA had made some improvements in service and processing, but these resulted early in the SMP plan and were largely the result of hardware purchases and running the old software faster. Whatever progress in productivity occurred did so at the expense of employees and service to clients.

By 1988, SSA management conceded that SMP had indeed doubled in size to a projected $1 billion, but by 1988 the SMP plan had actually spent slightly less ($444 million) than the original estimate of $500 million. Management conceded that the time required to reach state-of-the-art processing had been extended to 1992; that there was an excessive emphasis on hardware, that software development was slow, and that the agency carried over large balances of unbudgeted funds from year to year (indicating difficulty in managing projects and allocated funds).[3] In fact, software development was four years behind schedule, and the database redesign (the so-called "backend" of the system) was still being considered after five years. Nevertheless, SSA had documented steady improvements in a number of measures of services to beneficiaries, many of which are due to the SMP:

- A 25 percent decrease in RSI claims processing time.
- A small decrease in disability insurance (DI) claims processing time (2.2 days).
- A high and improving rate of RSI claims accuracy (95.7 to 97.2 percent).
- A 41 percent decrease in SSI processing time.
- A 7 percent decrease in SSI blind/disabled processing time.
- A 47 percent decrease in retired survivors disability insurance (RSDI) status processing time.

Stable administrative costs in RSI since 1980 (1.1 percent of benefits).

Management pointed to the following key changes brought about by the SMP: Management claimed that overall SMP brought about a 25 percent increase in productivity. The agency was doing slightly more work in 1988 than it was in 1982 but with 17,000 fewer employees. SSA created a new deputy commissioner for systems development and raised the status of systems in the organization to the senior management level. Management noted that SMP had made great progress in its specific program areas.

Hardware Capacity Upgrade

Between 1982 and 1988 SSA increased processing capacity twenty fold, from 20 MIPS to a total of 400 MIPS, replacing outdated computers purchased without competitive bids with hardware supplied by three manufacturers on a competitive basis.

System Operation and Management Program (SOMP)

The central processing facility in Baltimore developed efficient job scheduling standards and procedures for handling tapes and documents so that 95 percent of its processing is completed on time.

Data Communications Utility Program (DCUP)

Under SMP a network of more than 50,000 devices was installed nationwide, with the objective of putting a terminal on every claims representative's desktop.

Network capacity increased from 1200 characters per second in 1982 to 7000 characters per second in 1988.

Software Engineering

SSA made major progress redesigning the software for the retirement program. Now millions of retired persons can initiate the claims process or inquire about their accounts using an 800-number teleservice or have a claims representative initiate the claim on-line from a district office. In 1982 this capability was not even imagined. Developing such interactive systems to deliver services required entirely new code; the old software could not be salvaged.

Database Integration

SSA converted 500,000 reels of tape to more modern DASDs. All master files were converted to disk, making it possible to handle more than 2 million inquiries per day directly on-line. SSA developed its own in-house data management system called the Master Data Access Method (MADAM) to handle all on-line and batch access to SSA master files. However, the data are still organized according to major program areas. SSA has yet to develop an integrated database for all or even some of its major programs that could provide a "whole person" view of SSA clients. A major difficulty is deciding on an overall database architecture that could integrate information from the major program areas.

SECTION III: SSA'S STRATEGIC PLAN AND INFORMATION SYSTEMS PLAN

SSA issued a new Agency Strategic Plan (ASP) in 1988. The plan was updated in 1991 to incorporate a wider vision of the agency's future. The new ASP strategic priorities called for improvements in client access to SSA, the appeals process, and the disability process; movement toward a paperless agency; and establishment of a decentralized data processing structure.

In August 1990 Renato A. DiPentima took over as deputy commissioner of systems. DiPentima initiated a seven-year Information Systems Plan (ISP) in September 1991 to support the ASP. The ISP was updated in 1992 and late 1993.

The ISP is SSA's long-range plan for managing information systems as the agency moves into the 1990s and beyond. Its primary goal is to support the ASP by building a systems environment that improves service to the public and SSA users. Long-term strategic priorities include improving the disability process, the appeals process, and the public's access to SSA by turning SSA into a paperless agency with electronic claims folders, and establishing a cooperative processing architecture. The ISP was designed to be a continuous plan that could always be upgraded.

Both plans address the challenges faced by SSA as it moves into the twenty-first century. SSA's total workload is expected to increase by 26 percent between 1990 and 2005. There will be limited funding for new initiatives, coupled with increased demands for higher levels of service to the public. In the past, most SSA clients preferred to visit SSA field offices. Today, they prefer to conduct their business over the telephone, and they expect the same fast, efficient service they receive in the private sector. SSA must enhance systems to handle increasing workloads without hiring more employees and keep costs low because of scarce budgetary resources. The number of field and operational employees has already decreased substantially since the 1980s and the remaining employees require new technologies to handle the increased workload.

