XEROX: OUTSOURCING GLOBAL INFORMATION TECHNOLOGY RESOURCES

June 1994, Jagdish Dalal, head of Xerox's global outsourcing team, finalized a 10-year, $3.2 billion contract with Electronic Data Systems (EDS). Reflecting on the hard work his staff had accomplished and confident that the agreement they had crafted would allow Xerox to create a new business, Dalal was pleased with what he accomplished:

This case was prepared by research associate Kevin Davis under the supervision of Professor Lynda M. Applegate.

The deal was noteworthy both for its size and for the way it was to be managed. This was reputed to be the largest computer outsourcing deal in history, and the first to be implemented on a global scale. Few vendors could support such a contract.

Outsourcing model Xerox was pioneering would automatically adjust to environmental changes while keeping EDS's and Xerox's incentives aligned.

The term outsourcing is inappropriate. This is really more of an integration of two separate companies. We wanted to take the best parts of each culture and put them together. The same goes for structure, strategy, and people. We will realize substantial economic value if we can achieve commitment to a high degree of integration. It is the spirit of the agreement that creates this commitment; there are no "mechanisms" that can be put into place as a substitute for the spirit.

Finally, for some observers, Xerox's outsourcing had an additional message. Xerox expressed substantial technological prowess within the digital and computer arenas. Xerox PARC had, among other things, invented the first graphics-oriented monitor, the first "mouse" input device, the Ethernet protocol, the first laser printer, and the applications "windowing" concept. Hence, Xerox's outsourcing seemed to signal that even at companies where digital technologies were important core competencies, the IT function could be outsourced.

Company Background

Xerox, a global enterprise addressing the worldwide document processing market, developed, manufactured, marketed, serviced, and financed a complete range of products and services designed to make offices around the world more productive. It marketed copiers, duplicators, digital production publishers, electronic printers, facsimile products, scanners, workstations, networks, computer software, and supplies in more than 130 countries using a direct sales force and a network of dealers, agents, and distributors.

After struggling to develop a strategy to address its newly competitive environment, in 1980 Xerox began to aggressively pursue benchmarking and employee involvement.

Company History

After spending more than a decade perfecting the xerographic copying/duplicating process, Xerox introduced its model 914 copier in 1959; sales went from $32 million in 1969 to $1.1 billion in 1968; employment surged from 900 in 1969 to 24,000 in 1966. By 1970, Xerox held a 95 percent share of the plain-paper copier market. Gross margins for many products in 1970 ranged from 50 to 60 percent. (See Exhibit 1 for selected Xerox financial information.) At the same time, Xerox's phenomenal growth and profitability attracted federal lawsuits. In 1975, Xerox reached a settlement with the Federal Trade Commission: Xerox was forced to forgo patent protection and had to license its copiers.

From 1978 to 1982, Xerox's share of U.S. copier installations dropped from an estimated 80 percent to 13 percent, due to competition provided by such Japanese companies as Canon, Minolta, Ricoh, and Sharp. Licensing also dramatically increased Xerox's new product introductions: between 1971 and 1976, 77 different plain-paper copiers were introduced in the United States; between 1978 and 1980, another 70 arrived (see Exhibit 2).

After struggling to develop a strategy to address its newly competitive environment, in 1980 Xerox began to aggressively pursue benchmarking and employee involvement.
### EXHIBIT 1 Xerox Financial Highlights

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<tbody>
<tr>
<td><strong>Operations</strong></td>
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<tr>
<td>Operating revenues (sales, service)</td>
<td>$13,384</td>
<td>$3,260</td>
<td>$3,781</td>
<td>$4,584</td>
<td>$11,602</td>
<td>$11,029</td>
<td>$10,320</td>
<td>$5,955</td>
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<td>Cost of sales, service, and rentals</td>
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<tr>
<td>Sales</td>
<td>$7,260</td>
<td>$7,166</td>
<td>$6,666</td>
<td>$6,656</td>
<td>$6,237</td>
<td>$5,778</td>
<td>$5,352</td>
<td>$4,014</td>
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<tr>
<td>Research and development expenses</td>
<td>$4,050</td>
<td>$4,177</td>
<td>$4,497</td>
<td>$4,492</td>
<td>$3,929</td>
<td>$3,647</td>
<td>$3,600</td>
<td>$3,597</td>
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<tr>
<td>Income from document processing</td>
<td>$883</td>
<td>$922</td>
<td>$980</td>
<td>$980</td>
<td>$980</td>
<td>$980</td>
<td>$980</td>
<td>$980</td>
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<tr>
<td>Income from insurance operations</td>
<td>$4</td>
<td><strong>$779</strong></td>
<td>$2</td>
<td>$1</td>
<td>$154</td>
<td>$181</td>
<td>$188</td>
<td>$129</td>
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<tr>
<td>Income from continuing operation</td>
<td>$(139)</td>
<td><strong>(139)</strong></td>
<td>$(239)</td>
<td>$(239)</td>
<td>$(239)</td>
<td>$(239)</td>
<td>$(239)</td>
<td>$(239)</td>
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<tr>
<td>Net Income</td>
<td><strong>(129)</strong></td>
<td><strong>(129)</strong></td>
<td>$(1,020)</td>
<td>$(1,020)</td>
<td>$(1,020)</td>
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### Financial Position

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<tr>
<td>Total document processing assets</td>
<td>$16,156</td>
<td>$17,140</td>
<td>$16,178</td>
<td>$14,421</td>
<td>$13,488</td>
<td>$12,415</td>
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<td>Total insurance assets</td>
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<td>Shareholder equity</td>
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<td>Long-term debt</td>
<td>$3,972</td>
<td>$3,875</td>
<td>$3,514</td>
<td>$3,501</td>
<td>$3,035</td>
<td>$3,571</td>
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<tr>
<td>Shareholders equity</td>
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<td>Per Share</td>
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<tr>
<td>Net income per common share</td>
<td><strong>(2.46)</strong></td>
<td><strong>(3.32)</strong></td>
<td><strong>3.91</strong></td>
<td><strong>5.51</strong></td>
<td><strong>6.66</strong></td>
<td><strong>3.60</strong></td>
<td><strong>5.35</strong></td>
<td><strong>4.52</strong></td>
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<tr>
<td>Dividends per common share</td>
<td>$1.00</td>
<td>$1.00</td>
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<td>$1.00</td>
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*Includes the following special pretax charges: Severance pay and other employee separation benefits ($543 million); lease cancellation and site consolidation ($288 million); write-down of various assets ($244 million); litigation settlements ($776 million).

**Includes insurance operations restructuring charge ($776 million) after tax.**

***Includes the following special after tax charges: insurance operations restructuring ($776 million); adoption of FASB FASB 130, relating to employee benefits ($506 million); adoption of FASB FAS 139, relating to income taxes ($166 million).***

****Includes a $1.0 million after-tax charge for the net of a workforce reduction.**

Includes a before-tax charge of $375 million as a provision for real estate leases. In 1970 the company discontinued its real estate operation and related real estate financing operations.

Includes severance and various special pretax charges: Write-off of excess electronic typewriter manufacturing capacity ($140 million); overhead and employment reductions ($100 million); revaluation of assets ($35 million).

**Before results of discontinued operations of $0.82 per share in 1989, -2.84 in 1990, -0.67 in 1986, +0.86 in 1985, and special items of -7.97 in 1983 and +0.46 in 1986.**

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### Source
Xerox Annual Reports and Standard and Poor's Reports.

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In addition, under the leadership of CEO, David P. C. W. Allmendinger, the company's annual meeting, investor relations, and management center, has expanded. Xerox is the only company in the world to have a detailed, comprehensive, and widely accepted investor relations program. Its model of investor relations has been adopted by leading companies around the world. These include such companies as Coca-Cola, General Electric, IBM, and Microsoft. This model includes investor relations—participation, feedback, and continuous improvement. This model has been adopted by many companies around the world. The model has been adopted by many companies around the world. The model has been adopted by many companies around the world. The model has been adopted by many companies around the world.
In performance against similar operations at other companies, Xerox had begun to build long-term relationships with our best vendors," she explained. "We began to treat our vendors as part of an extended family and to strain them in the principles of Leadership Through Quality." Xerox's efforts to improve quality earned the company several prestigious awards: In 1989, it earned the national Malcolm Baldridge Quality Award; shortly afterward, Xerox Canada won the Canadian National Quality Award; and, in 1992, Xerox became the first winner of the European Quality Award.

The emphasis on participation, benchmarking, and quality seemed to work in the marketplace as well. Between 1984 and 1993, Xerox's market share in low-end copiers rose from 8 percent to 18 percent, while its mid- and high-end copiers' share rose from 26 percent to 36 percent.

