In essence, recombinant DNA, molecular cloning, and DNA recombination all refer to the same activity, namely, the insertion of a DNA segment into an intact DNA molecule that is replicated faithfully by the descendants of the organism into which it is placed. This is not unlike coupling a new set of boxcars into the molecular "train" used earlier as an example. Furthermore, the instructions for polypeptide or protein synthesis must be recognized and obeyed by the bacterium.

Given the ability to augment the molecular instruction book for chemicals manufacture by cells, is it reasonable to ask what one might accomplish? Generally speaking, there are two approaches to be taken. Cells (bacterial, animal, or plant) can be made to express a chemical in far greater quantities than they normally would by multiple copying of the gene (or genes) that codes for the chemical. For instance, a particular microbe might produce a useful substance, a protein; however, the rate at which the protein is synthesized may be low. By "stitching" in multiple copies of the organism's gene that codes for the protein, then it would, in principle, be possible to amplify chemical productivity. This procedure would be akin to xeroxing the same page in the microbe's instruction manual many times, yet having them all read more or less simultaneously. The other approach is that of removing the instruction page (the gene) responsible for a particular chemical's synthesis and pasting it in someone else's manual (e.g., an unrelated organism). An example would be the insulin example referred to earlier. In either case, we are talking about synthesizing chemicals already made by cells. By virtue of DNA recombination, the cells will either make the material in more copious quantities (e.g., at higher rates), or else manufacture chemicals they normally (as a result of evolutionary pressures) did not but which instead were produced by some other cell line.

Since almost every chemical substance, or at least the precursor to same, is or can be synthesized by some type of cell, the possibilities for putting this new technology to work are indeed staggering. Already a number of biochemicals have been synthesized using molecular cloning techniques. Among them are: human insulin, human interferons (antiviral proteins), and somatostatin (a brain hormone). The current interest in interferons is particularly keen due in part, I presume, to their current retail value of $20 billion per pound.

In time we will see a host of recombinant products become available. Most of them will fall into one of the following classes: pharmaceuticals and biologicals; fine, intermediate, and bulk chemicals; and fuels. Examples of each include: pharmaceuticals and biologicals—human-growth hormone, antibiotics, nerve-growth hormone, other immune proteins besides the interferons, and vaccines; chemicals—epoxides, oxides, glycols, alcohols, acids, herbicides, pesticides, enzymes, lubricants, and sugars; fuels—alcohols, hydrogen, and methane. The impact of this new technology will also be felt by the farming and food industries. Fertilizers are normally produced from ammonia, which in turn is manufactured using methane, a dwindling resource. Some bacteria are able to form a symbiotic relationship with plants, the result of which is the direct fixation of atmospheric nitrogen to organic nitrogen, thereby obviating the need for externally applied fertilizer. Gene-splicing can, in principle, be employed to genetically alter plants to give them pest resistance and tolerance to drought and to saline soils, or to enhance their photosynthetic efficiency. Cells cloned to manufacture prodigious amounts of protein offer a new source of food and food supplements.

Case II-3
EDS: Information Technology Outsourcing

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EDS (Electronic Data Systems) had been the leader in the information technology (IT) outsourcing industry since the 1960s. In an industry which it pioneered and continued to develop, EDS held a commanding market share. In the early 1990s, however, EDS faced new challenges as clients' outsourcing needs were changing, innovations in computing technology were altering the delivery of services, and additional competitors were entering the industry.

The IT Outsourcing Industry

Information Technology

IT referred broadly to the resources a firm applied to process and manage its data. These resources included computing hardware, software, communications (voice, data, and video), and associated personnel. Advances in IT over the past few decades had led to new applications and substantial changes in how businesses employed IT.

The decentralization of companies after World War II increased the need for centralized financial control. The emergence of the mainframe computer as a commercial device in the 1960s allowed companies to process data centrally, and the mainframe became the center of firms' IT operations. IT applications during this time focused on automating highly repetitive tasks, and investment decisions in IT were usually evaluated in terms of reduced labor costs.

In the 1970s, the introduction of the minicomputer allowed firms to develop applications which served specific departments or groups within the firm to supplement the centralized functions running on the mainframe. Data on these two different hardware platforms could be processed independently or shared in so-called distributed networks. The minicomputer also increased usage of IT as firms that could not afford mainframe systems could now invest affordably in IT. During this period, return on IT projects was still equated with savings related to cost reductions; however, accurate measurement was more complicated because more advanced technologies increasingly allowed intellectual rather than mechanical labor to be replaced.

During the 1960s and 1970s when companies' IT operations relied on mainframes and minicomputers, a firm typically housed its computer and communications equipment and related personnel in a data processing center. Users accessed data online by displaying it on computer terminals or by generating printed reports. The data center was also responsible for running various software application programs in "background," which processed and updated data for users.

Personnel in the data center performed such activities as entering commands to start the running of software applications, mounting magnetic tapes for backups, monitoring the computer's performance, and maintaining the computer. Data center person-nel usually reported to the firm's management information systems (MIS) department.

Related to the data center operations and also part of the MIS department was the development of new software applications. MIS departments had a staff of analysts and programmers who identified, designed, and developed new software applications to support the firm's activities.

The 1980s introduced the personal computer (PC) and a proliferation of hardware and software standards which began to alter these traditional structures. Due to the availability of inexpensive PCs, departmental managers began developing stand-alone applications outside the control of the central MIS department. These applications met specific departmental needs but were not coordinated with corporate data. By the end of the decade the installed computer power of PCs exceeded that of the large mainframes of the MIS department. The complexity of managing large-scale systems development projects and integrating disparate systems with varying standards resulted in escalating MIS budgets. Such increases prompted companies to view outsourcing as a source of cost containment and efficiency (Exhibit 1 illustrates the evolution of IT).

Outsourcing Services

Outsourcing provided companies with an alternative to their own in-house IT activities. Outsourcing included consulting, systems development, systems integration, and systems management.

IT consulting services were concerned with identifying a strategy for applying technology to achieve the client's business goals. One of the values of a consulting project was identifying new applications which would improve the competitive position of the client. Before assuming the operations of a client's data center, a provider often performed a consulting study to establish such a strategy. To perform a consulting study it was necessary to have both general business and specific industry knowledge. Consulting projects often led to follow-on work to develop and implement the identified applications.

Systems development involved designing and implementing custom software applications to automate a business process or function. Developing an application consisted of identifying user requirements, coding and testing programs, and incorporating them into the firm's existing applications.

EXHIBIT 1   Evolution of Information Technology

Information Technology Complexity (vertical axis)

	1960s	1970s	1980s	1990s
	Mainframe	Minicomputer	Desktop (PC class)	Desktop (workstation class)
	Magnetic tape master files	Structured programming techniques	Relational DBMS	Object oriented DBMS
	Batch oriented systems	Hierarchical DBMS	Computer Aided Software Engineering	Integrated CASE
		Character based terminals	Artificial Intelligence	Heterogeneous networks
		Online transaction processing	Graphical user interfaces	RAID disk architecture
			LAN work groups	HIPI interfaces
				Fiber optic networks
				Client/Server architecture
				International systems
				Cooperative distributed processing
				Parallelism
				Natural language interfaces
				Neural networks
				Scalable hardware architectures
Control	Senior management	MIS management	Department management	Users
Delivery method	Centralized	Departmental	Desktop	Distributed
Investment criteria	Labor/capital tradeoff	Flexibility through technology gains	Strategic planning	Organizational effectiveness

Depending on the size of the application, a development project took from a few weeks to several years and required industry and technical knowledge and project management skills.

Systems integration involved modifying or creating interfaces for disparate hardware and software components to make them compatible. Integration differed from development in that it involved combining existing hardware and software technologies rather than creating custom applications. For example, often a company wanted to incorporate a packaged software system into its existing applications, but the two were incompatible, or it wanted to integrate two systems that had been developed separately over time or had been purchased from two separate vendors. Combining the disparate systems involved modifying the existing applications or creating custom interface programs. Systems integration required industry and technical knowledge and project management skills.

The most highly publicized segment of the outsourcing market was systems management outsourcing. *Systems management* referred to the assumption of all or part of clients' IT operations by an external provider. A provider managed and operated a client's data processing center, frequently from their own off-site data centers. The systems management provider managed all elements of the data processing center: hardware, software, communications, and personnel.

