Market Analysis
Program (MAP)

Industry Sector Markets 1988-1993

Medical Sector

INPUT®

1280 Villa Street, Mountain View, CA 94041 (415) 961-3300

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INDUSTRY SECTOR MARKETS 1988-1993

MEDICAL SECTOR

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I

Issues, Trends, and Events

A
Medical Industry Trends

According to the 1988 U.S. Industrial Outlook, health care expenditures will rise to $544 billion, a 9% increase over 1987. Hospital care expenditures will rise by 9% to $211 billion, physician services 9% to $111 billion, and nursing home care 9% to $46 billion.

HMOs and PPOs play a major role in the health industry. Enrollment, revenues, and number of plans continue to grow. By the 1990s, it is estimated that half of all Americans may belong to HMOs or PPOs. Health maintenance organizations (HMOs) continued their high growth rates; the number of plans and enrollment grew as shown in Exhibit I-1.

Consolidation through mergers, acquisitions, and joint ventures among hospitals will continue but at a decreasing rate. Of the 6,800 hospitals in the United States and Puerto Rico, investor-owned hospitals constitute 1,360 of the nation's hospitals.

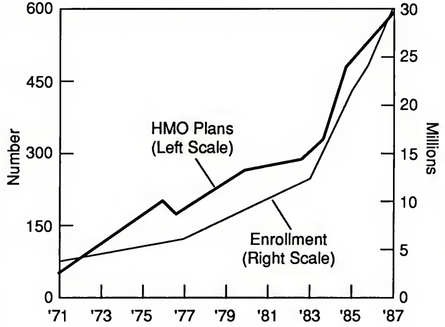
Nursing home care and home health care show the greatest opportunity for acquisitions by hospitals or by chains. Nursing home chains increased from 28% of all nursing homes in 1977 to 41% in 1985. Hospitals are moving into home health care; by 1987, 70% of hospitals offered home health care services. Hospital acquisitions have not slowed home health care growth; the number of new propriety home health reached 2000 in 1986.

The efforts of the health care industry and government to control health care costs have yielded negligible results. Medical prices continue to rise faster than general inflation.

The one significant issue for health care providers in the 1980s is control of cost. The federal government's introduction of prospective payment systems (PPSs)—known as diagnosis-related groups (DRGs)—for Medicare beneficiaries has forced health care providers to compete not only for declining numbers of patients but also for medical reimbursements.

EXHIBIT I-1

GROWTH IN HEALTH MAINTENANCE ORGANIZATIONS, 1971-1987



Source: Office of Health Maintenance Organizations and International Trade Administration.

The federal government has been a primary force behind the health industry effort to control costs. Methods include:

- Establishing the Medicare and Medicaid program. The federal program providing medical coverage for 54 million beneficiaries supported by $112 billion tax dollars in 1986.
- Establishing the prospective payment system based on diagnosis-related groups, which shifted reimbursement plans from cost-based to fixed-cost accounting
- Freezing reimbursements and physician fees
- Paying fixed rates to ambulatory surgical centers for selected procedures in direct competition with hospitals
- Accepting and actively seeking Medicare and Medicaid enrollment into HMOs at a fixed cost to the government
- Introducing the catastrophic illness coverage that extended benefits to include unlimited hospital stays, skilled nursing benefits, home health care benefits, and prescription drug payments.

The catastrophic illness bill was signed into law on July 1, 1988. Not since the introduction of the PPS in 1983 has there been a major revision of the Federal Medicare Program created by Title XVIII of the Social Security Act in 1966. The law, which is expected to cost $31 billion over the next five years, will entitle medicare beneficiaries (1) unlimited hospital stays after an annual deductible, (2) 150 days at a skilled nursing facility, (3) 38 days at a home health care institution, and (4) prescription drug coverage.

The new law will result in increased use of outpatient care, such as skilled nursing and home health care. Reimbursement incentives for outpatient care will result in greater demand for clinical and financial information systems.

Hospitals will begin to recover expenses not previously covered by medicare.

The administration of the new prescription drug program and increased claims processing provides a window of opportunity to information systems vendors.