**Corporate Restructuring**

Despite improvements in market share, overall corporate performance declined in the early 1990s. In 1992, Xerox's CEO, Paul Allaire, announced a major reorganization: Xerox would create nine divisions along market segments and three customer operations along geographic lines (see Exhibit 4). The nine market segment divisions were created to move decision making closer to the customer. According to the 1992 Annual Report, "Each Xerox division [has] its end-to-end responsibility for a set of products and services, a set of primary market segments, an identifiable set of competitors and an income statement and balance sheet." Allaire determined to do more than just change the formal structure, explained. "Many times people will change just the structure and reporting relationships. But if you want to change a company, you'd better change more than that. That's the formal structure and then there's the way the company really works. You have to change the way it really works."10

Reorganizing the corporation along customer lines meant redefining both operational and management processes. The company also focused on its core competencies, as evidenced by its moves to sell its financial businesses. In January 1993, Allaire announced, "We've decided to disengage from our reinsurance and other financial services businesses. With the decision to exit from financial services, we can now focus clearly and unencumbered on our Document Processing business." Finally, Xerox announced in 1993 that it would be reducing the size of its document processing workforce by 10,000, approximately 10 percent, over the next two to three years.

**Information Management (IM) at Xerox**

Xerox established corporate information management (CIM) in the early 1970s to be responsible for managing data centers and networks; in 1987, however, these were moved to a separate division called the general services division (see Exhibit 4). Patricia Barron, appointed director of CIM in June 1987, explained CIM's new mission: [We were] to develop the information technology strategy for

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Xerox Corporation: IT Management Organization, 1988

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<tr>
<th>Position</th>
<th>Division</th>
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<tr>
<td>CEO</td>
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<td>Vice Chair</td>
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<td>President</td>
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<td>Vice Chair</td>
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<tr>
<td>Business Products</td>
<td>U.S. Marketing</td>
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<tr>
<td>and Services</td>
<td>(1,000; $900M)*</td>
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<td>General Services</td>
<td>Corporate Information Management</td>
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<td>(650; $150M)**</td>
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<td></td>
<td>Special Markets</td>
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<td></td>
<td>(100; $260M)*</td>
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<td></td>
<td>International</td>
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<td></td>
<td>(1,500; $150M)**</td>
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* Information Management (IM) was highly decentralized with autonomous information management organizations located within each division. The numbers in parentheses represent IM headcount and budget.
** The Corporate Information Management unit provided information management leadership for Xerox Corporation. In addition, a small system development group was responsible for corporate application development and corporate data management.

Xerox and ensure that it was implemented in all the business units. As Bill Giauvin, vice chairman in the late 1980s, "We expected CIM to provide the overall information technology leadership to the company."

Yet as Barron worked to provide this leadership, she found she would not be able to fulfill this mission without substantial organizational changes. "While senior management expected CIM to ensure that the $500 million information technology budget was well spent, the business unit managers regarded attempts to audit expenditures as unnecessary," Barron observed. In order to assess IM at Xerox, in 1988 she brought in an IT strategy consulting firm—and it found numerous areas of concern. In particular, the diffusion of authority in IT decision making had created many problems at Xerox.

The consultant elaborated:

There was no overall coordination or management of the hundreds of millions of dollars spent each year in an corporate-wide management of IM investment priorities. The CIM organization at Xerox was not positioned, chartered, or staffed to perform many of the CIM functions. Overall, CIM was a peripheral player in the IT management picture because they were not chartered to direct or manage infrastructure or necessary to furnish leadership.

The IT function at Xerox possessed a narrowly focused IM talent pool, reported to superiors who viewed IT infrastructure investment as an expense to be avoided, required redundant and overlapping efforts to find out or reconcile the most basic information, and lacked effective staff development mechanisms.

It was clear that the 1989 Xerox IM infrastructure could not support the company's strategic direction in the 1990s.

Centralizing Xerox IM

In 1993, in order to align IM with the direction the company was taking, Patricia Wallington, head of corporate information management, asked for and received direct authority over IM worldwide. (See Exhibit 5 for the new IM organization implemented by Wallington.) For several years, senior managers had been addressing the problems Barron and the consultants had identified, but changes had been slow. Thus, as the IM workforce tried to support the new Xerox divisional structure, it became obvious that the

13Wallington was appointed head of CIM in 1992; Barron, the previous head, was promoted to president of the newly created office document products division as part of the 1992 reorganization.

It was existing information systems infrastructure was inadequate. IM was simply unable to provide the data needed to support Xerox's new divisions.

At investigating the extent of the problems facing IM, Wallington presented her findings at the Xerox Presidents Council meeting in April 1993. Xerox had spent $570 million on IM during 1992, a figure that was forecast to grow to $1 billion by the end of the decade, she noted. IM personnel were well aware that the division presidents did not support them getting an adequate payback from what amounted to 3.7 percent of Xerox revenues. Suzanne Higgins, head of IM management processes, commented on Wallington's presentation: "She actually pulled together all this information; it was a real eye-opener. At that point the Presidents Council said we needed to get control of these dollars. There was a sense from the division presidents that they were not getting what they needed for the dollars being spent."

The IM 2000 Project

To address IM problems, CIM started the "IM 2000" reengineering project in mid-1993. An initial IM 2000 design team was formed to identify IM problem areas and recommend strategies to address them. Projects implementing these strategies would be implemented by transitional teams, which would ultimately move IM to a new information systems infrastructure.

Sufficient IM problems. Xerox possessed aging applications portfolio built on proprietary technologies created to support the previous, functionally structured organization. IM appeared to be "trapped in a spending spiral on outdated legacy systems infrastructure."
### EXHIBIT 5: Xerox Information Management Organization, December 1993

<table>
<thead>
<tr>
<th>Business Process Management</th>
<th>Global Integrated Business Solutions</th>
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<tbody>
<tr>
<td>Technology Services</td>
<td>IM Controller</td>
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<tr>
<td>IM Quality Strategies</td>
<td>IM Human Resource Operations</td>
</tr>
<tr>
<td>Information Management</td>
<td>Global Data Management</td>
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*Corporate Officer:

Note: This chart shows reporting relationships only and is in no way intended to reflect relative importance.

The corporate change to a divisional structure had exposed the inflexibility of existing information systems. Justin Malaszenko, head of the CIM strategy function, explained:

"The company had reorganized the previous year to a divisional, product line focus, versus what primarily had been a regional or geographic focus. Where our systems essentially fell apart was in not being able to supply information about how a particular division's products were being sold. We were jury-rigging a lot of systems and a lot of data to try to respond to this new divisional structure. The division presidents were not getting the information they needed to run their businesses. We needed better access to information and flexible solutions that would be relevant even if the number of divisions changed."

Malaszenko noted that, in part, Xerox's "legacy" systems prevented IM from addressing division needs. "I spent 110 percent of my time on this."

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**Legacy** refers to transaction processing systems designed to perform a specific function, which, over time, may not accurately reflect business information needs. In addition, as hardware and software improvements occur in the information systems marketplace, older IS solutions may be more costly to operate and maintain.

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3. Leverage Worldwide IM Resources. IM was to create a library of shareable core modules, centrally developed and purchased, which could be used locally to create solutions. Central monitoring of solutions would limit redundancy.

4. Business Process Driven Solutions. The current portfolio of applications (legacy systems) was to be retired or replaced with solutions supporting new Xerox business processes.

### The Information Systems Outsourcing Decision

Xerox's earlier drive for quality had created a change in the corporate culture by promoting a sense of partnership with suppliers. Hence, given the company's experience with outsourcing and creating alliances, the president of the Xerox Information Systems Council instructed top IM staff to complete outsourcing as a way to change IM accordingly. Malaszenko recalled:

"He was very specific in their request, saying, 'Give us the data, documented that we should be considering this radical and significant move, including outsourcing. Only if the division president agreed would he consider outsourcing their pieces of the product; they might be outsourcing some of their sales through channels. The term outsourcing was not foreign."

"Why not consider using the same concept and see what it might apply in an IM world?"

At first, many IM managers felt that outsourcing was unnecessary; they could accomplish the needed changes internally. Yet, the Xerox IM design team quickly realized, however, that many internal obstacles would not be easily overcome.