The centerpiece of the provider's operation was its technical infrastructure, which included computer hardware, operating systems, peripheral equipment, and telecommunications (such as local area networks and satellite or terrestrial data transmission). This infrastructure was used to run the unique software applications necessary to process data for each client.

The provider could combine up to hundreds of clients' processing needs on the same facilities. Increased capacity utilization allowed investment in productivity-enhancing technology and automation of labor-intensive functions, such as scheduling and submitting computer programs for running, loading magnetic tapes, and monitoring system performance.

A systems management contract usually involved deploying provider personnel to the client's site. In addition to running the client's existing software applications, the on-site personnel handled user inquiries and enhanced existing client applications or created new ones. Except for these employees, the end users could not distinguish systems management services from an internal data center. Ter-

minals were linked to the provider's remote data center and reports were printed on the premises or delivered from a printing facility. The following example demonstrates one approach to providing systems management services.

A systems management contract could be implemented in three major stages. This phased approach was required because of the complexity of managing a data center; however, the sequence of events in implementing these stages varied across providers and clients. During the first stage, the provider assumed all assets and personnel of the client's existing data center and operated the data center at the client site. Client personnel were integrated into the provider organization, although most remained at the client site to provide continuity during the transition of the data center. The provider supplemented this staff with its own technical experts to manage the transition.

In the next stage, the provider transferred the client's applications to its remote data center. This step could require substantial effort because the client's software often had to be modified to be compatible with different hardware platforms at the provider's data center. At this point, the client's staff was available to be integrated into the provider's organization.

In the final stage the provider took additional measures to increase the efficiency of the client's data processing. Efficiency improvements could be as simple as making minor changes to programs to allow them to read data faster or as major as processing portions of the client's data on the provider's own proprietary applications. During the life of the systems management contract, the provider was responsible for maintaining the client's applications. In addition, the provider usually provided a pool of analysts and programmers to make minor modifications to the software. Major modifications or systems enhancements not identified in the original contract could be priced as separate consulting, systems development, or systems integration projects.

Unlike systems management services, consulting, systems development, and systems integration activities were personnel-intensive. Outsourcing providers also offered these services separately from a systems management contract. Traditionally, these discrete services were performed on a fixed-price basis or according to time and materials used. Systems management outsourcing providers faced additional competition when bidding for unbundled services from firms such as American Management

Systems in systems development and Booz Allen & Hamilton in consulting. Also, a client often maintained an internal staff to perform these activities after outsourcing its data center.

Clients

Any corporation with an in-house data center was a potential client for outsourcing its systems management activities. Since the early 1960s, thousands of small and medium-sized companies, as well as government agencies, had outsourced their data centers. In the late 1980s several large corporations entered into systems management outsourcing agreements. Because of their greater IT needs, the contracts they entered into were larger and of longer duration than previous contracts. With a value of at least $100 million and a typical duration of 10 years, these contracts were known as *megacontracts* in the industry. The total value of megacontracts had grown from close to zero in 1987 to an estimated value of $8.4 billion in 1991.

While the first commercial megacontracts were signed in the early 1980s, such contracts gained widespread attention with the contract signed by Eastman Kodak in 1989. Kodak outsourced its data processing business to three providers: IBM for its data center operations, Digital Equipment Corporation (DEC) for its telecommunications, and Businessland for maintaining its installed base of personal computers. This contract increased interest in systems management outsourcing among the Fortune 500. Since then, many other large corporations had signed megacontracts (Exhibit 2). One market research firm predicted in 1989 that all Fortune 500 companies would evaluate systems management outsourcing during the 1990s and that 20 percent of them would sign contracts.[1]

Although figures varied by industry, corporations spent up to 4 percent of their revenues on information technology products and services (Exhibit 3). Ideally, the application of IT affected the business performance of the entire organization. If properly applied, IT could be used to enhance the competitive position of the firm by improving the cost structure of the entire firm, improving the quality of the product produced or service performed, and improving the ability to respond to its customers' needs.

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[1]Yankee Group quoted in *Network World*, July 2, 1990.

EXHIBIT 2   Outsourcing Megacontracts, 1988–1991

End User	Supplier	Estimated Revenue ($m)	Length (years)
1991			
General Dynamics	CSC	$3,000	10
Continental Airlines	EDS	2,100	10
National Car Rental	EDS	500	10
McDonnell Douglas	EDS	n.a.	n.a.
First American Bancshares	Perot	400	10
Continental Bank	IBM, E&Y	400	10
SAAB	EDS	360	10
Signet Bank	EDS	300	10
Zale	IBM	286	10
NCNB	Perot	200	10
United Technologies	IBM	n.a.	n.a.
Supermarkets General	IBM	150	10
FAI Insurance Ltd	PMS	140	10
Comdata	IBM	120	10
Ramada/Howard Johnson's	EDS	100	10
Signetics	EDS	100	10
Robert Plan	Perot	100	10
Greyhound Bus	ACS	80	10
Federal Home Loan Bank S.F.	Systematics	80	n.a.
Total		$8,416	
1990			
First Fidelity	EDS	450	10
Sun Refining/Marketing	Andersen	180	n.a.
Riggs National Bank	IBM	160	10
International Telecharge	ACS	160	10
American Medical International	Perot	115	5
Team Bank	Systematics	100	10
Integra (Union National Bank)	Systematics	100	3
Total		$1,265	
1989			
Eastman Kodak	IBM, DEC, Businessland	500	n.a.
Glendale Fed./Gesco	FIServ	300	n.a.
Great Western Financial	EDS	300	9.5
ICH Insurance	Perot	250	n.a.
Western Union	EDS	250	10
Cummins Engine	EDS	240	10
Meritor Savings Bank	EDS	250	10
Southland	ACS	150	10
Hibernia National Bank	IBM	150	9
First Tennessee National Bank	IBM	150	n.a.
Bank South	IBM	120	10
Columbia Pictures Entertainment	EDS	95	10
Total		$2,755	
1988			
First City Banc	EDS	600	10
Enron	EDS	500	10
Banc One Texas (M Bank)	EDS	275	10
Freeport McMoRan	EDS	200	10
Total		$1,575	

SOURCE: Merrill Lynch, Ledgeway.

EXHIBIT 3   IT Expenditure by Industry, 1988

	Expenditures as Percent of Revenue*	Total Expenditures ($M)
Auto and industrial	3.2	$11,179
Banking and finance	0.6	6,303
Electronics	3.7	7,135
Food and beverage	1.1	1,189
Health care and pharmaceuticals	2.6	1,570
Insurance	1.7	2,545
Metal and metal products	2.2	1,117
Petroleum	1.3	3,670
Process industries	2.1	2,978
Retail	0.8	1,583
Telecommunications	4.0	5,294
Transportation	2.6	1,979

*For banking, assets rather than revenues
SOURCE: Business Research Group

In-house data centers were operated by an MIS department under the leadership of an MIS executive. The MIS executive's responsibilities on a daily basis were to ensure that the computer system was available and responding quickly for online use, that data were processed without error, and that reports were available on time. On a longer-term basis the MIS executive chose software and hardware to support the organization in the future and oversaw any in-house application development. Beginning in the mid-1980s, large corporations often employed a chief information officer (CIO) to oversee the firm's technology strategy, but in smaller firms the MIS executive fulfilled this role. The MIS department was usually treated as a cost center and its costs were allocated as overhead. It normally submitted an annual budget for funds. Special expenditures such as capital equipment purchases or large systems development projects were evaluated separately.

The Systems Management Outsourcing Decision

The decision to outsource a data center was usually made by the chief executive officer (CEO), chief financial officer (CFO), or CIO because it was a business decision rather than a technical one. The decision was complex, with many parameters. Although MIS executives participated in the decision, the relationship between the MIS manager and the provider was sometimes strained because

the MIS executive's management of the data center was directly compared to the provider's promised performance. There was less tension for providers who had a strong, preexisting relationship with the MIS executive.

Outsourcing brought two broad categories of benefits to the client. First, cost savings were achieved by consolidating many small data centers of different clients into one, reducing expenditures in overhead, hardware, software, and personnel. Industry analysts estimated that these economies could be reaped up to a data center capacity of about 250 millions of instructions per second (MIPS) in a mainframe environment.[2] Large corporations with efficient operations could reap such economies on their own since their data center capacities exceeded that size. In the past many corporations lacked the experience to run an efficient data center operation, but by the late 1980s most could match the efficiency of an outsourcing provider.