The administration and processing of 700 million claims for new drug benefits are expected to cost $500 to $600 million in 1991.

The health care finance administration (HCFA) will likely contract with 3 to 5 claims-processing vendors to administer the new drug benefit. Sources estimated that the processing of drug claims can potentially double the business of most claims-processing vendors.

HCFA and the drug-processing vendors will subcontract for installation, maintenance, and training on point-of-service computer terminals at participating Medicare pharmacies.

The law's requirement that generic drugs be used when available will discourage research and development spending by the drug industry. The need for information systems by drug manufacturers will increase in the face of declining market share by generic drugs.

Transition from inpatient to outpatient services such as home health care and skilled nursing will increase because of (1) the increasing proportion of the aging U.S. population that is 65 and over, (2) the reduced cost of outpatient visits, and (3) active support by the Medicare program and insurers.

Nursing home care will provide a major market for medical equipment, medical supplies, pharmaceuticals, and information systems.

Health care's share of the total U.S. GNP will increase to 11% in 1988 and will continue to represent a large proportion of the U.S government fiscal budget.

The uninsured, AIDS, and testing for AIDS will become major political and social issues to health care providers, insurers, and politicians.

Corporations and hospitals will continue diversification into outpatient facilities.

The health care industry will increase emphasis on advertising and marketing to acquire new patients.

The cost of health care will continue to rise faster than the consumer price index.

The growing Medicare population and a smaller contributor base will put greater strain on the Medicare program.

Health insurers will attempt to increase premiums on a regular basis.

The primary driving forces in the medical industry are summarized in Exhibit I-2

EXHIBIT I-2

MEDICAL INDUSTRY DRIVING FORCES

- Cost Containment
- Changing Government Regulations
- Industry Consolidation
- Increasing Outpatient Services

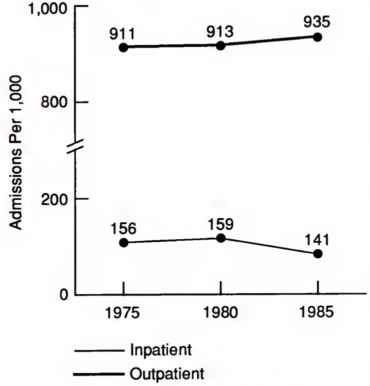
B

Hospital Industry Trends

Hospital admissions are declining, but people are making more outpatient visits to nursing homes and home health care institutions, as shown in Exhibit I-3. In response, hospitals are transforming themselves into integrated health care providers by acquiring or forming alternative health care systems.

EXHIBIT I-3

MEDICAL ADMISSIONS, 1975-1985



Source: American Hospital Association

Hospitals are engaging in other non-health-related activities such as providing health insurance to companies, groups, or individuals in their service area.

The number of investor-owned hospitals has been growing steadily but slowly. Investors are turning to specialty hospitals for possible investment growth. Investor-owned specialty hospitals increased from 407 in 1985 to 469 in 1986.

Increases in the number of hospital and physician alliances is expected as hospitals push to fill beds and as physicians seek access to hospital services to improve productivity.

Wages can account for 60% or more of a hospital's cost. Hospitals are turning to greater use of automation and computers in labor-intensive operations such as point-of-care information systems.

C

Physician Industry Trends

The number of office visits per physician has been declining since the late 1970s when physicians saw about 100 patients per week. Today, a physician sees on average about 75 patients a week. Dropping office visits have not impacted the number of newly graduated physicians. This number has been increasing, with an oversupply as of many as 80,000 projected by 1990.

With declining office visits and increased competition, physicians are entering joint ventures with hospitals. Single practitioners are joining with medical groups to reduce overhead costs and increase patient referrals. New physicians are seeking employment with HMOs as salaried employees instead of opening their own practices. In general, the number of medical group practices has been on the rise and some estimates are that the United States has 30,000 medical groups.

Physicians are automating their practices to become more competitive. Physicians seek to improve performance and productivity and seek access to clinical information about their patients in hospitals.