"First, any attempt to solve IM problems in an isolated manner would have to contend with the relationships between IM and its customers. The business divisions—which apparently did not fully appreciate the problems it faced—top IM managers found that, after
Xerox: Outsourcing Global Information Technology Resources

Improvement. Xerox businesses were facing an increasingly competitive environment and were being forced to adapt quickly (as evidenced by the increase in product introductions in Exhibit 2). To provide the information the business divisions needed, IM managers knew they had to rebuild IM infrastructure rapidly while radically changing the processes IM personnel used. Top IM managers began to realize they would not be able to change quickly enough without outside help. Many managers admitted that modest change efforts in the past hadn’t been particularly successful, as Audrey Fantas, the CIO’s executive assistant during the outsourcing effort, explained:

It wasn’t as if we hadn’t tried to implement change internally; we had tried—with varying degrees of success. Unfortunately, the business required us to change more rapidly. The key to outsourcing was that Xerox would be able to move towards the future quickly. We were focused on building the new solutions;

Outsourcing Benefits

Based on first-level feasibility studies, completed in November 1989, the team, having identified numerous potential benefits, decided to pursue an outsourcing arrangement.

Financial benefits from outsourcing included rapid funding of new systems development and economies of scale and scope. According to Dalal, “As part of the transaction, IT assets were sold. This gave Xerox an opportunity to renew their asset base and accelerate growth towards the new infrastructure.” Xerox’s internal experience with consolidation convinced the outsourcing team that every new system could be achieved by an external vendor. A Xerox manager observed, “Xerox has consolidated some internal data centers in the last three years. Through these consolidations, we experienced cost reductions in hardware, software licensing, facilities, and support. An outside vendor will be able to attain further economies by continuing this consolidation effort.”

The team also expected to capitalize on outside vendor’s extensive IT problem-solving knowledge. Malasenko, for example, stated that the vendor’s expertise was expected to improve the team’s ability to address complex issues.

The outsourcing team was created to formally examine the benefits and feasibility of outsourcing. If outsourcing was found to be feasible, the team was to find a partner and create a contract. Dalal, Xerox’s lead outsourcing manager, enlisted XHS Bailey, an IM manager from the USA customer operations division, and Charles Gilliam, senior corporate counsel, to assist him in the recruitment of an outsourcing team. These three served as the core Xerox outsourcing team. Over time, the number of people working on the outsourcing effort grew to 60. The group was managed functionally, without a definitive organizational structure. As the need for expertise arose, team members approached new people who could provide it.

Areas of expertise included: Tax, Treasury, Human Resources, Finance, Audit, and Security. Most team members worked on outsourcing in addition to their normal duties.

Outsourcing Summary

Outsourcing was described as a way to renew Xerox’s asset base and accelerate growth towards the new infrastructure. The outsourcing team, with the help of an external vendor, was able to achieve significant cost reductions and improve the company’s overall efficiency. The team also leveraged the vendor’s extensive knowledge and capabilities to address complex issues more effectively.
afford intially. That opened up a lot more avenues to future technologies.

Managers also believed that an outside vendor would manage the IT function more efficiently. Another Xerox manager pointed out that a vendor's "main competency was managing, computer systems. Through their skill, leverage, and economies of scale, they could provide a level of efficiency that we could not achieve at Xerox." Bailey agreed: "This was their core competence. And a combination of that and their focus allowed them to harness all that energy and be more effective. The top outside vendors had standardized approaches. In this company, every pocket of systems expertise had a tendency to do it their own way and march to a different drummer."

Perhaps most important, outsourcing allowed internal IM managers to focus on the development of new IT infrastructure. Underlying the outsourcing effort, according to Bailey, was a fundamental strategy: "to offload legacy applications and operations, so we would focus on developing new strategic applications to support the global business processes, which were being reengineered." Skotnicki added: "The idea was to outsource all of our existing legacy applications. We were going to screw up and spend on legacy, enabling Xerox to focus on new development." Bailey summarized the benefits of outsourcing this way:

Many people thought the only reason you would outsource was because your company was in trouble and you needed immediate cash or your information management organization was considered a hopeless failure. Our reasons for looking at outsourcing were quite different: One, we wanted to control and drive down spending on our "legacy" IM environment to provide investment funding for new strategic systems and infrastructure, two, we wanted to improve both the quality and cost of our IM services; and, three, we wanted to focus the company's resources on our primary mission as "The Document Company." We believed outsourcing would help us address all three objectives.

The Outsourcing Process

Choosing a Partner

The outsourcing team began by inviting numerous companies to bid. (See Exhibits 7, 8, and 9 for diagrams of the selection and project processes.) One manager who worked on the outsourcing recounted how they decided whom to invite: "We opened it up to some of the companies we've done business with or do business with, as well as major customers that we've had that might have some options for pursuing this, and left it open to them to refuse."

The size and complexity of the deal, however, forced most potential bidders to walk away: only two vendors and one vendor team formally responded. "They needed themselves out," recalled Bailey. Added Skotnicki, "You're not just looking at running a data center or supporting business applications, you're also including network and infrastructure solutions on a worldwide scale."

The team then created a list of criteria (see Exhibit 10) providing a general sense of how potential vendors would be judged. [Such] scoring allowed us to eliminate one vendor, noted Dalal. Next, following intense negotiations with the remaining two providers, Xerox chose EDS, based on several factors. "First," Dalal explained, "global presence was extremely important and EDS was believed to have a superior global presence." Xerox was also quite interested in ensuring a good transition for outsourced employees. Dalal described EDS as, "more willing to tailor their human resource program for our folks." Finally, EDS entered a very competitive bid, and Dalal was confident EDS could make money on that bid: "Our intention was not to have EDS lose money. The best partner is a viable, strong provider," he explained. He also felt that it was irrelevant to ask whether EDS would be losing money during the first year or two. "You really couldn't make money in one year, whether it was early or late. You really had to look at the whole deal."

Interestingly, the outsourcing team felt that another vendor actually offered the best "cultural match." IM managers considered the advantages of a vendor with a different background; however, they felt "out-of-box" thinking was needed—and that would be facilitated by partnering with a firm with a different culture.

The Contract

In June 1984, Xerox signed a $3.2 billion, 10-year deal with EDS. (Exhibit 11 shows contract highlights; Exhibit 12 provides a generic outsourcing contract checklist.) EDS was responsible for running mainframes, maintaining legacy systems, and handling worldwide voice and data communications in 19 countries. (See Exhibit 13 for a summary of the deal's scope.) Approximately 1,900 Xerox IM personnel, and about $170 million in assets, were transferred to EDS. Xerox retained control of strategic and architectural information management functions and new applications development; 700 IM workers were retained to work on these functions. According to Wallington, the mission for those staying on at Xerox was clear: "We want to focus our internal staff on moving us to the environment in which we will survive tomorrow." EDS's share of the Xerox IM budget was forecast to be 70 percent in the first year of the contract and shrink to 30-35 percent by the final year. According to Dalal, by the end of the 10-year contract, "We will have rebuilt all of our applications systems, and our legacy that we are outsourcing to EDS will no longer exist." However, even without legacy retirements, the IT expense was expected to decline. According to lawyer John Halvey, an outsourcing expert from Willbank Tweed who worked on the Xerox contract:

EXHIBIT 7 Outsourcing Vendor Selection Process

- Leading vendors eliminated
- (8-10)
- Selected: CSC
- EDS
- IBM - ISSC
- Andersen Consulting
- 93 Jan 94
- Feb 94
- Mar 95
- Selected EDS
- Literature search
- Request for information
- Final bids against terms and baseline
- Selected (1 bid): 1) CSC - Andersen Consulting (partners)
- 2) EDS
- 3) IBM - ISSC and AT&T (partners)

\(^{1}\) Computerworld 20 (June 1994), p. 12.
EXHIBIT 8: Outsourcing Process

- IM design team recommendations
- Q & A and clarifications
- Responses
- Final tender to vendors and proposal evaluation
- Final negotiation and selection of EDS for contract development
- Terms finalized and contract drafted
- Evaluation checklist
- Technical
- HR
- Financial
- Qualifications
- Commercial
- Legal

There were several reasons why IM executives at an outsourcing company expected their LT processing volume and expenses to decline. First, they believed that, over time, the vendor would increase overall LT efficiency. Second, personnel and hardware expenses were expected to decrease for any given level of LT capacity as new technologies became available. Third, many companies were downsizing and expected their LT usage curve to fall as they began to concentrate on core competencies, and stopped trying to do everything else.

EXHIBIT 9: Benchmarking Completed during Phase I of the Outsourcing Process

Extensive benchmarking was conducted resulting in information on:

- Outsourcing strategies
- Outsourcing process
- Contracting
- Transitioning
- Ongoing management of the relationship
- Vendor references
- Human resource impact

Companies used in the benchmarking process included:

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Though confident that they had created a robust agreement, IM managers knew they had to keep the transition from the legacy environment to a new information infrastructure on track. Confirming the importance of a timely transition, Dalal remarked, "The goal was, after 10 years, to replace the legacy systems with new business solutions. We ran a risk of increasing costs if we did not achieve our systems retirement plan."