The second source of benefits to the client was the provider's knowledge of IT. Even the very largest corporations could reap these benefits. Because of their size, providers could employ specialists even a large company could not afford. This expertise allowed providers to remain current with rapid changes in technologies and industry practices which would influence clients' investments in IT.

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[2] "Consolidating Multiple Data Centers," I/S Analyzer, November 1990.

Other criteria were taken into account when deciding whether to outsource. Many executives believed that outsourcing demystified the technical aspects of computing, turning it into a quantifiable business. The strategic importance of the company's IT function affected the decision to outsource. Some firms viewed IT as a core business function and preferred to keep it in-house. Other firms wanted to focus on what they considered to be their core business functions, such as marketing or distribution, and to leave technology decisions to outside experts. Many firms, especially those with severe cash flow constraints, were attracted by the cash infusion, often of several million dollars, that resulted from selling data center assets. In the late 1980s several firms, such as Avon and American Standard, that had to meet interest payments from leveraged buyouts, decided to outsource.

Many potential clients were reluctant to outsource their data center even if they could lower costs or increase performance. Many feared a loss of control from turning over their data center to a third party. Other clients feared the difficulty of reversing an outsourcing contract. Although clients had successfully brought their data center operations back in-house, contracts could be difficult to reverse because the provider had absorbed the client's MIS personnel. Resuming internal operations required rehiring personnel and significant cooperation from the outsourcing provider. Clients also worried that it might be difficult to preserve confidentiality in an outsourcing contract since providers shared personnel across clients. Because of all of these factors, it was essential for a provider to maintain an excellent reputation for being trustworthy.

Some criteria for choosing a provider were common to all potential clients. One important criterion was the provider's reputation for timely and accurate service delivery. Reputations were established through client references or, especially, a preexisting relationship with the provider. Financial stability was also important given the length of outsourcing contracts and the implications if a provider were to lack funds to update old technology or applications or provide ongoing processing services.

Other criteria depended upon the firm's outsourcing needs. Some firms simply wanted a provider to keep their hardware and software running so that their own internal development team could identify and develop new applications. Other firms wanted to work closely with the provider to apply a full range of services in helping

them meet their business objectives and highly valued the industry expertise of the provider personnel. These firms tended to be less price-sensitive than those interested in pure data center operations. It was estimated that about half the companies that outsourced viewed it primarily as a way to save money, while others focused more on the provider's service.[3]

Because of significant setup costs, outsourcing tended to be done through multiyear contracts. Although provider practices varied, contracts were usually fixed-price with additional fees based on processing volume, or time and material costs for setup with processing fees based on volume. Service performance parameters specified in the contract typically included terminal response time, online availability, report delivery responsibilities, and backup/recovery requirements. Contracts also clearly specified control and transfer of equipment, space, and personnel.

Market Growth

IT services represented only 18 percent of the $848 billion IT industry in 1990, but was the fastest growing segment. Between 1991 and 1996, the services sector was expected to grow at a rate of 13 percent compared to the industry growth rate of 7 percent.[4]

Worldwide market size estimates for systems management outsourcing varied greatly depending on which services were included, but most analysts agreed it was around $92 billion in 1990.[5] Systems management outsourcing revenues were expected to increase at a rate of 11 percent per year until 1996. This rapid growth was expected for several reasons.

First, MIS directors were facing pressures of tighter budgets and rising user expectations. The historical IT budget increases of 10 percent to 30 percent in the early 1980s had given way to pressure to cut costs. Moreover, many firms were concerned that the large expenditures on IT in the early 1980s had not resulted in substantial productivity gains or increases in market position. Firms wanted to be able to contain and predict their IT costs.

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[3]"Why Not Farm Out Your Computing," *Fortune*, September 23, 1991.

[4]Based on data by Input Inc. and casewriter estimate.

[5]Based on data by Input Inc. and casewriter estimate. Definition of systems management includes equipment services, processing services, systems operations, and network services.

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Second, within MIS departments, systems management outsourcing allowed the staff to focus their energies on developing new applications to improve the company's competitive position rather than on maintaining, or making minor enhancements to, existing applications. On average, 70 to 80 percent of application development personnel in MIS departments were involved in maintenance and enhancement work.[6] Consequently, most MIS departments had an extensive backlog of user requests for new applications.

Third, the increasing complexity of technology and proliferation of standards increased the risk of choosing the wrong technology and the difficulty of staying current with technology. Contracting with an outsourcing provider gave firms access to specialists and state-of-the-art proprietary software. For example, Systematics used its own banking software to run the operations of its client banks.

Suppliers

Outsourcing providers were large users of computing equipment, software, and communications services. For example, EDS was IBM's largest commercial customer for mainframes, and was estimated to purchase about 50 mainframes per year.[7] These large purchases allowed providers to receive discounts not available to other customers. Most independent outsourcing providers used multiple suppliers of hardware to receive the best prices.

The software used by providers was of two kinds. The first consisted of operating systems, database management systems, and communications switching systems which formed a basic platform on which specific applications were run. Software of the first kind was typically licensed from the leading vendors to facilitate compatibility with clients' applications. The second consisted of the applications programs themselves. Applications software was available from multiple software vendors, although functionality differed greatly across packages. Providers also developed their own applications software.

The consolidation of data centers by clients and through systems management outsourcing providers had resulted in a shrinking customer base for software vendors. The licensing fee for a given main-frame capacity was lower than that for equivalent capacity on multiple smaller computers. Many software providers had begun to take a strong stand on the transfer of software licenses in outsourcing contracts. It was believed that some systems management deals were made considerably less attractive because of fees demanded for software license transfers.[8] Several court cases were pending in 1991 involving disputes over these transfers.

No providers were fully vertically integrated in support services. IBM, DEC, and EDS used subcontractors for specific skills when it was more cost-effective in selected locations. EDS, for example, had teamed up with independent providers for hardware support and local network integrators for LAN support services.[9]

Human Resources

Outsourcing providers competed aggressively for a limited pool of highly skilled personnel. In the late 1980s, the demand for qualified new computer personnel exceeded the number of those entering the workforce.

Because it focused exclusively on IT services, an outsourcing provider offered employees better advancement possibilities than clients usually did. Providers also offered employees the opportunity to work with a variety of clients. Although personnel policies varied across firms, providers generally rotated employees through different industry or technical areas during their first few years before having the employee specialize in a technical area or industry area and work for multiple clients applying that specialty.

Training was also critical to ensure that employees were familiar with current technologies and industry trends. Some providers employed an internal development group which developed methodologies and tools which were used across clients and industries.

Marketing

The marketing efforts of outsourcing providers were aimed at identifying and building a relationship with potential clients. Personnel would establish contact with a potential client through trade shows, refer-

[6]Chris Disher, of Nolan, Norton & Company, quoted in *I/S Analyzer*, September, 1990.

[7]"Why EDS Loves a Recession," *New York Times*, October 20, 1991.

[8]"Software Licensing and Pricing: The Network Changes the Rules," Yankee Group.

[9]G2 Research report, G2 Research Inc.

rals, or "cold calls." After establishing contact, the salesperson would attempt to build a relationship through consultations about the client's business and technology needs and discussions of the provider's previous work, especially in the potential client's industry. Consequently, previous success stories and client references were critical. Providers often used smaller lead-in projects like a consulting or systems development project to establish a relationship which could lead to a full systems management outsourcing contract.

Proposals could be generated in one of two ways. In some cases the provider took the initiative and wrote the proposal outlining its services and price. In other cases, companies seeking outsourcing first published a request for proposal (RFP), and then the interested providers responded with written proposals.

During the 1980s, several providers, including Andersen Consulting, IBM, and EDS, began nationwide print and media advertising to raise general awareness of their service offerings. However, most marketing was still performed at the industry level.

Competitors

The market consisted of both full-service and niche outsourcing providers. Full-service providers were large firms with the resources to provide the full range of IT services to the government and large corporations across a variety of industries. Niche providers concentrated on specific industries or services. For example, Policy Management Systems focused on the insurance industry while Systematics served the banking industry. Full-service providers benefited from both expertise within each industry and generic technical expertise which spanned across industries. Niche providers competed based on their extensive expertise in a single industry. The Policy Management Systems' 1989 10-K report stated:

> These [full-service competitors], especially the larger ones, present a significant competitive challenge to the Company's information services business growth, but the Company believes that it can meet this challenge through its knowledge of the insurance industry and its ability to meet the customer's needs.