The use and exchange of information between hospital and physician have become marketing tools for both to build volume, increase referral base, and increase market share.

A major concern to physicians in the future is the proposed resource-based relative value scale (RBRVS). Medicare payments are usually based on what physicians have charged in the past. The RBRVS, if implemented, might reimburse physicians based on the amount of work or resources they expend in treating the beneficiary. The new system would redistribute the way in which physicians would be reimbursed from the Medicare program, and this in turn would change the economics of physicians and specialists whose income derives primarily from the Medicare program.

D

Issues for Vendors

The major issues for vendors are summarized in Exhibit I-4.

EXHIBIT I-4

ISSUES FOR VENDORS

- Industry Consolidation
- Multifacility Providers
- User Dissatisfaction

Single hospital closures and consolidation among hospitals will result in a limited market for individual information systems and an expanded market for networked systems. Vendors can expect increased competition, acquisitions by larger vendors, and joint ventures as vendors seek a share in a smaller market.

As hospitals expand their services, hospitals will seek an integrated information system to gain efficiencies and cost reductions. Vendors must offer a single solution to a hospital's information needs. Vendors are allocating more monies in research and development as hospital transactions become more complex. The complexity of future systems will result in longer sales cycles and opportunities in education and training for vendors.

In general, hospitals are unsatisfied with their currently installed systems. Inflexibility, limited functions, and the inability to share data are reasons hospitals are actively seeking improvements and expansions to their systems. Vendors must improve and expand their product offering in a constantly changing environment.

II

Market Forecasts

A

Introduction

The SIC (Standard Industrial Code) for the health services market is major group 80. The market includes:

- 801 Physicians
- 802 Dentists
- 803 Osteopaths
- 804 Health Practitioners
- 805 Nursing Facilities
- 806 Hospitals
- 807 Medical and Dental Laboratories
- 808 Home Health Care Services
- 809 Health and Allied Services, not elsewhere classified

INPUT divides the health services market into three sectors: hospitals, physicians (which includes dentists, osteopaths, and health practitioners), and "other" medical (which includes nursing facilities, laboratories, home health care services, and health and allied services). The health services demographics are summarized in Exhibit II-1.

Demand for industry-specific medical information services will grow 17% annually through 1993, increasing from $3.2 billion in 1988 to $7.1 billion in 1993. For details, see Exhibits II-2 through II-11 and Appendix Exhibits B-1 through B-4.

EXHIBIT II-1

MEDICAL INDUSTRY SECTOR— DEMOGRAPHIC DATA

Standard Industrial Classification	Industry Name	Type of Statistic	Data
All	Medical	Number of Establishments (1985) Number of Employees (1985)	388,324 6,333,867
801	Physicians	Number of Establishments (1985) Number of Employees (1985)	180,078 924,445
802	Dentists	Number of Establishments (1985) Number of Employees (1985)	98,412 445,472
803	Osteopaths	Number of Establishments (1985) Number of Employees (1985)	6,867 30,739
804	Health Practitioners (N.E.C.)*	Number of Establishments (1985) Number of Employees (1985)	45,527 150,629
805	Nursing Homes	Number of Establishments (1985) Number of Employees (1985)	15,951 1,206,200
806	Hospitals	Number of Establishments (1985) Number of Employees (1985)	5,825 2,943,749
807	Medical and Dental Laboratories	Number of Establishments (1985) Number of Employees (1985)	13,231 112,254
808	Outpatient Care Facilities	Number of Establishments (1985) Number of Employees (1985)	12,489 257,337
809	Health and Allied Services (N.E.C.)*	Number of Establishments (1985) Number of Employees (1985)	9,928 263,042

*Not Elsewhere Classified.

EXHIBIT II-2

MEDICAL SECTOR MARKET FORECAST INFORMATION SERVICES BY DELIVERY MODE, 1988-1993

Sector	User Expenditures ($ Millions)		1988-1993 CAGR (Percent)
	1988	1993	
Processing Services	1,020	1,900	13
Network Services	390	1,340	28
Applications Software Products	670	1,540	18
Turnkey Systems	670	1,140	11
Systems Integration	160	500	25
Professional Services	300	680	18
Total	3,210	7,100	17

B

Medical Segments

1. Hospital Segment

The hospital segment is the largest of the three segments researched, with $2.5 billion in expenditures in 1988, as shown in Exhibit II-3. Hospital information services spending will increase 17% annually through 1993, with 1993 expenditures totaling $5.6 billion.