The "Spirit" of the Contract

As they hammered out an agreement, Xerox's core outsourcing team (Dalal, Bailey, and Gilliam) met frequently with EDS's core team (see Exhibit 14). According to Dalal, it quickly became evident that the outsourcing relationship required something more than negotiations with a traditional IT supplier. Reed agreed: "This is not a client/vendor relationship; this is not a supplier relationship; this is not a win/lose situation; this is a strategic relationship." But both sides realized that integration could only be achieved if they developed a high degree of cooperation.

The first obstacle to be overcome was what Dalal termed "fear of publication." In order to achieve the level of honesty required to attempt an integration, participants had to be assured that what was said in the core meeting would not be shared beyond the members of the core team. Only after creating an environment of trust could the two (who came to view themselves as a single team) work to understand each corporation's objectives. Dalal described how an open environment and sharing of objectives were accomplished:

Each side made two lists. First we wrote down our company's objectives; then we wrote down what we thought were the other company's objectives. All of the objectives were then put on flip charts. This procedure allowed us to quickly identify disconnects. In order to ensure complete honesty, we went a step further and the two of us who led the team put up our personal objectives as well; right down to what...
EXHIBIT 10 Xerox Vendor Selection Criteria

Vendor Qualifications
- Global presence
- Capability to manage "globally"
- Experience in large-scale outsourcing
- "Core" strengths in various "frameworks"
- Desire to "create a different outsourcing environment" (for Xerox)
- Management processes and strength

Human Resources
- Treatment of Xerox employees
- Human resource values

Technical Solutions
- Overall productivity commitment: % and credibility
- Support for existing Xerox diverse environments
- Capability to help "migrate"

Financial
- Translation of productivity savings to Xerox
- Flexibility in meeting Xerox financial requirements (globally)
- Experience in "engineering" financial environment (worldwide)

"Soft" Criteria
- "Congruence" with positive Xerox cultural traits
- Eyebrow benchmark for desired Xerox cultural traits

"Frameworks" included data center, telecommunication, infrastructure support, and applications.

Source: Xerox presentation by J. Dalal.

EXHIBIT 11 The Xerox-EDS Contract

Contract Highlights

"Evergreen" contract means a "new concept.

The objective was to create a contract that would automatically adjust to current global needs.
Mechanisms used to achieve this evergreen concept included:
- Schedules and exhibits
- Terms that have "built in" renewal processes (e.g., pricing)
- Terms and performance separated for management purposes (e.g., Service Responsibility Manual, Operations Manual)
- Global terms for the life of the contract separated from transition terms to include on-line transition activities.

Other contract terms, some of which are unique, included:
- Global contractual terms
- Human resource terms
- Pricing mechanism: benchmarking and indices
- Service level management: "Service Level Variance" Concept (Adaptation of Xerox Quality processes/teams)
- Ongoing relationship terms built on "partnership" rather than establishing a "supplier/buyer" model
- Future business relationship terms

Source: Xerox presentation by J. Dalal.

Once the team reached an understanding of the "spirit" of the relationship, the rest of the negotiations proceeded smoothly. To ensure that the spirit persisted, they worked hard to capture a sense of it within the final contract. Dalal explained how the contract was used to capture the spirit and maintain a focus on IM 2000 objectives:

Article one of the contract covers the spirit of the agreement. It addresses the vision of IM 2000 and what makes us successful. The objective was not to outsource but to accomplish IM 2000. Outsourcing is simply the first in an integrated set of strategies. It provides the savings that help us deliver the rest of the strategies. If EDS doesn't help us by delivering on the agreement, we cannot achieve the IM 2000 vision.

Yet the very length and complexity of the contract made transmitting the "spirit" of the deal difficult. Global issues alone demanded more than 50 pages of contractual language. According to Dalal, the team responded to this problem by creating a summary of the contract that was circulated among senior Xerox management to ensure that everyone understood the spirit of the relationship. Dalal also held one-day sessions with IM managers to ensure "that they understood not only the contract but also the spirit of the agreement."

The team attempted to use the contract as a repository of corporate memory, instead of as an instrument to define organizational boundaries and limitations. Hence, longtime employees would be able to use the contract to refresh their memories as to the nature and spirit of the agreement; new employees could use the contract to learn about the EDS/Xerox relationship. The team expected the spirit to evolve over time in response to changing environmental realities. They agreed to change the contract as needed to ensure that it mirrored any changes in the spirit.

Two sets of contractual issues presented a significant challenge in maintaining the relationship: divorce issues and pricing issues. The pricing issue was solved by an intricate mechanism. Dalal recalled:

Xerox built on its quality and benchmarking heritage and devised a unique methodology. The contract required annual price benchmarking. Therefore, the contract guaranteed both to Xerox and EDS that current prices would always be at benchmark levels worldwide. Our price benchmarking would be based on forty odd price elements rather than aggregate prices. We had found an appropriate benchmark index for each of these price elements. The contract ensured that we wouldn't have to worry about price swings that occurred during the duration of the contract. The contract would not have to be reopened to adjust pricing; the contract renewed itself.

Divorce concerns were addressed by including clauses in the contract that would adequately protect each party if a split became necessary. The contract had certain checks and conditions along the way that provided the capability for moving out, Malaszewicz noted. "Restoring would be complex. Any transition employed might not be available or interest at returning to work in their previous capacity."

The actual negotiation of the divorce clause was apparently not very difficult. The team was insistent on understanding each other's objectives up front, as Dalal stated:

The termination portion of the agreement was when the objectives helped most. We tried to ensure that corporate and personal objectives were live throughout any termination of the relationship. The termination negotiation did not take long; I think we did it in a couple of hours the morning.

Dalal underlined the importance of not dwelling on divorce issues. "You can't drive your own commitment based on dissatisfaction." Other IM managers expressed similar views. For example, one manager commented, "If we did have a real strong feel that it was going to work, we wouldn't have gone into it at all. And Bulkeley added, "I believed it was very important to approach both the contract and the relationship with a win-win attitude because it was important that the relationship was a healthy one."
EXHIBIT 13  Scope of the Xerox/EDS Outsourcing Deal

Data Center Operations
Operations and management of data centers
- Monroe County, NY (serving the United States, Canada, and Mexico)
- London, England
- Brazil
- Various "decentralized"
All print operations—centralized and decentralized—EDS in turn outsourced print operations to Xerox Business Systems on a subcontract

Network Operations
Operations and management of:
- Worldwide voice
- Worldwide data/video—WAN and LAN

Legacy Applications Maintenance and Enhancements
Production support of applications worldwide
Limited enhancements of applications worldwide

Infrastructure Support
Support of Information Management activities for all the above platforms: includes worldwide
desk top devices and Local Area Networks (6965, Personal Computers)
- Help desk
- Software and hardware support (move, add, change)

Source: Xerox presentation by J. Dalal.

EXHIBIT 14  The Core Xerox and EDS Outsourcing Teams

The Core Xerox Outsourcing Team
Jagdish Dalal  Lead Outsourcing Manager, Xerox
Richard Bailey  Formerly an IM manager, Xerox's U.S. Customers Operations Division
Charles Gilliam  Corporate Counsel

The Core EDS Outsourcing Team
Mike Reed  Lead Outsourcing Manager, EDS
Will Clark  Proposal Manager, EDS
John Funk  Corporate Lawyer

A system that dynamically adjusted IM prices to ensure that Xerox groups in other countries were better off after implementation of the outsourcing agreement. For most services, prices for each country were in local currencies, not dollars, and were benchmarked against the local economy. IM managers felt that if they allowed groups in other countries to become dissatisfied with outsourcing efforts, significant problems could result. As Bailey noted:

"Theoretically, we could have told them that this was how it was going to be. But if we screwed it up and messed up their business results, they'd be impossible to control. It was in our own self-interest to make sure they were involved and taken care of properly."

Implementing the Outsourcing Agreement

In mid-1994, the integration of EDS and Xerox was proceeding smoothly, largely because of the sense of partnership. Reed commented on the process:

"In a typical outsourcing deal the announcement is made one day, and the people are told, "tomorrow you all work at EDS." That is the wrong way to outsource. It can take you a year to get everyone back up to speed because you just destroyed their trust. What we did at Xerox was identify the leadership that would be transitioning to EDS, and they empowered them to participate in the transitioning and integration of their employees. This made the transition date, when the people and assets from Xerox officially moved to EDS, unimportant because everything had already begun to move forward."