It was difficult for niche providers to expand into other industries without forming alliances or merging with other providers. Many niche players were forming such alliances with full-service competitors.

EXHIBIT 4	Estimated Market Shares of Systems Management Outsourcing Megacontract Providers (1991)
EDS	45%
CSC	23
IBM	13
Andersen	1
Others	18

SOURCE: Casewriter estimates.

Industry analysts focused on the value of megacontracts when determining the relative strength of providers. On an annualized basis the revenues from megacontracts for 1991 were estimated to be $2 billion. Estimates of provider market shares for systems management megacontract revenues varied greatly, but EDS was by far the industry leader with a 45 percent market share (Exhibit 4). However, four other full-service providers that had entered the industry during the last few years, IBM, DEC, Andersen Consulting, and Computer Sciences Corporation (CSC), were increasing their market shares. Approximately 400 niche players comprised the remainder of industry revenues.

The leading competitors in outsourcing are profiled below. Their financial positions are summarized in Exhibit 5.

Computer Sciences Corporation. CSC was founded in 1959 to subcontract programmers to clients on a temporary basis. By the 1980s it had evolved into a full-service provider of IT services. All of CSC's revenues in 1989 came from IT services, the majority from systems integration and development projects. Historically, CSC's revenues had been based on long-term federal government contracts, mainly from the operation of government-owned data centers.

In the late 1980s, CSC decided to pursue the commercial market. It scored a major victory in 1991 when it was awarded a $3 billion outsourcing contract by General Dynamics, the largest contract to that date. The three data centers purchased in the agreement doubled CSC's capacity to service commercial outsourcing contracts. As a result of this contract, CSC's commercial revenues in fiscal year 1992 increased to 41 percent of overall revenues, up from 36 percent the year before.

EXHIBIT 5   **Financial Performance of Leading Competitors ($ millions)**

	1991	1990	1989	1988	1987	1986	1985	1984	1983	1982
Computer Sciences Corporation										
Sales	$1,738	$1,500	$1,304	$1,152	$1,031	$839	$723	$712	$695	$630
Profit before tax	103	103	84	71	58	43	41	30	33	34
Total assets	1,007	918	715	661	596	468	431	398	354	320
Equity	526	458	389	333	285	214	186	158	139	120
Pretax return on sales (%)	5.9	6.9	6.5	6.2	5.6	5.1	5.7	4.3	4.7	5.3
Return on total assets (%)	6.8	8.0	7.6	6.9	6.1	5.3	6.7	4.9	5.3	5.9
Return on equity (%)	13.2	15.5	14.6	14.1	13.0	12.0	16.1	12.3	13.8	16.1
Electronic Data Systems										
Sales	$7,099	$6,109	$5,467	$4,844	$4,428	$4,366	$3,442	$948	$630	$503
Profit before tax	894	789	680	589	524	464	362	139	101	70
Total assets	5,703	4,565	3,918	3,416	3,107	2,512	1,665	649	406	330
Equity	2,610	2,182	1,764	1,404	1,054	798	531	346	260	205
Pretax return on sales (%)	12.6	12.9	12.4	12.2	11.8	10.6	10.5	14.6	16.0	14.0
Return on total assets (%)	9.6	10.9	11.1	11.2	10.4	10.4	11.4	12.4	14.5	14.2
Return on equity (%)	21.0	22.8	24.7	27.4	30.7	32.7	35.8	23.4	22.6	23.0
International Business Machines										
Sales	$64,792	$69,018	$62,710	$59,681	$55,256	$52,160	$50,056	$45,937	$40,180	$34,364
Profit before tax	121	10,203	6,645	9,033	8,609	8,389	11,619	11,623	9,940	8,222
Total assets	92,473	87,568	77,734	73,037	70,029	63,020	52,634	42,806	37,461	32,541
Equity	37,006	42,832	38,509	39,509	38,263	34,374	31,990	26,489	23,219	19,960
Pretax return on sales (%)	0.2	14.8	10.6	15.1	15.6	16.1	23.2	25.3	24.7	23.9
Return on total assets (%)	−0.6	6.9	4.8	7.5	7.5	7.6	12.5	15.4	14.6	13.5
Return on equity (%)	−1.5	14.8	9.6	14.9	14.5	14.4	22.4	26.5	25.4	23.4
Andersen Consulting* (estimated)										
Sales	$2,260	$1,748	$1,220	$1,199	$749	$546	$344	$282	n/a	n/a
Digital Equipment Corporation										
Sales	$13,911.	$12,943	$12,742	$11,475	$9,389	$7,590	$6,686	$5,584	$4,272	$3,881
Profit before tax	(520)	124	1,421	1,741	1,689	857	431	401	411	673
Total assets	11,875	11,655	10,668	10,112	8,407	7,173	6,369	5,593	4,541	4,024
Equity	7,624	8,182	8,036	7,510	6,294	5,728	4,555	3,979	3,541	3,165
Pretax return on sales (%)	−3.7	1.0	11.2	15.2	18.0	11.3	6.4	7.2	9.6	17.3
Return on total assets (%)	−5.2	0.7	10.3	14.1	14.6	9.1	7.5	6.5	6.6	11.2
Return on equity (%)	−7.8	0.9	13.8	18.9	18.9	12	10.5	8.7	8.5	14.3

*Prior to 1990, estimate of data processing revenues for Arthur Andersen & Co.

SOURCE: Annual reports. Datamation for estimate of Andersen Consulting.

CSC's 1991 annual report stated that its goal was to become one of the industry's top three professional services firms. In the same report it outlined its approach to achieving that goal:

Our extensive experience with systems operations in the federal arena will enable us to gain a larger commercial market share, focusing on vertical industries such as insurance, health care, and financial services where we are well-established providers of systems and services.

To increase its consulting capabilities and contacts with large corporations, CSC had purchased the Index Group, a leading IT consulting firm. Although the Index Group had contacts with many large corporations, it had historically advised MIS departments on improving their internal operations.

CSC's experience in providing IT services to the government provided it with data center operation, project management, and system development skills that were directly transferable to commercial contracts. However, CSC had limited experience in industry practices and identifying the need for and requirements of commercial systems. CSC also was accustomed to bidding for cost-plus government contracts rather than fixed-price commercial contracts.

Andersen Consulting. Arthur Andersen & Co., a Big Six accounting firm, had provided IT services since implementing one of the first commercial computer applications for General Electric in 1954. In October 1988, Arthur Andersen & Co. reorganized, separating its IT service offerings from its tax and audit structure under a separate unit called Andersen Consulting. Andersen Consulting grew dramatically during the 1980s. Its staff grew from 3,600 in 1980 to over 18,000 in 1989 mainly from systems development and integration business.

Although Andersen had provided advice and help to clients in running their data center operations for many years, Andersen did not begin systems management outsourcing until the late 1980s. As of 1991, Andersen had landed only one megacontract but had over 40 smaller contracts. Andersen had its own data centers as well as a worldwide communications network to support outsourcing. Andersen predicted that outsourcing would move from a cost reduction device in the 1980s to a strategic positioning tool in the 1990s provided by value-added service firms, such as Andersen. Andersen stated

that its approach to outsourcing was as a business partnership focused on attaining business goals.

Andersen's desire to create an outsourcing business was believed to be motivated by two factors. First, it viewed outsourcing as an attractive business. Second, it found that potential development contracts were being won by providers of the downstream outsourcing services.

Andersen benefited from established relationships with most of the Fortune 500 firms from its audit and consulting experience. Andersen was also considered a leader in IT strategic consulting, providing it with a good understanding of clients' business needs. Some securities and investment analysts believed that firms like Andersen Consulting, with experience in accounting and management consulting, had a better understanding of clients' business than its competitors.[10]

As a partnership, Andersen was more limited in its sources of financing, but in the late 1980s Andersen was raising new capital to finance the hardware and software associated with large systems management contracts. In 1990, Andersen's CEO announced that the company was preparing a credit line of $250 million as a war chest for competing with EDS and IBM for large systems management contracts. It was also reported in 1991 that Andersen had raised more than 5 percent of its current capital through private placements with banks and insurance companies. Andersen was using the funds to support its heavy investment in training and equipment.