One estimate is that 16% of the United States' hospital bed capacity is expected to close by 1990. The driving issue for hospitals is how information systems can support the bottom-line profitability of the hospital.

EXHIBIT II-3

MEDICAL SECTOR MARKET FORECAST INFORMATION SERVICES, HOSPITAL SEGMENT BY DELIVERY MODE, 1988-1993

Sector	User Expenditures ($ Millions) 1988	User Expenditures ($ Millions) 1993	1988-1993 CAGR (Percent)
Processing Services	810	1,500	13
Network Services	310	1,100	28
Applications Software Products	530	1,200	18
Turnkey Systems	530	900	11
Systems Integration	130	400	25
Professional Services	240	540	18
Total	2,550	5,640	17

The trend for hospitals is increased spending for information systems as one of the most effective means of controlling costs. The spending for hospital information systems will continue to increase because of the following reasons.

The trend from inpatient services to outpatient services delivered in different locations and perhaps by different providers will create new information requirements.

In the past, hospital information systems were acquired piecemeal by individual departments within the hospital. The change to the prospective payment system because of rising medical costs will drive hospitals to integrate their systems by networking and/or replacing their current systems.

The demand for labor-saving automation will continue, also stimulated by the severe nursing shortage in the United States.

The traditional separation between hospitals and physicians is disappearing, resulting in the convergence and exchange of clinical and financial information. Networking technology and microcomputers make it easier for physicians at remote locations to link into a hospital information system.

The need for decision support systems has emerged because hospital marketing departments are developing more-aggressive marketing approaches. Hospitals are seeking information on their customer base and on positioning of the hospital in its marketplace. The new focus of the hospital's marketing efforts places additional demands on the hospital's information system.

The changes in government regulation and creation of increasingly complex billing systems have resulted in the need for accurate claims processing. The elimination of the periodic interim payment (PIP) program by HCFA can result in cash-flow problems for hospitals that submit erroneous claims.

The price of computer systems continues to drop, attracting the development of software and new buyers.

In response to (1) the changing competitive environment and (2) dissatisfaction with older, installed systems, hospitals are increasingly upgrading or replacing their information systems.

The increased use of prepaid health plans like HMOs has resulted in hospitals redesigning their systems to accommodate these prospective functions.

2. Physician Segment

The physician segment will grow at an annual rate of 16%, from $570 million in 1988 to $1.2 billion in 1993, as shown in Exhibit II-4.

The health care industry's emphasis on cost control has made computerization an immediate priority. Studies have shown that physicians have been slower than their other medical counterparts to computerize.

Possible reasons for physicians' slow acceptance of computers are: medical schools have been slow to introduce computers in their curricula; lack of time for physicians to learn or evaluate computers, and the conception that current systems are too difficult to use.

EXHIBIT II-4

MEDICAL SECTOR MARKET FORECAST INFORMATION SERVICES, PHYSICIAN SEGMENT BY DELIVERY MODE, 1988-1993

Sector	User Expenditures ($ Millions)		1988-1993 CAGR (Percent)
	1988	1993	
Processing Services	180	330	12
Network Services	70	200	27
Applications Software Products	120	300	18
Turnkey Systems	120	200	11
Systems Integration	30	90	25
Professional Services	50	120	18
Total	570	1,240	16

The trend toward group practices is supporting the physician segment growth rates. Group practices are more likely to have the resources to purchase information systems because of reduced overhead cost, increased patient volume, and an organizational need. Decreasing hardware cost and increased selection of software will make automation more attractive, particularly for microcomputer-based systems.

The overall trend for the physician segment is toward systems with a link to a hospital. Hospitals with their extensive resources and computer expertise are selecting computers for physicians or participating medical groups. One result of the physician-hospital relationship is that physicians can automate the financial side of their businesses and gather clinical information on patients from the hospital while in remote locations.