Within Xerox the outsourcing effort was to be implemented as part of the overall IM 2000 reengineering effort. For example, a portion of the money saved via outsourcing was to be used to move the company away from legacy systems. Suzanne Higgins, leader of the IM 2000 project, explained that "this (fund) was for new projects; nothing that would be enhancing the legacy systems would be funded out of these dollars." The 700 IM professionals who remained on the IM 2000 project's management team, explained, "this (fund) was for new projects; nothing that would be enhancing the legacy systems would be funded out of these dollars." The J 700 IM professionals who remained on the IM 2000 project's management team, explained, "this (fund) was for new projects; nothing that would be enhancing the legacy systems would be funded out of these dollars."

EDS had created a separate global strategic business unit dedicated solely to Xerox. Reed was trying to structure this unit in a non-hierarchical way. He knew that he needed to create an environment that fostered cooperation, because, "when you have a globally diverse group, you have no alternative; you must cooperate, or you can't operate."

According to Dalal, it was important to differentiate among three outsourcing terms: "transformation is the event of officially moving IM to EDS; migration refers to the activities and process that lead to a successful transition; integration is the process of bringing the two companies together over time" (see Exhibit 15). Dalal and Reed knew that long-term success depended on the degree of integration achieved by the two organizations.

According to Dalal:

The integration to be successful five dimensions had to be addressed: culture, strategy, structure, people, and processes. We created a set of EDS/Xerox teams to focus on each of these dimensions from a quality perspective. For example, we have a team that identified current and future processes; their challenge is to work on the transition from one to the other. To capture the relationship's potential economic value we must emphasize integration. My organizing model for systems integration uses "degrees of integration" on one axis and "opportunity for integration" on the other. Our agreement with EDS contains a lot of opportunity for integration; therefore, we will realize substantial economic value if we can achieve commitment to a high degree of integration. It is the spirit of the agreement that creates this commitment; there are no "mechanisms" that can be put into place as a substitute for spirit. For example, after we were done with the pricing mechanism, we discovered that there was a whole class of users that we had not priced properly. We sat down with EDS and constructed a whole new set of prices and published them. The word outsourcing does not really describe this relationship. Mike Reed and I believe that what we have done is hand a Xerox function over to EDS, which they now manage for us. And Xerox doesn't really have an outsourcing management organization; EDS was franchised by our commitment to integration.

Issues To Be Clarified

While the outsourcing process had been a valuable learning experience (see Exhibit 16 for a "lessons learned" list), the integration process was only beginning in late 1994. The partners were working on many important issues, including:

1. Structure. Both sides were still working on their organizational structures. (See Exhibit 17 for the initial Xerox..."
EXHIBIT 16  Lessons Learned

General Lessons
- The quality process works for outsourcing
- Good understanding of objectives and "what you want" is essential for good results
- A multidisciplinary team is a necessity
- A full-time project manager (with IM and business backgrounds) is a key success factor
- Activities and efforts take longer than expected
- A good contract requires a tremendous amount of data
- Collection and identification of pre-outourcing cost data is critical
- Employee communication is a key success factor
- The vendor management process must be subject to strict discipline

Global Lessons
- Global integration of IM is necessary for a global contract
- Acceptance of a global IM strategy is a necessity for ongoing contract development
- Global consistency of IM measurement is a necessity
- Economic differences prevent a global pricing methodology without significant effort on part of both the companies
- Vendors/Consultants are not yet experienced in managing a global outsourcing contract
- Local legal requirements for Human Resources and billing require thorough research and understanding before a global outsourcing contract is developed

Critical Success Factors
- Existence of a multiyear, total IM strategy
- Corporate commitment to the IM strategy
- Corporate commitment to outsourcing, where the process defines the results
- Quality culture and "team Xerox" attitude
- Not being bound by "this is how it is done"

Source: Xerox presentations by J. Dalal.

Taking the best practices from both, [H] EDS has a process that they've already got defined and working, we'll examine it.

3. Management processes. While the contract specified, in part, the measures to be used to judge EDS's effectiveness, the actual management processes to be used required finalization. In addition, incentive systems for the relationship still needed to be worked out.

4. Human resource management. The roles of IM workers would be further clarified as management and business processes were taken on. For example, to what extent would IM managers need to become negotiators and coaches in addition to their duties as technologists or administrators?

Since these areas were interdependent, it was believed that the relationship would take many months to reach a stable form.

Source: Xerox presentations by J. Dalal.

Post-outsourcing IM structure. In response to this need for initial governance mechanisms, Xerox IM had set up what it called "framework teams." "There's a framework team around applications, there's a framework team around telecommunications, there's a framework team around infrastructure. They are jointly being run," explained a manager. But the details of how the IM 2000 transition teams and framework teams were to interact with EDS still had to be worked out. As Dalal noted, "We're working on details that relate to the fine line of how some groups relate." The goal, according to Bailey, was to create "an integrated organization which would continue to serve Xerox, but under EDS management."

2. IM operating processes. Xerox and EDS were working together to define IM processes. Higgins explained, "We're..."
In November 1989 ground was broken to build the Denver International Airport (DIA). Located 25 miles from downtown Denver, Colorado, it was the first major airport to be built in the United States since the opening of the Dallas–Fort Worth Airport in 1974. In 1992, two years into construction, the project's top managers recommended inclusion of an airport-wide integrated baggage-handling system that could dramatically improve the efficiency of baggage delivery. Originally contracted by United Airlines to cover its operations, the system was to be expanded to serve the entire airport. It was expected that the integrated system would improve ground handling efficiency, reduce close-out time for hub operations, and decrease time-consuming manual baggage sorting and handling. There were, however, a number of risks inherent in the endeavor: the scale of the large project size; the enormous complexity of the expanded system; the newness of the technology; the large number of resident employees to be served by the same system; the high degree of technical and project definition uncertainty; and the short time span for completion. Due to its significant experience implementing baggage-handling technology on a smaller scale, BAE Automated Systems Inc., an engineering consulting and manufacturing company based in Carrolton, Texas, was awarded the contract. Construction problems kept the new airport from opening on the originally scheduled opening date in October 1995. Subsequently, problems with the implementation of the baggage system forced delays in the opening of the airport another three times in seven months. In May 1994, under growing pressure from shareholders, the business community, Denver residents, Federal Aviation Administration (FAA) commissioners, and the tenant airlines and concessionaires, Denver mayor Wellington Webb announced that he was hiring the German firm Logplan to help assess the state of the automated baggage system. In July, Logplan issued an 11-page report to the City of Denver that characterized BAE's system as "highly advanced" and "theoretically capable of living up to its promised "capacities, services, and performance," but acknowledged "mechanical and electrical problems that "make it most improbable to achieve a stable and reliable operation." Logplan suggested that it would take approximately five months to get the complete BAE system working reliably. It also suggested that a backup system of tugs, carts, and conveyor belts could be constructed in less than five months.

In August 1994, Mayor Webb approved the construction of a backup baggage system. At the same time, he notified BAE of a $12,000-per-day penalty for not finishing the baggage system by DIA's original October 29, 1993, completion date. Webb also demanded that BAE pay for the $50 million conventional tug-and-cart baggage system. Gino Di Fonzo, President of BAE, knew that his company could not design an airport and an airport facilities in the same city. He suggested that the BAE system, according to Webb's design, was not feasible. The mayor agreed to negotiate a new contract with the city.

Building the Most Efficient Airport in the World

Until about 1970, Denver's Stapleton Airport had managed to accommodate an ever-growing number of airplanes and passengers. Its operational capacity was severely limited by runway layout, and Stapleton had two parallel north-south runways and two additional parallel east-west runways that accommodated only commuter air carriers.

Denver's economy grew and expanded greatly in the early 1980s, consequent to booms in the oil, real estate, and tourism industries. An aging and saturated Stapleton Airport was increasingly seen as a liability that limited the attractiveness of the region to the many businesses that were flocking to it. Delays had become chronic. Neither the north-south nor east-west parallel runways had sufficient lateral separation to accommodate simultaneous parallel arrival streams during poor weather conditions. When significant flight disruptions affected the layout of Stapleton's taxiways, it caused significant flight delays, during high-traffic periods, even when weather conditions were good.

Denver's geographic location and the growing size of its population and commerce made it an attractive location for airline hubbing operations. At one point, Stapleton had housed 14 airline hubs, more than any other airport in the United States. In poor weather, Denver experienced several high-traffic volume disruptions, however, its limitations disrupted connection schedules that were important to maintain; these operations. A storm...
could easily congest air traffic across the entire U.S. network.