It was believed that Andersen was focusing on selected industries and technological environments to increase its share of the outsourcing market. For example, Andersen was targeting clients migrating from a mainframe to a client-server environment and had formed a partnership with Systematics to serve banking clients.

International Business Machines. Founded in the early 1900s, IBM was the largest producer of computers in the world. It sold about 10,000 computer hardware, software, and peripheral products in more than 130 countries.

By the mid-1980s, IBM's superiority in the computer hardware business was being threatened. Advances in semiconductor technology had allowed independent suppliers to produce standardized

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[10]Stephen McClellan quoted in *Information Week*, April 30, 1990.

computer parts which independent companies could purchase and assemble. This decreased the scale needed to manufacture computers and led to a surge in competition and a significant drop in hardware margins. At the same time competitors began offering so-called open systems, which had operating systems that allowed easier interconnection of different providers' hardware. This was a direct threat to IBM's proprietary systems. Even within its own product line, IBM mainframes were incompatible with its minicomputers. IBM also faced slowing growth in hardware sales, especially mainframes, whose sales were projected to grow at about 2 percent in the early 1990s. Much of this decline in growth was attributable to an increase in processing power in smaller machines which had led to some mainframes being substituted by desktop and minicomputers linked through networks. In order to decrease its reliance on hardware sales, IBM set a goal of generating 50 percent of its revenues from software and services by the year 2000.

On May 15, 1991, IBM announced the formation of a wholly owned subsidiary to handle its out-sourcing business, the Integrated Systems Solutions Corporation (ISSC). ISSC inherited some existing outsourcing contracts from its predecessor, the IBM Systems Services Division. The transferring of its outsourcing contracts to a wholly owned subsidiary was done to avoid legal pressure from competing outsourcing providers over an earlier consent decree. These legal challenges had surfaced due to IBM's increasing emphasis on services. In 1956, IBM signed a consent decree not to compete in the service bureau business defined as "the preparation of information and reports for others on a fee basis." The consent decree did allow IBM to compete through an independent subsidiary. Although IBM had limited its range of offerings prior to the formation of ISSC, one market research firm commented that "with the formation of ISSC, concerns about what IBM can or cannot offer have been eliminated."[11]

ISSC's revenues were estimated to be $800 million in 1990.[12] This included systems management contracts as well as disaster/recovery services for 1,000 clients. IBM had signed at least 17 major outsourcing

accounts by 1991. IBM also received outsourcing revenues from the Federal Systems Division which included government contracts. In addition, IBM performed significant systems integration work for the government and large commercial customers.

Through ISSC, IBM hoped to shift its revenue base toward software and services in order to increase its margins and take advantage of the faster growth in services revenues. Although IBM was known for its excellent hardware support services (IBM had a representative on-site in most major data centers to assist in running applications on its hardware), it had always been reluctant to explicitly price its services, choosing instead to bundle them with the hardware purchase.

Historically, IBM's contract with a client was usually limited to the MIS department and the running of the data center and did not extend into the user community. In 1989, IBM established an Applications Solutions Division to focus on application and industry-specific solutions in order to establish credibility outside the MIS environment and generate consulting and systems development projects.

ISSC provided the full range of outsourcing activities, including on-site and remote data center operations, consulting, systems development, and systems integration, although it was believed that IBM subcontracted services in some instances. It was believed that the new structure would make IBM more responsive to clients and perhaps give IBM more credibility in presenting itself as vendor-independent.

IBM's applications and systems software revenue increased from 10 percent in 1986 to 14 percent in 1990. However, its service revenue fell from 17 percent to 16 percent during the same time period. The decrease in services revenue was due partially to a decline in hardware-maintenance fees, but was also thought to have resulted from IBM having lowered its prices to compete with other outsourcing firms.

At the same time as the formation of ISSC, IBM had formed a joint venture with Coopers & Lybrand, a Big Six accounting firm, to improve its position in the services business. IBM had also formed a joint venture with AT&T to make its mainframes more compatible with AT&T's networks.

IBM had no direct outsourcing sales force but instead depended on its geographically organized sales force to generate new outsourcing business. Only on potentially large accounts would ISSC

11"IBM Subsidizes Outsourcing," Yankee Group, p. 2.
12"IBM Spins Off Outsourcing Unit," *Computerworld*, May 20, 1991.

become involved to help the account manager. In the late 1980s IBM began an advertising campaign which emphasized IBM's ability to deliver cost benefits to clients. IBM placed an advertisement in major newspapers with the headline: "The cost crunch. Budgets get cut. Demands don't. If you need help, we have it." The advertisement included an image of a penny.

Digital Equipment Corporation. DEC, also a major computer manufacturer, had pioneered production of the minicomputer. In the late 1980s, DEC, like IBM, suffered from the drop in hardware margins and identified services as a way to supplement its declining hardware margins. The 1991 DEC annual report clearly identified outsourcing as one of DEC's goals:

> Our service organization designs and installs networks, integrates systems, runs complete information shops ... and provides all the services the customer wants, or needs, after our equipment is shipped. This business is growing and profitable and is key to our success.

In its 1989 annual report DEC claimed to support 8,000 hardware and software products by 800 other manufacturers. DEC had performed significant systems integration work. Systems integration accounted for about 11 percent of DEC's revenues in 1991.

DEC was hiring industry experts to supplement its technical expertise: "If we're asked to help with a banking problem we have former bankers on our staff. If it's a manufacturing problem, we'll assign manufacturing specialists to the job." Many of these specialists had experience in management consulting firms. DEC had organized these industry experts into 17 industry groups, called Application Centers for Technology, in which industry consultants and systems specialists worked together. DEC had also formed an alliance with Deloitte & Touche, a Big Six accounting firm, to jointly pursue the utilities industry. DEC faced the challenge of integrating these newly hired consultants into its sales organization and developing account managers to sell services rather than products.

To date DEC had participated in only one major outsourcing contract, the Kodak deal, in which it managed Kodak's communication systems. Analysts predicted that DEC would target those industries in which it had performed systems integration work and expand into other industries later.

Electronic Data Systems

EDS was the world's largest computer services company with 1991 revenues of $7.1 billion and after-tax earnings of $547 million. About 47 percent of EDS's revenue originated from its parent General Motors (GM), down from 73 percent of total revenue in 1985 (Exhibit 6). EDS employed 70,500 people worldwide and had operations in 30 countries. EDS provided all outsourcing services, including consulting, systems development, systems integration, systems management, and process management. However, systems management and process management services accounted for 70 percent of its revenues (Exhibit 7). EDS planned to continue its rapid growth. Les Alberthal, CEO of EDS, said: "We believe the marketplace we are in can take this company to $25 billion. If you take our base business and grow it at 20 percent compounded annually and keep the GM business flat, you can reach it."[13]

History of EDS

EDS was founded by Ross Perot in 1962 with the belief that computer services would become much more important than computer equipment. In the beginning, EDS operated by renting excess computing capacity on other companies' computers to run its clients' data processing applications. Each night, EDS employees filled the trunks of their cars with forms, tapes, and programs and drove to different locations to process the work. During this period, EDS introduced the long-term fixed-price contract that became one of its standard contracting mechanisms.

In 1963, EDS signed the first outsourcing contract with Frito Lay. This five-year agreement was the forerunner for systems management agreements with predetermined scope of work, delivery time, and pricing. Following the establishment of Medicare and Medicaid in 1965, EDS signed a number of major contracts in the health care industry. In 1965, EDS designed and developed a system to process insurance claims and payments for Texas' Medicare program. Modified versions of this system were then installed in other states in rapid succession.[14]

By 1969 EDS expanded the scope of outsourcing contracts by becoming an independent provider for Blue Shield of Pennsylvania and Blue Shield of Cal-

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[13]Quoted in *Fortune,* July 10, 1990.
[14]EDS annual report, 1987.