The ISP calls for moving SSA toward a distributed architecture, ending its total reliance on centralized mainframe computers for its programmatic applications that deliver services to SSA clients. Selected business functions are being distributed between headquarters and local processors. Most SSA employees will use LAN-based intelligent workstations with multiple levels of software running on platforms ranging from mainframes to PCs. Databases are being distributed. Greater efficiency will result from having processing close to the data source and information user.

The SSA's technology modernization calls for an IWS/LAN (intelligent workstation and local area network) Technology Program. IWS/LAN is intended to move SSA to a more decentralized computing environment by replacing SSA's "dumb terminals" with 60,000 PCs arranged in token ring LANs. The LANs give SSA field staff more autonomous computing power and the ability to perform word processing, to share data, and to exchange e-mail messages. They are being linked to the agency's main network, SSANet. By early 1999, SSA had converted 80 applications to Windows NT servers.

By distributing processing and storing data at the level where the work is done, the number of data accesses and the volume of network traffic should be minimized, decreasing the response time for many workloads. For example, access time for important records has been reduced from several minutes to 30 seconds. This arrangement allows the automation of many functions that are presently not cost effective to do on a mainframe or practical to do on a PC.

The SSA's computer centre in Baltimore will continue to supply mainframe-processing power for programs such as retirement and supplemental security. But as applications are rewritten, the PCs will perform more of the processing and the mainframe will gradually evolve into a database server role. SSA has argued that implementation of IWS/LAN is essential to provide an infrastructure for future electronic delivery and reengineering initiatives and to avoid problems and expenditures resulting from breakdowns in existing dumb terminals.

SSA replaced many batch applications with on-line interactive systems, starting with the Title II claims process, then the Title XVI, disability, and Title II post entitlement processes. By the year 2000, SSA expects to convert most of its major systems to an interactive environment using an appearance-of-update technique, which from the user's perspective appears to update master records on-line. Expert systems, such as an application to provide answers to telephone inquiries, will help reduce manual processing.

Although databases will be distributed over SSA's multilevel telecommunications system, commercial DBMS are still not capable of handling SSA's specific requirements under a distributed processing environment. SSA plans to monitor the performance improvements of commercial DBMS as they mature for future consideration. The decision to distribute SSA's large databases will be based on cost/benefit and service improvement considerations.

SSA is reducing transmission costs by using telephone switching systems to integrate network access when possible. It will provide a common connection to be shared by voice services, video teleconferencing, fax, LAN interconnections, and SSANet. SSA communications planning will use OSI standards, specifying appropriate protocols, interfaces, and network technologies to obtain required intercommunication and interoperability.

SSA points to many service improvements that resulted from these systems initiatives. An 800-phone number now receives more than 64 million calls annually. Customers can use this 800 number to file retirement or survivor claims immediately.

Seventy percent of babies in the United States are enumerated at birth, eliminating the need to make separate applications for Social Security numbers.

Is Distributed Technology Enough?

In the spring of 1994, the OTA released a report stating that the SSA's $1.1 billion five-year migration from mainframe to client/server computing was technically sound but ahead of the agency's understanding of how to use intelligent workstations and LANs to improve service delivery. The OTA report reiterated concerns raised by the GAO that SSA was unlikely to realize significant benefits because it had not linked its proposed technology strategy to specific service delivery improvements. GAO questioned SSA's plans to implement IWS/LAN before determining the service delivery improvements that could result from this technology. OTA noted that SSA had made a good-faith effort to restructure its service delivery but that the agency had "prioritised . . . installation according to current SSA operational and service delivery needs-essentially automating marginal improvements in the status quo." OTA believed that SSA needed to include its clients, labour representatives, and individuals with experience in electronic service delivery into its planning process, and it needed to reengineer its business processes to dramatically improve service. OTA also believed SSA had not done enough analysis of the costs and benefits of automation, including IWS/LAN, and of the impact of automation against specific performance goals.

OTA pointed out that SSA's ever-increasing workload, coupled with staff reductions from further government downsizing, could again threaten SSA's ability to deliver the level of service expected by Congress and the public. OTA also questioned the feasibility of managing a massive distributed computing environment from a single facility in Baltimore. Deputy Commissioner DiPentima responded by noting that it was a big challenge to maintain such a large network and monitor it centrally. If SSA were to monitor the network locally, it would require 2000 LAN managers. The centrally managed network has been able to process 20 million transactions per day with 99.9 percent uptime. OTA recommended that SSA receive funding for reengineering and service delivery planning and that the agency participate in government-wide electronic delivery pilots and projects such as the following:

- Electronic data interchange (EDI) for filing earnings reports by business.
- Direct electronic deposit of benefits payments.
- Electronic bulletin boards and networks to provide the public with information about SSA.
- Multiprogram electronic benefits delivery in which a single card could be used to obtain payment for Social Security benefits, Medicaid, and food stamps.
- Integrated electronic records for SSA recipients, providing a single electronic folder instead of separate electronic and paper files.
- Automated disability determination to streamline determination of initial and ongoing medical qualifications for disability insurance benefits.