The City and County of Denver had determined in the mid-1970s that Stapleton International Airport was in need of expansion or replacement. In July 1979, a study to assess the airport's needs was commissioned by the City of Denver to the Denver Regional Council of Governments. Upon completion of the study in 1983, a report was issued saying that, due to its size and geographic location and strong commitments by United and Continental Airlines, Denver would remain a significant hub for at least one major U.S. carrier. The study recommended expansion of Stapleton's capacity.

**Political Situation**

The City of Denver's 1983 mayoral race precipitated initiatives to improve the airfield infrastructure. Three candidates were vying for mayor: Monte Pasco, Dale Tooley, and Frederick Peña. Pasco, a prominent Denver attorney and former State Democratic Party co-chair, seized upon the airport issue, forcing other candidates to adopt stronger positions on airport expansion than they might have otherwise. Peña and Tooley, however, drew the highest numbers of votes in the general election, and were forced into a runoff. At the persistent urging of the Colorado Bar Association (a collection of 50 of the state's top business executives), Peña and Tooley signed a joint statement committing themselves to airport expansion. Peña was the runoff. Committed by a public promise that could not be enforced, if necessary, by the most highly motivated members of the region's business leadership, Peña immediately restated his intent to expand Stapleton.

The City of Denver and neighboring Adams County began to develop plans for long-term airport development in 1984. In 1985, a new site northeast of Denver was chosen. Construction of the airport's terminal, however, was left to Adams County voters, who had to vote to permit the City of Denver to annex property therein. The city hired a consulting firm to help organize its resources and its efforts to work through the legal process. The data that was gathered through the master planning and environmental assessment later proved useful for public education.

An "air access agreement" between Adams County and the City of Denver, which reached on April 21, 1988, Adams County voters approved a plan to let Denver annex 45.8 square miles for the construction of an airport. In a special election on May 16, 1989, voters of Denver endorsed a "New Airport" by a margin of 62.7% to 33.5%. According to Edmond, "These two referendums passed largely on the merits of the economic benefits: jobs and sales tax revenues.

**Economic Considerations**

A number of trends and events in the mid-1980s alarmed bank economists and others who have been in a leadership role in the mid-1980s. The collapse of oil and shale ventures between 1982 and 1986 saw mining employment fall from 42,000 to 26,000 jobs, while service support jobs fell from 23,500 to 11,700. Construction jobs fell from 90,700 to 36,600 jobs, and the value of private construction plummeted from $24 billion to $9.5 billion.

A lackluster economy led many government officials in counties and municipalities as well as in Denver to embark upon an unprecedented policy of massive public construction to save the region from what was regarded in 1987 as an economic freefall. A $100 million-plus municipal bond was issued for public improvements, including a new downtown library, neighborhood shopping centers, and citywide infrastructure investments. During the same period, the Peña administration moved decisively to confront an increasingly aggressive Chamber of Commerce leadership that was promoting airport relocation.

The determination of the "pro-New Airport" plan was growing. The project was being marketed as technologically advanced, a state-of-the-art structure to draw businesses, in port federal capital, and fund the creation of new jobs with bonded debts to overcome the short-term decline in the economy. The airport was to become a grandiose project to revitalize the Colorado economy and public works administration. The "entire business community, and a master showcase for the Public Works Department. The "entire business community," recalled a member of the Mayor's administrative team.

Chamber of Commerce, members of the city council, the mayor, and state legislators, participated in an informal agreement with other businesses that had recently built airports. (This enabled) everybody to understand the magnitude of the project. So we studied the other two airports that had been built in the United States in the last 50 years and said, "Tell us everything that you went through and all the places you think there will be problems."

We were not going into it blindly.

Forecasts of aviation activity at Stapleton by the Airport Consultant team, the FAA, and others, however, did not anticipate events such as a new phase of post-deregulation consolidation, the acquisition in 1984 of Frontier Airlines by Texas Air (the owner of Continental), significant increases in air fares for flights in and out of Stapleton, and the bankruptcy of Continental. Consequently, the level of aviation activity in Denver was overestimated. Instead of rising, Stapleton's share of total U.S. domestic passenger enplanements fell 4% per year from 1986 through 1989.

**The Master Plan**

The City of Denver's approach to preparing a master plan for the airport was typical. "One hires the best consultants on an airfield layout, noise impact, terminal layout, on-site runway, off-site roads, cost estimation, financial analysis, and forecasting," observed FAA administrator Gail Edmond. "They line up and generate the alternate layouts as possible. *Alternatives* were discussed and eliminated at periodic joint planning sessions, and a technical subcommittee was organized to gather input from the eventual airport users, airlines, pilots, and the FAA. "Everybody knew how to begin an airport master plan," Edmond added.

Following a bid, the consulting contract was awarded to the joint venture of Greiner, Inc., and Morrison-Rudinse Engineers for their combined expertise in the fields of transportation and construction. The
consulting team, working under the direction of the DIA Director of Aviation, focused first on four elements: site selection; the master plan; the environmental assessment and developing support by educating the public on economic benefit. The final master plan presented to the city by the team in the fall of 1987 called for the construction of the world's most efficient airport. It was to be created from the ground up with no predetermined limitations. The plan was to allow the airport to grow and expand without compromising efficiency. Twice the size of Manhattan at 53 square miles, the nation's largest airport was to be designed for steady traffic flow in all weather conditions. It was to comprise a terminal with east and west buildings joined by an atrium structure, three concourses, an automated underground people-mover, and five parallel 12,000-foot-long runways on which as many as 1,750 planes could take off and land daily. Its flow-through traffic patterns would allow planes to land, taxi to concourse gates, and take off again all in one direction. The ultimate buildout, projected for the year 2020, was to include up to 12 full service runways, more than 200 gates, and a capacity of 110 million passengers annually. Estimated cost (excluding land acquisition and pre-1990 planning costs) was $2 billion. By the end of 1991, the estimated cost had increased to $2.66 billion. Plans called for the project's completion by the fall of 1993.

In September 1989, Federal officials signed a $20 million grant agreement for the new airport, which was to be financed in multiple ways—by issuing revenue bonds and securing federal grants—supplemented by a sizable investment by the city (County of Denver 1991). Estimated federal grants for the new airport originally totaled $501 million. Portions of these were forthcoming from the FAA, for federal fiscal year 1986 in the amount of $90 million and for federal fiscal year 1991 in the amount of $25 million. The remainder of the $501 million letter of intent was to be received on an annual basis through fiscal year 1997. The revenue bonds assumed the "Debt of Beneficial Occupancy" (DBO) to be January 1, 1994, with bond repayments to begin on that date. At that time, the city determined that DIA would meet the DBO no later than October 31, 1993. A member of the Mayor's administrative team described the approach:

What we did was plan the DBO date and then we planned an extra six months just in case there was a lag in the opening, which, in essence, allowed us to create stability in the market. The other thing we did was that we conservatively financed and filled every reserve account to the maximum. So we borrowed as much money as we could at the lower interest rate and were able to average the debt cost down, not up, as we thought it would be.

A Build-Design Project

By the time construction began at DIA in November 1989, a transfer of authority was taking place in the City of Denver. Wellington Webb was elected the new mayor. According to one of his assistants, the Peña administration had announced that the airport would be operational in October 1993. "This was a build-design project, which means that we were building the airport while we were designing it," he explained. "Because of the delays early on in the project, we had to accelerate construction immediately. There was a lot of pressure and too many players. This was an airport built by committee. We had regular meetings to straighten things out but it didn't always work."

Although the Webb administration inherited the airport project without a commitment on the part of the major carriers, the support and input of concerned airlines were absolutely key, not only financially but also in terms of input on overall airport layout, scope, and capacity, and supporting systems such as fueling and baggage handling. Denver launched the DIA program with a specific commitment from either of Stapleton airport's two major tenant airlines, United and Continental, which together accounted for more than 70% of existing passenger traffic. Continental committed to the new airport on February 1990, United in December 1991. Fundamental changes were made to the airport layout plan and facilities (some already under construction) to accommodate the operational needs of these carriers.

The Webb administration followed the predecessor administration's emphasis on assuring that the project's greatest beneficiaries would be local businesses. The desire was to involve as many individual firms as practicable and to use Denver-area talent. It was reasoned that local talent was easily accessible to the program management team (PMT), knew Denver building codes and practices, and had available the necessary professional labor pool to accomplish the design in accordance with the demanding schedule. In addition, existing law stated that 30% minority-owned firms and 6% women-owned firms had to participate in a public works program. The result was a contracting philosophy that maximized opportunities for regional businesses and the local workforce to compete for the work. At least five of 30 contracts awarded for the design of DIA went to Denver-area firms. These 60 design contracts generated 110 construction contracts. Eighty-eight professional service contracts also had to be coordinated. Many local firms had to be hired, and the program was chopped up into many smaller contracts. Involvement totaled 200 900 firms and reached 400 during the construction phase. Five different firms designed the runways, four the terminal. The city's emphasis on encouraging every participant to compete and yet be part of the project increased the potential for interface and coordination problems.