3. "Other" Medical Segment

The "other" medical segment will grow at an annual rate of 18%, from $95 million in 1988 to $220 million in 1993, as shown in Exhibit II-5.

EXHIBIT II-5

MEDICAL SECTOR MARKET FORECAST INFORMATION SERVICES, "OTHER" MEDICAL SEGMENT BY DELIVERY MODE, 1988-1993

Sector	User Expenditures ($ Millions)		1988-1993 CAGR (Percent)
	1988	1993	
Processing Services	30	60	13
Network Services	10	40	28
Applications Software Products	20	45	18
Turnkey Systems	20	40	15
Systems Integration	5	15	25
Professional Services	10	20	18
Total	95	220	18

The “other” medical market segment is driven by the dramatic growth of alternative health care facilities, primarily in home health care.

The expansion of home health care agencies into “other” medical services, and increased patient volume, is expected to fuel the need for medical information systems.

Minicomputers, turnkey systems, and microcomputers are preferred growth areas in the home health care market because of their lower cost and perceived flexibility in place of processing services.

C
Information Services Forecasts

1. Processing Services

Processing services will continue to thrive in small- to medium-sized hospitals. Processing services will grow at an annual rate of 13% from $1.0 billion in 1988 to $1.9 billion in 1993, as shown in Exhibit II-6.

EXHIBIT II-6

MEDICAL SECTOR MARKET FORECAST PROCESSING SERVICES, 1988-1993

Sector	User Expenditures ($ Millions)		1988-1993 CAGR (Percent)
	1988	1993	
Transaction Processing Services	480	800	11
Systems Operations	550	1,100	14
Total	1,030	1,900	13

In the early 1970s, hospitals began using shared patient accounting services because hospitals did not have the expertise to develop in-house systems and because currently available systems were expensive. In the 1970s, shared processing services accounted for 70% of patient accounting systems. By the 1980s, the trend shifted to the purchase of in-house systems. The change was facilitated by systems becoming more sophisticated and prices falling as new technological improvements were available.

Hospitals—faced with declining patient volume, shorter hospital stays, and reduced government medical contribution—turned to in-house systems as a means of controlling costs.

Many of the nation's hospitals cannot automate because they find it too costly in terms of capital expenditures. Small hospitals have turned to processing services; this trend is expected to grow, particularly for many of the nation's small hospitals in rural areas where staffing may be a problem.

Mid-size hospitals will continue to use processing services but at a declining rate. Large hospitals will continue to install and expand in-house systems and represent a declining proportion of the processing services market. It is estimated that 25% of mid-sized hospitals and 8% of large hospitals use processing services.

2. Network Services

Network services will grow at an annual rate of 28%, from $390 million in 1988 to $1.4 billion in 1993, as shown in Exhibit II-7. INPUT defines network services as network applications and electronic information services (EIS). INPUT defines network applications as value-added networks (VANs), electronic mail, and electronic data interchange (EDI). EIS is defined as on-line data base access to specific information via terminal-based inquiries—such as stock prices and airline schedules; on-line news services that offer current information, either general or for a specific category; and videotex services.

EXHIBIT II-7

MEDICAL SECTOR MARKET FORECAST NETWORK SERVICES, 1988-1993

Sector	User Expenditures ($ Millions)		1988-1993 CAGR (Percent)
	1988	1993	
Electronic Information Services	250	700	23
Network Applications	140	700	35
Total	390	1,400	28

Hospital information systems were sought first for patient accounting and financial management. Systems were then purchased for the clinical aspects of health care. The trend today is toward networking and communications with remote locations. The prospective payment system is continuing to drive hospitals into outpatient services; networked information has been recognized as a growing need.

Physicians are beginning to discover the benefits of electronic networking. Technological improvements are making it possible for physicians in remote locations to link with hospital information systems. Physicians can seek clinical information on patients without leaving their homes or offices; the result is more time with patients and increased productivity.