EXHIBIT 6   EDS's Financial Performance, 1986–1991 (in millions except per share data)

	1991	1990	1989	1988	1987	1986
Income Statement						
Revenues:						
Systems and other contracts						
GM and subsidiaries	$3,362.2	3,234.2	2,988.9	2,837.0	2,883.3	3,195.1
Outside customers	3,666.3	2,787.5	2,384.6	1,907.6	1,444.8	1,127.7
Interest and other income	70.5	87.1	93.3	99.5	99.6	43.2
Total revenues	7,099.0	6,108.8	5,466.8	4,844.1	4,427.7	4,366.0
Cost and expenses:						
Cost of revenues	5,415.1	4,639.0	4,168.6	3,749.5	3,452.5	3,463.1
Selling, general, and administrative	761.9	663.0	605.2	500.0	447.0	434.8
Interest	28.3	18.1	12.7	5.2	3.9	4.1
Total cost and expenses	6,205.3	5,320.1	4,786.5	4,254.7	3,903.4	3,902.0
Income before income taxes	893.7	788.7	680.3	589.4	524.3	464.0
Provision for income taxes	330.7	291.8	245.0	205.3	201.2	203.1
Consolidated net income	547.5	496.9	435.3	384.1	323.1	260.9
EPS attributable to GM Class E Stock	1.14	1.04	0.9	0.79	0.66	1.07
Cash dividends per share of GM Class E common stock	0.32	0.28	0.24	0.17	0.13	0.2
Selected Balance Sheet Numbers						
Property and equipment, net	1,551.6	1,197.1	1,083.1	1,076.6	1,106.8	1,125.8
Operating and other assets	2,206.0	1,651.8	1,377.2	1,000.0	422.3	302.6
Current assets	1,945.6	1,716.4	1,457.9	1,339.4	1,577.8	1,083.1
Current liabilities	2,396.7	1,653.9	1,494.5	1,377.2	1,337.7	908.3
Long-term debt	281.9	285.1	326.4	401.9	531.3	633.7
Expenditures on PP&E	673.2	514.8	382.5	300.5	324.8	727.7
Stockholder's equity	2,610.3	2,181.8	1,763.6	1,403.9	1,053.5	798.3
Total assets	5,703.2	4,565.3	3,918.2	3,416.0	3,106.9	2,511.5

Note: In 1991, EDS took a cumulative accounting adjustment of $15.5 million.
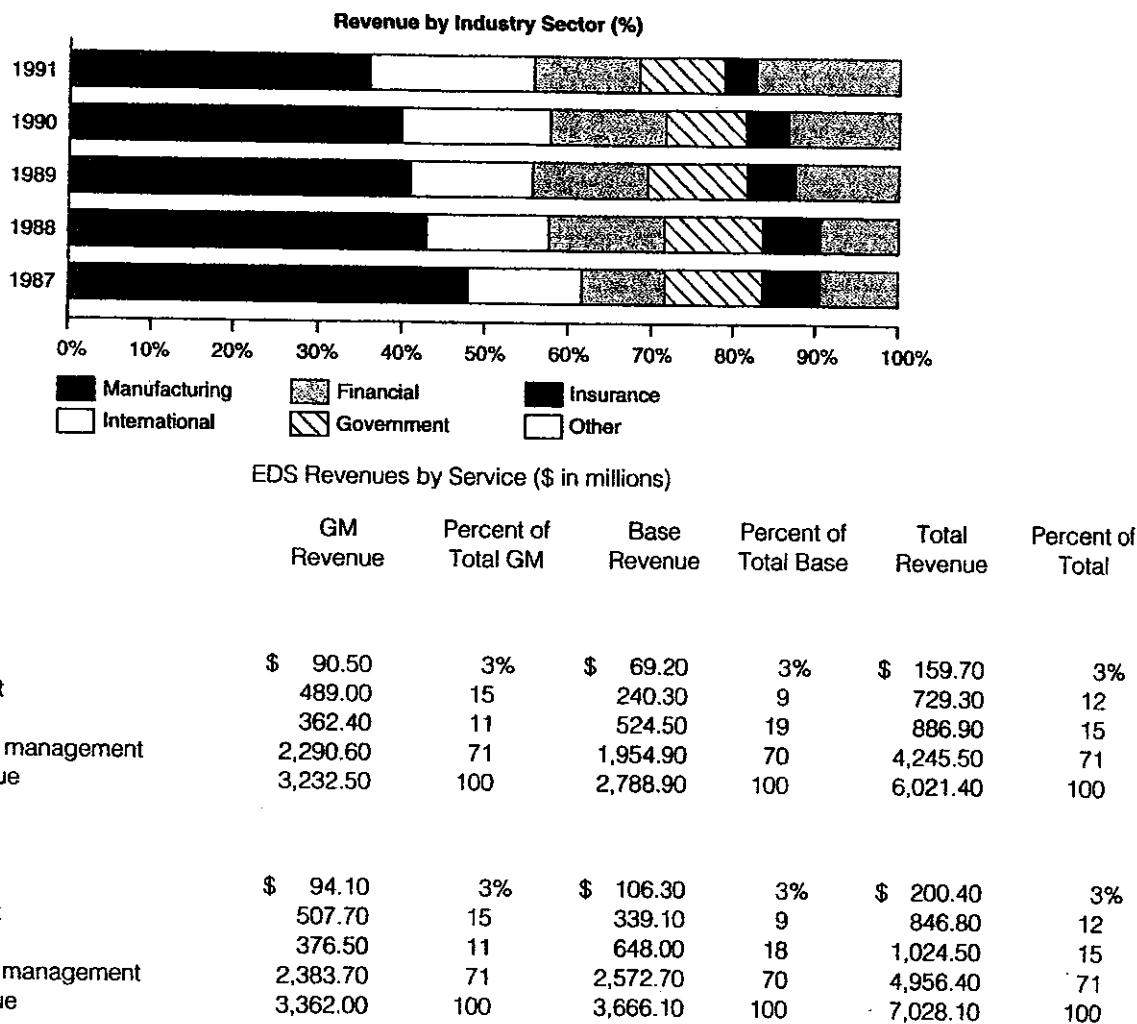
SOURCE: EDS annual report.

ifornia (BSC). EDS contracted with BSC to process claims, monitor membership, and perform underwriting, actuarial, and administrative services. This was the first contract in which EDS had assumed responsibility for running the client's entire data center as well as business applications. In this case, EDS broadened its pricing scheme from a fixed charge to charging BSC a fee per claim processed. EDS initially assumed BSC's existing applications but later developed and installed a new system which automated many of the pricing, benefit, and payment functions. The system was improved several times in subsequent years to add functionality. In 1987, EDS consolidated BSC's processing with that of Blue Cross and Blue Shield of Arizona. In 1991, the BSC contract was further extended to the year 2001.

In 1968, EDS went public with annual revenues of $7.7 million and 303 employees. In the ensuing years, EDS expanded its computing facilities through the creation of regional data centers which it called Information Processing Centers (IPCs). These IPCs represented the consolidation of computing facilities to serve multiple clients in a region. In 1982, EDS signed the largest systems integration contract ever awarded, a $650 million contract with the U.S. Army.[15] In 1984, GM acquired EDS for $2.6 billion. As a result of the acquisition, EDS's revenues increased from $1 billion to $3.4 billion overnight. Over the next 18 months EDS's workforce grew threefold from 14,000 to 40,000. The merger received significant media attention partly because of the merger of two markedly different corporate cultures.

A majority of EDS contracts with GM were covered by fixed-price, multiyear agreements.

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[15]EDS financial data.

EXHIBIT 7   EDS's Revenues by Industry and Service Line

Revenue by Industry Sector (%)

Manufacturing Financial Insurance
International Government Other

EDS Revenues by Service ($ in millions)

	GM Revenue	Percent of Total GM	Base Revenue	Percent of Total Base	Total Revenue	Percent of Total
1990						
Consulting	$ 90.50	3%	$ 69.20	3%	$ 159.70	3%
Systems development	489.00	15	240.30	9	729.30	12
Systems integration	362.40	11	524.50	19	886.90	15
Systems and process management	2,290.60	71	1,954.90	70	4,245.50	71
Total operating revenue	3,232.50	100	2,788.90	100	6,021.40	100
1991						
Consulting	$ 94.10	3%	$ 106.30	3%	$ 200.40	3%
Systems development	507.70	15	339.10	9	846.80	12
Systems integration	376.50	11	648.00	18	1,024.50	15
Systems and process management	2,383.70	71	2,572.70	70	4,956.40	71
Total operating revenue	3,362.00	100	3,666.10	100	7,028.10	100

SOURCE: EDS.