Denver's flat economy led the administration to keep construction money within the city. Although this benefited the city, it introduced an additional burden on administration. As many as 40-50 concurrent contracts involved many interrelated milestones and contingencies or overlapping operational areas. The estimated daily on-site workforce population exceeded 2,500 workers for a 10- to 12-month period beginning in mid-1991 and peaked at between 9,000 and 10,000 in mid-1992. Adding to the human resource coordination problems was a forecasted 4,000 deliveries daily. Construction volume for six months in mid-1992 exceeded $100 million per month.

The prolonged period of assessment and negotiation prior to final approval of the project, and the financial plan selected (which required that bond repayments begin on January 1, 1994), pressured the PMT to push the project ahead at all cost. Because the project had to assume the characteristics of a "fast-track" project early in the construction startup, the compressed design and construction effort precipitated a need for a "comparative bid, fixed price" program. Reliance on a design/build method for the project was, according to one DIA official, "unusual because projects of this size normally happen during separate stages. For example, you need to finish up the site selection before you begin the master planning."

Moreover, communication channels between the city, project management team, and consultants were neither well defined nor controlled. "If a contractor fell behind," a resident engineer who reported to one of the area managers said,
the resident engineer would alert the contractor and document this. The resident engineer would document what would have to be done and what additional resources were necessary to get the job on schedule and finish the contract on time. As a public agency it was enormous, the amount of documentation that we did. I don't know how many trees we cut down just for this project. The resident engineer had about 12 to 18-drawer filing cabinets of documentation, and this was nothing compared to what the area manager had. It was just incredible. There were at least four to six copies of everything.

The scheduling manager described the evolution of the tracking system that was used.

One of the biggest problems we had was keeping track of all the changes. So we developed a database system that was installed at each one of the resident engineer's trailers, and each contract administrator was then charged with keeping that system up to date and feeding us disks, which would then merge together periodically to produce an integrated report. But even after they developed their own tracking system before the start of the project. That worked well for each group, but there was no way to take each one of these divergent systems and combine it into one, comprehensive report. So when we introduced the change tracking system everybody said, "Fine, that's wonderful, and I'll update it when I get to it and when I get time." It took three years to implement the tracking system.

Project Management
In a fast-moving, ever-changing environment such as the development of a new airport, the management structure must be able to rapidly produce engineering alternatives and the supporting cost and schedule data. But because DIA was financed by many sources and was a public works program, project administrators had to balance administrative, political, and social imperatives. The City of Denver staff and consultant team shared leadership of the project and coordinated the initial facets of DIA design.

The initial thought reflected one staff member, "was that the city staff do their thing and the consulting staff do theirs, and later we would coordinate. It became evident within a very short time that we were doing duplicate duties, which was inefficient. Finally the city decided to coordinate resources."

The city selected a team of city employees and consultants and drafted a work scope document that clearly separated the city's from the consultant's responsibilities. The elements the city did not delegate to consultants included ultimate policy and facility decisions, approval of payments, negotiation and execution of contracts, facilitation of FAA approvals, affirmative action, settlement of contractor claims and disputes, selection of consultants, and utility agreements. The city delegated some elements, such as ahs engineering, construction market analysis, claims management, change order management, and state-of-the-art project control (computerized management of budget and schedule). Exhibit 1 depicts the DIA management structure.

The program management team became the organization dedicated to overseeing planning and development for the new airport. Headed by the associate director of aviation, the team was partially staffed by city career service employees. To add experience and capability, the city augmented the PMT.
with personnel from the joint venture of Greiner Engineering and Morrison-Knudsen Engineers, the consulting team. Observed one program management team member, "This working partnership of the City of Denver and consulting joint venture team developed into a fully integrated single organization, capitalizing on the best to be offered by all participants, and optimizing the use of personnel resources."

DIA's operational project structure comprised five different areas subdivided into smaller units. The working areas were: site development (earthmoving, grading, and drainage); runways and on-grade parking (service roads, on-airport roads, and off-airport roads connecting to highways); airfield paving; building design (people-mover baggage-handling tunnel, concourses, passenger bridge, terminal, and parking); and utility/special systems and other facilities (electrical transmission, oil, and gas line removal and relocation). An area manager controlled construction within each area. Area managers were responsible for the administration of all assigned contracts and, in coordination with other area managers, for management of the portion of the overall site in which their work took place.

United Airlines Baggage System

From the public's perspective, the "friendliness" of any airport is measured by time. No matter how architecturally stimulating a new airport structure, the perception of business or leisure travelers is often registered in terms of efficiency in checking luggage at the departure area or waiting to claim a bag in the arrival area. The larger the airport, the more critical the efficient handling of baggage. Remote concourses connected by underground tunnels present special problems for airport planners and operators because of the great distances passengers and baggage must travel. The purpose of an airport being to move passengers efficiently as possible, moving bags as quickly as is possible will reduce the processing and handling time. Rapid transport of frequent flyers accomplishes very little if bags are left behind.

DIA's Concourse A, which was to house Continental Airlines, was situated some 400 meters, and United Airlines' Concourse B nearly 1,000 meters, north of the main terminal. Concourse C, home to other carriers, including American, Delta, Northwest, America West, and TWA, sat parallel to the other two concourses more than 1,600 meters north of the main terminal. The initial project design did not incorporate an airport-wide baggage system, rather the airport expected the individual airlines to build their own systems as in most other American airports. United Airlines, which in June 1991 signed on to use DIA as its second-largest hub airport, proceeded to do just that.

Understanding an automated baggage-handling system if it was to be turned around in less than 30 minutes, United, in December 1991, commissioned BAE Automatic Systems, Inc., a world leader in the design and implementation of material-handling systems, to develop an automated baggage-handling system for its B Concourse at DIA. The contract, which included engineering and early parts procurement only was valued at $20 million; and the task was estimated to be completed in two and one-half years. "We began working at DIA under a contract directly with United Airlines," recalled Di Fonzo. "Obviously, United Airlines has experience with airports. They concluded that the schedule had gotten totally out of control from the standpoint of baggage, and they acted to serve their own needs, basically to protect themselves. We constructed with United Airlines already designing their portion of the system before the city went out for competitive bidding."

BAE was founded as a division of Dutcetel Corporation in 1968. Ductetel, which had developed the Telecar (a track-mounted automated baggage system), constructed an automated baggage system for United Airlines at San Francisco airport in 1975. When Ductetel ran into financial difficulties during this installation, United asked Boeing, a major supplier of its aircraft, to take over the company. Boeing agreed, and the new company, a wholly owned subsidiary dubbed Boeing Airport Equipment, completed the San Francisco installation. In 1982, Boeing sold the company to its senior management, which renamed it BAE Automated Systems. In August 1985, BAE became an operating unit of Clarkston Industries, a wholly owned subsidiary of London-based Britrplc. Britr plc (formerly British Tire and Rubber), was a $10 billion conglomerate with global interests in building, paper and printing products, and agricultural and aircraft equipment.

In 1994, BAE's 365 employees worked on projects across the United States and in Europe and Australia. In-house engineering, manufacturing, and field support capabilities enabled BAE to develop, design, manufacture, install, and support every project it undertook from start to finish. BAE also provided consulting, engineering, and management services for airport projects and a variety of material-handling applications. With sales of $140 million in 1994, up from approximately $40 million in 1991, BAE accounted for 90% of U.S. baggage-sorting equipment sales. Between 1972 and 1994, the company had successfully designed, manufactured, and installed nearly 70 automated baggage-handling systems (worth almost $500 million) at major airports in the United States, in New York City/Port Worth, Chicago, San Francisco, Atlanta, Miami, Newark, and Pittsburgh. It had also installed systems in Vancouver and London and was selected in 1992, as a consultant to the $560 million main terminal for the New Seoul Metropolitan Airport in South Korea.

BAE was a self-contained, integrated company structured along two business lines: manufacturing and engineering. Its approximately 200,000 square foot manufacturing facility was capable of producing nearly 10 of the components required by BAE systems, wave motors, gears, and bearings. The engineering department was structured according to major projects. Each project was assigned a project manager who reported directly to the company president.