3. Application Software

Increased computer power and declining hardware prices are expanding computer applications and enabling a larger number of medical personnel to effectively use computers. Growing use of computers by hospitals and physicians will generate purchases of software. Applications software will grow at an annual rate of 18%, from $670 million in 1988 to $1.5 billion in 1993, as shown in Exhibit II-8.

EXHIBIT II-8

MEDICAL SECTOR MARKET FORECAST APPLICATION SOFTWARE, 1988-1993

Sector	User Expenditures ($ Millions) 1988	User Expenditures ($ Millions) 1993	1988-1993 CAGR (Percent)
Mainframes	300	480	10
Minicomputer	220	450	14
Workstation/PC	150	590	32
Total	670	1,520	18

Presently most available applications stress financial systems such as patient accounting and medical records. The market for financial systems is saturated, with 99% and 93% of hospitals having accounting and medical record systems, respectively. Hospitals are looking into other areas of their operations to improve productivity and control costs. One area that has been ignored by vendors is the clinical side of health care.

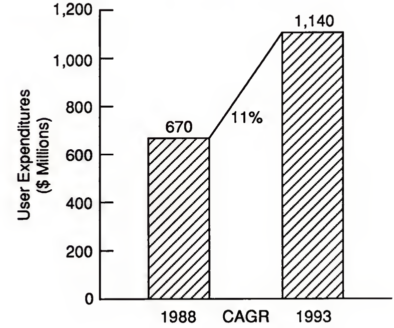
4. Turnkey Systems

Turnkey systems will grow at an annual rate of 11%, from $670 million in 1988 to $1.1 billion in 1993, as shown in Exhibit II-9.

The growth in turnkey systems lies with system replacements and first-time purchases. Hospitals will continue to replace and upgrade their systems as improved offerings become available. The trend for first-time purchases is related to patient care in the following applications: patient care order entry, pharmacy, laboratory, radiology, and nurse staffing.

EXHIBIT II-9

MEDICAL SECTOR MARKET FORECAST TURNKEY SYSTEMS, 1988-1993



The fastest growing segment in the U.S. health-care market is home health care, with total expenditures of $8 billion. The growing alternative health-care market brings a need for information systems. The most desired applications mentioned by home health care agencies are minicomputer- and microcomputer-based turnkey systems offering clinical, durable equipment, financial, and scheduling applications.

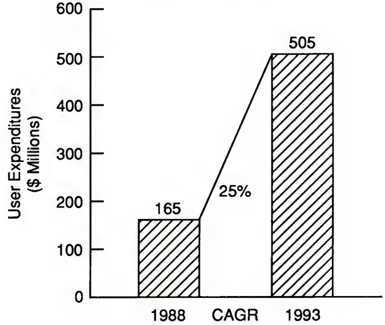
5. Systems Integration

Acquisitions and consolidations in the hospital sector will support the systems integration annual growth rate of 25% over the next five years. Systems integration expenditures will reach $505 million in 1993, starting from $165 million in 1988, as shown in Exhibit II-10.

Consolidation and formation of investor-owned and multiple facility providers will result in a need for integrated information systems for centralized reporting and accounting. Increasingly, hospitals and hospital management companies are moving into alternative health-care delivery markets. With continuing acquisitions, providers will need to integrate their new ventures with their corporate structure.

EXHIBIT II-10

MEDICAL SECTOR MARKET FORECAST SYSTEMS INTEGRATION, 1988-1993



6. Professional Services

Professional services will grow at an annual rate of 18% from $300 million in 1988 to $680 million in 1993, as shown in Exhibit II-11.

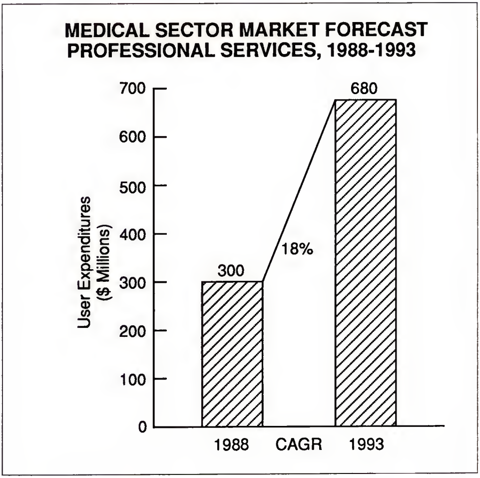
Education and training expenditures will increase as larger numbers of first-time users such as nurses, lab technicians, and physicians enter the computer age.