Although profit margins vary, these contracts, all initially on a cost-plus basis, have been estimated by analysts to carry pre-tax profits between 10 and 12 percent, a few points lower than those on EDS's other business.[16]

In the late 1980s EDS began to sign megacontracts that differed from earlier contracts in size, duration, and the use of new financial engineering techniques. Under some of these contracts EDS would pay money up front to buy the client's computing equipment and hire the client's data processing staff. In a few cases EDS also purchased equity in the client's company. Many of these approaches were quickly adopted by other players in the industry.

EDS and its subsidiaries began signing megacontracts outside the government arena in the early 1980s. One of the first contracts was with Blue Cross and Blue Shield United of Wisconsin. In 1988, EDS won megacontracts with an estimated value of $1.6 billion.[17] One of the most significant contracts was with Enron Corporation, the largest natural gas company in the United States.[18] EDS signed a 10-year contract worth an estimated $500 million to manage Enron's computer and communications facilities.[19]

[16]Stephen McClellan quoted in *Business Week*, December 23, 1991.

[17]"Outsourcing Tidal Wave," Stephen McClellan, Merrill Lynch.
[18]"EDS," The Ledgeway Group.
[19]"Outsourcing Tidal Wave," Stephen McClellan, Merrill Lynch.

EDS paid $6 million for Enron's computers, software, and data transmission network and hired its 550 information services employees at comparable wages and benefits.[20]

Starting in 1988, EDS undertook a number of acquisitions of data processing companies. Analysts believed that these acquisitions were designed to acquire expertise and clients. In 1991, EDS acquired SD-Scicon PLC, a British computer services firm, for $266 million in a takeover bid. SD-Scicon PLC, along with its French subsidiary GFI, was one of the largest European computer services companies. That same year, EDS purchased McDonnell Douglas Systems Integration (MDSI) for $199 million.[21] MDSI provided EDS with additional expertise in aerospace and defense manufacturing, over 600 new clients such as General Electric and Pratt & Whitney, and the leading CAD/CAM product. Together, these businesses were believed to have added $700 million to EDS's 1991 revenues.[22]

Products and Services

EDS was a full-service provider of information services. Exhibit 8 illustrates the range of EDS's services. However, until 1990, consulting services were not marketed separately from systems management and process management services.

EDS's systems management services included data center operations and communication services. EDS provided these services by managing the company's facilities or providing the services from its network of IPCs. EDS's systems management contracts frequently included significant systems development and integration functions as well.

These contracts could evolve in one of several ways. One common path involved EDS signing a systems management contract for running the company's data center with the company's existing applications. EDS would modify the existing application or transfer the applications to its own proprietary systems to provide enhanced performance and functionality. Another method included beginning with an initial systems integration or systems development contract. Under this scenario EDS could contract to develop a new application for a client or combine existing applications with those developed by EDS and third-party providers into an integrated

system. Having completed the systems integration part, EDS could be assigned to run and maintain the applications for the client in a systems management contract. In some industries EDS developed a set of proprietary software applications in collaboration with a client, with the understanding that these applications would be used to serve other outsourcing clients in that industry.[23] Analysts believed that EDS had lower costs than its competitors.[24]

Although EDS began to market stand-alone consulting projects in 1990, many were part of a systems management or development contract. EDS had developed a methodology and computerized tools which it applied to consulting projects. Analysts did not expect personnel-intensive activities like consulting or systems development to become a major source of revenue for EDS in the future.[25] However, EDS considered these activities important for new business development.

Process management involved performing a business function rather than a purely technical function. Performance measures for process management services were usually business-based rather than technically based. An example of process management was Cadillac Roadside Service initiated in 1988 by GM. Under this program, Cadillac owners could call a 24-hour telephone service for travel assistance or help with an emergency. The telephone advisors were all employees of EDS Customer Service Technologies, a group that developed and supported customer service, marketing, and sales operations for clients. The customer service unit included nearly 1,000 employees who worked in a range of industries such as manufacturing, energy and chemicals, transportation, and retail.[26]

Most of EDS's services were offered on a fixed-price or per-transaction basis. However, since 1990 EDS had increased its emphasis on value-based (incentive-based) contracts in which EDS made part of its payment contingent on the value created for the client. Value was typically interpreted as an improvement in business performance measured by criteria such as increased profitability, reduced business costs, or improved time to market. Only a few value-based contracts (also known as incentive-based contracts) had been signed.

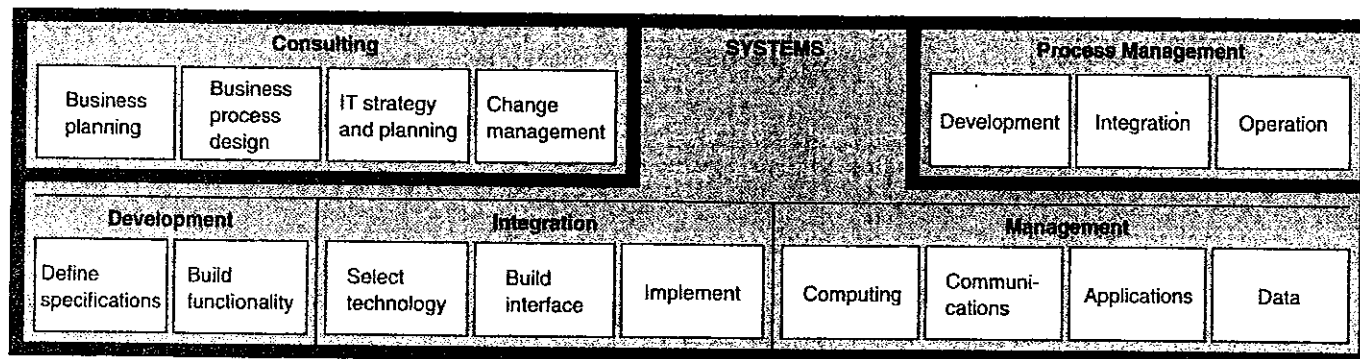[20]*Fortune*, September 23, 1991.
[21]EDS annual report, 1991.
[22]Merrill Lynch investor report, September 3, 1991.

[23]EDS annual report, 1989, pp. 4–5.
[24]*New York Times*, October 20, 1991.
[25]"EDS," The Ledgeway Group, p. 10.
[26]"Roadside Service Keeps GM Customers in the Fast Lane," EDS Success Stories series.

EXHIBIT 8   The EDS Business Integration Continuum

Consulting				SYSTEMS	Process Management		
Business planning	Business process design	IT strategy and planning	Change management		Development	Integration	Operation

Development		Integration			Management			
Define specifications	Build functionality	Select technology	Build interface	Implement	Computing	Communications	Applications	Data

A well-publicized example of a value-based contract was a contract with the Chicago Bureau of Parking Enforcement in 1990 to automate ticket issuance and collection of fines. The City of Chicago had a backlog of 19 million parking tickets representing $420 million in uncollected fines. EDS designed a new system in which parking enforcement aides used hand-held computers to transmit the data directly to EDS computers and print the ticket on the scene. According to news reports EDS won this contract over IBM, Unisys, and Lockheed because of its ability to assemble the most suitable hardware and software providers and to deliver the product on time.[27] The new system significantly reduced lost tickets by printing them on adhesive paper which would not blow away and eliminated a substantial data-entry backlog by eliminating the need to manually enter ticket data in the computer. After implementing the system, ticket collection increased from 10 percent of tickets issued to 65 percent in less than 18 months.[28] EDS's payment was estimated to consist of a base charge of $40 million and a percentage of the face value of delinquent tickets collected under the new system.[29]

Organizational Structure

In 1979, EDS was organized in three industry groups: Finance and Insurance, Commercial, and Government.[30] This broad industry grouping was maintained and refined in the ensuing years. In 1989, EDS

reorganized itself into 38 strategic business units (SBUs) and 49 strategic support units (SSUs) (Exhibit 9). The SBUs were aligned with industries, while the SSUs provided cross-industry support services. Under this structure each SBU was accountable for its own strategy and profits.[31] The SSUs provided technical support to the SBUs in such areas as telecommunications services, IPC operations, technical products, and research and development. The SBU presidents reported to the Leadership Council, the highest management organization in the company. The Leadership Council spent 70 percent of its time developing corporate strategy and the remaining time on the oversight of specific SBUs.[32]