Determining eligibility for disability benefits is considered the most troubled SSA service. SSA must continually ensure that recipients are eligible based on their medical and financial condition. Candidates for disability benefits are currently evaluated by state Disability Determination Service (DDS) offices, which are funded by SSA but are run by the states. Initial disability determinations can take up to several months, with a backlog of 750,000 cases. The backlog of continuing reviews is even larger. The error rate for disability insurance, resulting in overpayments to eligible recipients, payments to ineligible recipients, or denial of benefits to qualified people, is estimated to be about 3.5 percent, which is similar to the error rate for SSI programs. SSA-sponsored studies have suggested that automation will play a small role in improving the disability process in comparison to radically changing the organization and the flow of disability work. SSA set up a reengineering task force in mid-1993, with the full support of top management, to focus on ways to radically improve the disability benefit determination process. Its findings served as the basis of a blueprint for streamlining the disability process.

In its drive toward paperless processing, SSA developed capabilities for small businesses to submit wage reports electronically using a PC or high-speed data transmission lines. In 1998, wage reports for nearly 14 million employees were submitted this way. The electronic filing effort could replace the 62 million paper forms SSA receives annually from small businesses and reduce the workload at SSA's Wilkes Barre data operations centre. (Companies with more than 250 employees already file electronically.)

Most requests for benefits estimates are made on paper forms that cost SSA about $5.23 each to process. Congress has ordered the agency to provide annual benefits estimates for every worker over age 25, amounting to 123 million people, by the year 2000. SSA enhanced its Web site to allow visitors to request benefits estimates on-line, but it has backed away from delivering their estimates over the Web because of concerns about security and protection of individual privacy. Taxpayers must still receive their benefits estimates and history of reported earnings by mail.

The agency is exploring additional ways of using Internet technology to improve customer service. In June 2000 it announced it was partnering with CommerceNet, a non-profit consortium, for this purpose. CommerceNet is bringing together a number of technology companies such as Unisys, IBM, Cisco Systems, Oracle, and BroadVision to help SSA test various technologies such as instant messaging and voice over Internet, which will allow clients to contact agency representatives over the Internet and communicate with them at the same time they are visiting the SSA Web site. SSA is also experimenting with software that would allow their customer service representatives to better manage and aggregate customer information whether it comes from the Internet, telephone or field offices.

Much has been learned by SSA about the difficulties of building systems that can meet ever-changing business needs. Management has learned that deploying new information technology does not automatically translate into fewer employees, especially when transaction volumes are increasing. Can SSA continue to decentralize? Will SSA's information systems maintain the level of service the public and Congress expect? These are just some of the difficult questions facing SSA as it moves into the twenty-first century.

Sources: Social Security Administration, "Social Security Administration to Partner with CommerceNet to Conduct In-house Laboratory Testing of New Internet Technologies, "June 13, 3000. Edward Cone, "Social Security Gets It Right," Information Week Online, January 12, 1998; Matt Hamblen, "Are U.S. Agencies Ready for Year 2000?" Computerworld, January 11, 1999; Richard W. Stevenson, "Social Security: Divergent Paths," The New York Times, March 24, 1999; "Social Security Unit to Close a Web Site for Security Review," The Wall Street Journal, April 10, 1997; Sharon Machlis, "Web Apps May Cut Costs at Social Security," Computerworld, April 7, 1997; Dale Buss, "Social Security Going Paperless," Home-Office Computing, February 1997; David Bank, "Social Security Plans to Test W2 Forms Filed on the Internet," The Wall Street Journal, October 25, 1996; Martha T.

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[1] *Office of Technology Assessment, "The Social Security Administration and Information Technology, A Case Study," Washington, D.C.: U.S. Congress (1986).*

[2] *Based on interviews in northeastern U.S. metropolitan area district offices by the authors and Alan F. Westin.*

[3] *Social Security Administration, "Report on Social Security Administration Computer Modernization and Related Expenditures," prepared for the Senate Appropriations Committee, February 1989.*

1. What were the major factors in SSA's past that made it a leading innovator in information systems technology? How did these supportive factors change in the 1970s?
2. Describe briefly the problems with SSA's hardware, software, data storage, and telecommunications systems prior to SMP.
3. What were the major environmental and institutional factors that created the crisis at SSA?
4. Why did SSA's reform efforts in the late 1970s fail?
5. What were the major elements of SSA's implementation strategy for SMP? Describe its major projects
6. What successful changes in management and organizational structure have been brought about by SMP? How secure are these changes (what environmental factors could destroy them)?
7. In what areas has SMP had the greatest success? In what areas has SMP not succeeded? Why?
8. Evaluate SSA's IWS/LAN and Internet technology program in light of SSA's history of information systems projects.
9. How successful has SSA been in creating an appropriate information system architecture for the year 2000? Justify your explanation