Many hospitals do not have the expertise to develop in-house software and thus rely on contract software development, even though the trend will be toward developing software in-house to control costs.

To operate their own in-house systems, hospitals have to try to hire qualified data processing employees, who are in short supply and demand competitive salaries. Alternatively, hospitals will turn to consultants and professional systems operations services to operate their in-house systems.

The increased demand for computerization and the proper selection of systems will inevitably result in greater dependence on consultants in the decision-making process.

EXHIBIT II-11



III

Competitive Developments

A

Introduction

The medical information systems market is characterized by the presence of large, well-established vendors. Shared Medical Systems Corporation, McDonnell Douglas Health Systems Company, HBO & Company, Baxter Travenol Laboratories, and IBM Corporation are major players in the medical information systems market. In 1987, these five vendors accounted for 38% or $1.1 billion of the market.

Health-care providers are increasingly seeking a fully integrated single-source information system. As a result of changing market conditions, leading vendors of information services for the medical markets are positioning themselves as full-line suppliers, selling a broad range of delivery modes to all key markets. The key applications and technologies are summarized in Exhibit III-1.

EXHIBIT III-1

KEY APPLICATIONS AND TECHNOLOGIES FOR VENDORS

- Local Area Networks
- Relational Data Base Management Systems
- Bedside Terminals and Workstations
- Clinical Information Systems

The market shares of the leading vendors in the medical sector are shown in Exhibits III-2, III-3, and III-4.

EXHIBIT III-2

LEADING VENDOR SHARES OF MEDICAL SECTOR INDUSTRY-SPECIFIC INFORMATION SERVICES, 1987

Vendor Name	$ Millions					Medical Sector Market Share (Percent)
	Processing Services	Applications Software	Turnkey Systems	Professional Services	Total	
Shared Medical Systems Corporation	185	74	74	37	370	13
McDonell Douglas Information Systems	100	0	145	0	245 *	9
HBO & Company	18	23	91	44	176	6
Baxter Travenol Laboratories	20	55	10	65	150 *	5
IBM	0	65	70	0	135 *	5
Cycare Systems	45	20	0	0	65 *	2
TDS Healthcare Systems Corporation	0	25	6	8	45†	2
Systems Associates	35	0	0	0	35 *	1
Cerner Corporation	0	3	30	0	33	1
Meditech	0	30	0	0	30	1
Leading Vendors Subtotal	401	263	430	155	1,283	46
All Other Vendors	498	306	177	105	1,483	54
Industry Total**	899	569	606	260	2,766	100

*INPUT estimate

†Includes network systems revenue

**Totals do not add due to rounding

EXHIBIT III-3

LEADING VENDOR SHARES OF HOSPITAL SECTOR INDUSTRY-SPECIFIC INFORMATION SERVICES, 1987

Vendor	Total Revenues ($ Millions)	Market Share (Percent)
Shared Medical Systems	335	15
McDonnell Douglas Health Systems	195	9
Baxter Travenol	150	7
IBM	120	6
TDS Healthcare Systems	45	2
Systems Associates	35	2
Cerner Corporation	33	1
Meditech	30	1
Leading Vendors Subtotal	943	43
All Other Vendors	1,242	57
Industry Total	2,185	100

EXHIBIT III-4

LEADING VENDOR SHARES OF PHYSICIAN SECTOR INDUSTRY-SPECIFIC INFORMATION SERVICES, 1987

Vendor	Total Revenues ($ Millions)	Market Share (Percent)
Cycare	55	11
Shared Medical Systems	35	7
McDonnell Douglas Health Systems	25	5
Triad Systems	15	3
IBM	15	3
HBO & Company	12	2
Leading Vendors Subtotal	157	31
All Other Vendors	343	69
Industry Total	500	100

The revenues of medical claims processing companies (U.S. Administrators, Computer Sciences Corporation, and EDS) were accounted for in INPUT's insurance sector report.