Technical Infrastructure

In the last three decades, EDS had built a vast and sophisticated technical infrastructure consisting of 18 IPCs connected by a global communications network. The IPCs were large computer data centers with computing capacities ranging from 136 MIPs to a combined capacity of multiple IPCs in Plano, Texas, of 2,267 MIPS. The company's total computing capacity exceeded 260,000 MIPS, with 87 percent represented by desktop computers. IPCs were connected worldwide by EDSNET, EDS's communications network. EDSNET was one of the world's largest private digital communications networks with integrated voice, data, and video capabilities. The Information Management Center (IMC), located in Plano, Texas, was the hub for EDSNET, controlling more than 8 million long-distance phone calls and 284 million data transactions worldwide each month (Exhibit 10). The

[27]"EDS Win Tied to Partners," *Computer Systems News*, October 1, 1990.
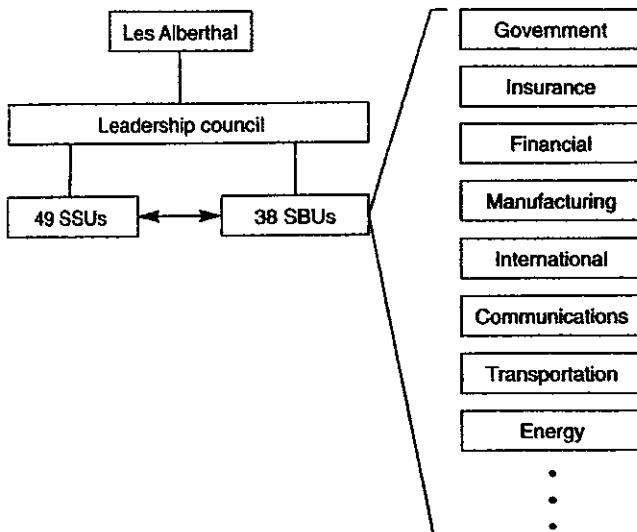
[28]*Business Week*, December 23, 1991 and EDS.

[29]"Crossing State Lines," *Computer Systems News*, November 26, 1990.

[30]EDS organizational data.

[31]*Business Week*, December 23, 1991.

[32]"EDS," The Ledgeway Group.

EXHIBIT 9   EDS Organization Structure

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        Les Alberthal                    Government

                                         Insurance

       Leadership council                Financial

                                         Manufacturing

   49 SSUs  ◄──►  38 SBUs                International

                                         Communications

                                         Transportation

                                         Energy
                                            •
                                            •
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EXHIBIT 10   EDS Information Management Center

EDS' futuristic Information Management Center in Plano, Texas, serves as the network command site for managing the company's global communications in more than 30 countries.

IMC used artificial intelligence tools to monitor network performance continuously. The IMC was equipped with tight security, sophisticated environmental controls, and advanced disaster recovery systems. In addition to IPCs, EDS had four print centers around the country employing over 500 professionals trained in various printing technologies.[33]

Sales and Marketing

Each SBU was responsible for its own marketing and sales activities, including planning, promotion, and research. The sales function was performed by each SBU sales staff, which sold EDS services to over 7,000 clients worldwide. Whenever possible, EDS directed its sales efforts at the CEO, CFO, or CIO of the client company.

The sales process was usually complicated and lengthy and involved developing a good understanding of the client's business needs as well as their technical infrastructure. The account manager who would serve the client was often included in this process to provide additional expertise or provide for continuity if a contract were signed. A crucial task performed by the sales staff was to assess EDS's risk in signing a fixed-price, multiyear contract. After a contract was signed account managers were physically located on the premises of the clients that they served. When necessary they would bring in technical and industry experts from within

EDS. The account manager also had responsibility for new business development. Most account managers were technical people promoted from within EDS. In 1985, EDS instituted a new program to recruit personnel exclusively for sales positions, especially individuals with previous selling experience. New recruits attended a nine-month sales development program in selling IT services.

In 1990, EDS created a corporate marketing department. Previously some of these functions had been performed informally by EDS senior managers. Part of corporate marketing's responsibility was to develop a cohesive marketing strategy and corporate message. The corporate marketing department had developed a message that EDS provided value through outsourcing. The message was designed to shift the focus from outsourcing as a means of reducing IT costs, which represented 1 to 2 percent of a firm's costs, to IT's potential for creating business value for the company. Since its inception, the corporate marketing department had spent considerable time in disseminating this message to industry analysts externally and to EDS staff.

Historically, EDS had maintained a low profile in the media. In 1989, EDS hired a market research firm to survey its reputation in the market. Les Alberthal reported on the study results: "The good news came back that we didn't have a bad image. The bad news was that we didn't have much of an image at all."[34]

[33]Ibid.

[34]"Sharper Image: EDS in the '90s," Computerworld, October 1, 1990.

In 1991, EDS initiated an advertising campaign in leading business publications and on television. The campaign was intended to communicate EDS's ability to help its clients take advantage of change. In 1992, the second phase of the campaign was launched, describing client success stories which demonstrated how EDS helped clients compete more effectively (Exhibit 11).[35]

Human Resources

EDS typically acquired people through recruiting and by assimilating client staff after a systems management contract. Entry-level technical people were trained internally in a three-year Systems Engineering Development (SED) program. Many EDS managers, including the CEO, were graduates of the company's SED program. Overall, EDS spent over $150 million annually on employee training.

On average, EDS officers had spent an average of 17 years with the company and more than a third had been with the company throughout their entire careers.[36] EDS typically promoted its senior managers internally. To advance, members of the management team were required to have worked in multiple industries and internationally and obtained experience in internal operations and staff positions.

[35]EDS organizational data.

[36]EDS annual report, 1987.

EXHIBIT 11   EDS Advertisement

Purchasing

EDS was the largest commercial buyer of computing equipment in the United States and IBM's largest commercial purchaser of mainframe computers. EDS also bought about $1 billion of PC and network hardware for itself and its clients from over 6,000 providers.[37] For large projects, EDS was usually designated the project manager and would use as many as 100 subcontractors.[38] In 1989, EDS, in partnership with Hitachi Ltd., purchased a 20 percent stake in National Advanced Systems Corporation, a seller of IBM-compatible mainframes. The company was renamed Hitachi Data Systems (HDS). According to press reports, EDS expected to enhance its ability to acquire compatible products from multiple vendors and to influence the direction of future products from its vendors.

Future Strategy

In charting their strategy for the 1990s, EDS senior managers were acutely aware that the industry that they had helped pioneer in the 1960s had changed radically in the last three decades. To achieve its growth objectives, EDS would have to consider the rapid advances in IT, the changes in clients' outsourcing needs, and the marked increase in the number of competitors.

Reading II–3
Taking Technology to Market

David Ford and Chris Ryan

Corporate management of technology requires careful planning of the relationships among a company's technologies, its markets, and its development activities. It requires coordination of R&D activities to ensure an optimum research level—depending on a company's available resources, competitive pressures, and market requirements. And it requires systematic linkage between a company's product and

process technologies: the products developed must also be produced efficiently.

Current management wisdom says that a company invests its skills and resources in developing products or services that are of value to its customers. However, we argue that to maximize the rate of return on its technology investment, a company must plan for the fullest market exploitation of all its technologies. These technologies may, but need not necessarily, be incorporated into that company's own products or services. In fact, the growth of low-cost Third World producers will make it increasingly difficult for Western companies to exploit fully their technologies through their own production alone.

Thus, a company's marketing strategy may—and probably should—provide for the sale of technologies for a lump sum or a royalty. (By *sale*, we mean either the direct sale of a technology or the sale of a license to use it.)

The marketing literature, however, provides little help for the manager who wishes to exploit fully his or her company's technologies. Many critical questions remain unanswered, among them:

■ What problems are involved in selling a technology?
■ Is a company that sells a technology giving away its "seed corn" and thus prejudicing its future?
■ How, to whom, and when should a technology be sold?
■ What is the relationship between the sale of a technology and the sale of a product based on that technology?

In this article, we draw on our own research to examine these important questions within the conceptual framework of the technology life cycle (TLC), which traces the evolution of a technology from the idea stage through development to exploitation by direct sale. In particular, we examine the relationships between product and technology sales and describe the important choices and strategies open to management throughout the TLC. Specifically, we examine the value of shifting from managing a product portfolio to managing a portfolio of technologies. We also consider the impact of the TLC positions of technologies in the portfolio and the significance of a company's level of dependence on individual technologies.

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[37]*New York Times* for number of mainframes; *PC Week* for number of PCs and vendors.
[38]"EDS," The Ledgeway Group.