Implementing an Integrated Baggage-Handling System

BAE had already commenced work on United's baggage system when the PDA recognized the potential benefits of an airport-wide integrated baggage system. Moreover, BAE had already commenced work on United's baggage system when the PDA recognized the potential benefits of an airport-wide integrated baggage system. Moreover, as one DIA senior manager explained, "Airports, other than United simply were not coming forward with plans to develop their own bagge system." Airport planners, too, began to draw up specifications, and BAE sent out a request for bids. Of 16 companies contacted, both in the United States and abroad, only three responded. A consulting firm recommended against the submitted designs on the grounds that the configuration would not meet the airport's needs.

BAE was among the companies that had decided not to bid for the job. BAE had installed the Telecar system at a number of other airports, and the basic technologies of the Telecar, laser barcode readers, and...
conveyor belt systems were not new. What was new was the size and complexity of the system. "A grand airport like DIA needs a complex baggage system," explained Di Fonzo.

Therefore, the type of technology to be used for such a system is the kind of decision that must be made very early in a project. If there is a surprise like what happened at DIA, then there is still time to react. At DIA this never happened. Working with United Airlines, we had concluded that destination-coded vehicles moving at high speed was the technology needed. But quite honestly, although we had believed that technology, it did not rise to implementation in a complex project like DIA's where it would have required significant greater time than the city had left available.

A United project manager concurred: "BAG told them from the beginning that they were going to need at least one more year to get the system up and running, but no one wanted to hear that." The City of Denver was getting the same story from the technical advisors to the Francis José Strauss Airport in Munich. The Munich airport had an automated baggage system but one far less complex than DIA. Nevertheless, Munich's technical advisors had spent two years testing the system, and the system had been running 24 hours a day for six months before the airport opened.

Formulae Intention  As BAAS was already working on United's automated baggage-handling system and enjoyed a worldwide reputation as a superior baggage system builder, Denver approached the company. BAAS was asked to study how the United concept could be expanded to create an integrated airport system that could serve the other carriers in the various concourses. BAAS presented the City of Denver with a proposal to develop an "most complex automated baggage system ever built," according to Di Fonzo. It was to be effective in delivering bags to and from passengers, and efficient in terms of operating reliability, maintainability, and future flexibility. The system was to be capable of directing bags (including suitcases of all sizes, skis, and golf clubs) from the main terminal through a turn into a remote conveyor and directly to a gate. Such efficient delivery would save precious ground time, reduce close-out time for hub operations, and cut time-consuming manual baggage sorting and handling.

Although an automated system was more expensive initially than simple bags and baggage carts, it was expected that it would reduce the manpower which was required to distribute bags to the correct locations. Bags unloaded from an aircraft in a given date, and there would be a number of freeze dates for mechanical design, software design, permanent power requirements, and the like. The contract made it obvious that only those parties who agreed to complete the project. The parties dealt mostly with all-access, fully complete, and grace of service. The agreement was for a period of power, provision of computer hardware; all these elements were specified at the same time.

Denver officials accepted these requirements and, in addition, committed to unrestricted access for BAAS equipment. Because of the tight deadlines, BAAS would have priority in any area where it needed to install the system. Di Fonzo elaborated:

When we entered into the contract, Continental Airlines was still under bankruptcy law protection. The city was very concerned that the airline would be unable to pay for their consequences. They only contracted for about 40% of the equipment that was to be installed, in Concourse A, which was the busiest of the three. Continental had leased that, but Concourse C had no immediate airlines as leaseholders at the time. The city, therefore, wanted the simplest, most elegant baggage system possible. BAAS C. The outputs and inputs were very, very crude, intentionally crude to keep the costs down because the city had no assurance of revenue stream at that point in time. The city did not get what they wanted or needed to operate. The approach was more along the lines of "we will build it out for you."

Project Organization and Management
No major organizational changes to accommo date the new baggage system were deemed necessary, although some managerial adjustments were needed in the BAAS project. Design of the automated baggage system was frozen on May 15, 1992, when the P3 MTM (mandatory) organizational requirements for the integrated baggage system. The direct relationship with BAAS was delegated to Working Area 1, which also had responsibility for building design efforts such as the people mover, airside/ground building, pedestrian bridge, main landside building complex and parking garage, and various other smaller structures. The area manager, though he had a great deal of experience in airport construction, bag the system technology, or the introduction of new technologies, possessed vast experience in construction project control and management.

BAAS had to change its working structure to conform to DIA's project management structure. Di Fonzo explained:

There was a senior manager for each of the concourses and a manager for the main terminal. This system, if anything, traverses all of them. A single project manager was to argue a case for any major change. The overall proposal and review process varied from four months to one. In addition, because no changes were happening fast at each of the sites, there was no time to have an information system there was no time to have an information system conversant with the project. The city was not involved. We had to be personally involved in order to understand what was going on. There was no one to tie it all together and overlap all these efforts because the basic organization was designed to work on it as discrete areas. It was a small thing. We
would keep saying; that over and over again. Who is in charge?

For the first two years of the project, Di Fonzo was the project manager. The project was divided into three general areas of expertise: mechanical engineering, industrial control, and software design. Mechanical engineering was responsible for all mechanical components and their installation, industrial control for industrial control design, logic controller programming, motor control panels, and software design for writing real-time process control software to manage the system.

At the time the contract with BAE was signed, construction had already begun on the terminal and concourses. Substantial changes had to be made to the overall design of the terminal, and some construction already completed had to be taken out and reinstalled to accommodate the expanded system. Installation of the expanded system was initially estimated to require more than $100 million in construction work. Walls had to be removed and a new floor installed in the terminal building to support the new system. Moreover, major changes in project governance were taking place during the baggage system negotiations. In May 1992, shortly after the baggage system negotiations commenced, the head of the DIA project resigned.

The story in October 1992 of Chief Airport Engineer, Gail Edmond, who had been a strong proponent of the baggage system and closely involved in negotiations with BAE, also exerted a significant impact on the project. His resignation had been essential because of the amount of heavy machinery and track that had to be moved and installed and the amount of construction work required to accommodate the system. His replacement, Gail Edmond, was selected because she had worked closely with him and knew all the players. Her managerial style, however, was quite different from Slinger’s. A Public Works manager recalled his initial reaction to the change: “The airport is not going to be open on time.” A United Airlines project manager summarized Edmond’s challenge thus:

Slinger was a real problem solver. He was controversial because of his attitude, but he was never afraid to address problems. He had a lot of autonomy and could get things done. Gail was in a completely different position. Basically, she had a good understanding of how the system worked and who the key players were, but didn’t know much about the actual construction. Also, the city council didn’t give her anywhere near the autonomy and the authority that Slinger had, and she had to get approval from the council just about all decisions. They really tied her hands, and everyone knew it. Di Fonzo echoed the project manager’s assessment:

Walter [Slinger] understood that one of the things we had to have was unrestricted access. He knew he could make available any part of the facility, especially the baggage handling system, to the public. I think he made the decision that it was the right thing to do.

In August 1992, for example, United altered plans for a transfer system for bag change planes, requesting that BAE eliminate an entire loop of track from Concourse B. Rather than two complete loops of track, United would have only one. This change saved approximately $20 million, but it required a system redesign. Additional skill, claim devices and old-size baggage elevators added in four of the six elevators of the terminal added $1.3 million to the cost of the system. One month later, Continental requested that automated baggage-sorting systems be added to its west basement at an additional cost of $4.67 million. The claim area length was first changed from 94 feet to 127 feet, then in January 1993, it was changed to $95.996,000, the second subtracted $125,000 from the cost. The same month, maintenance tracks were added to permit the maintenance workers to be placed under the main tracks at an additional cost of $912,000. One year later, United requested alterations to its odd-size baggage input—cost of the change: $432,000.

Another problem was the city’s inability to supply “clean” electricity to the baggage system. The motors and circuitry used in the system were extremely sensitive to power surges and fluctuations. When electrical feedback tripped circuit breakers on hundreds of motors, an engineer was called in to design filters to correct the problem. Although ordered at that time, the filters still hadn’t arrived several months later. A city worker had canceled a contract without realizing that the filters were part of it. The filters finally arrived in March 1994.

A third, albeit disputed, conclusion related to Denver’s requirement, and city law, that a certain percentage of jobs be contract to minority-owned companies. The City of Denver had denied BAE’s original contract because it did not comply with hiring requirements, whereupon BAE engaged some outside contractors in lieu of BAE employees. Di Fonzo estimated that this increased costs by approximately $6 million, an additional cost of $4.67 million. The additional cost of $4.67 million. The additional cost of $6 million.
BAE Automated Systems (A): Denver + International Airport Baggage-Handling System

Law suits and a Backup Baggage System

In February 1993, Mayor Webb delayed the scheduled October 1993 airport opening to December 19, 1993. Later, this December date was changed to March 9, 1994.

Everybody got into the panic mode of trying...