The leading processing services vendors—Shared Medical Systems (SMS), McDonnell Douglas Health Systems, and Cycare—account for 37% of the processing services market.

The leading applications software vendors—IBM, Baxter Travenol, and Shared Medical Systems—account for 35% of the application software market.

The leading turnkey systems vendors—McDonnell Douglas Health Systems, HBO & Company, and Shared Medical Systems—account for 51% of the turnkey systems market.

The leading professional services vendors—Baxter Travenol, HBO & Company, and Shared Medical Systems—account for 60% of the professional services market.

B
Acquisitions

Due to the prospective payment system, hospitals are purchasing more modern systems to merge financial, patient, and clinical data and are intensely analyzing their case mix. Increasingly, hospitals are turning toward integrated systems as a means to manage information and costs. Hospitals prefer to negotiate with single-source vendors that can supply the products and services hospitals need in a single package.

Information services vendors are seeking to buy the capabilities hospitals need by acquiring smaller, specialized companies. The competitive environment will force specialty vendors to join together or develop joint ventures with large vendors. The many specialty companies that exist today will be bought out and incorporated into larger corporations.

Significant acquisitions in the medical information services industry in 1988 include:

The Compucare Company has purchased assets, products, and services lines from Baxter Healthcare Corporation and resumed its operations as a newly formed private corporation. Terms of the purchase were not disclosed. Compucare was acquired in 1985 by Baxter Healthcare Corporation for $13 million and merged with Baxter's Systems Division.

Cycare acquired DataBill, Inc., a wholly-owned subsidiary of American Physicians Service Group, Inc. DataBill is a batch and on-line services and systems vendor with estimated revenues over $20 million in 1987. Cycare acquired 100% of DataBill, Inc. stock for $12 million.

Keane acquired DataFrame, a professional services firm based in New Providence (NJ).

GTE Information Services acquired InterMountain Health Care of Salt Lake City (UT).

HBO & Company sold its Computer Resources, Inc. subsidiary to Infomed of Princeton (NJ). Computer Resources, Inc. provides mini- and microcomputer-based turnkey systems to home care agencies.

McDonnell Douglas Health Systems Company sold the Physicians Systems Company (PCS) unit to PCS management. PCS was formed in 1984 with the acquisition of Science Dynamics Corporation of Torrance (CA) and provides processing services and turnkey systems to medical clinics, physicians, HMOs, and medical schools.

C

Vendor Profiles

The following are profiles of selected vendors in the medical market.

1. Cerner

a. Products/Services

Cerner Corporation develops, markets, and supports turnkey systems to the health care industry for use in clinical departments. Cerner's PathNet product line is a family of five categories of information systems: Laboratory, Common Clinical, Management, Commercial, and Advanced Laboratory Information Systems. Each of these categories address a different set of customer needs and can be combined as necessary for the customer's individual functional and budgetary requirements. PathNet is based on the DEC VAX and Texas Instruments minicomputers.

A substantial number of Cerner's customers enter into hardware and software maintenance agreements with Cerner. These arrangements normally provide for a fixed monthly fee for specified services. In most cases, Cerner subcontracts hardware maintenance to the hardware manufacturers.

b. Markets Served

The market for PathNet consists primarily of hospital-based laboratories, clinical laboratories associated with HMOs and other providers, independent reference laboratories, and blood banks. PathNet is designed to address the requirements of facilities ranging in size from 100 to over 200 beds.

As of December 31, 1986, Cerner had issued end-user licenses for PathNet to 48 customers in the U.S. and Canada. Approximately 99% of Cerner's sales were derived from the U.S. and 1% from Canada.

c. Recent Activities

Cerner entered into a marketing agreement with McDonnell-Douglas, which granted McDonnell-Douglas a license to market PathNet on a nonexclusive private label. The agreement also grants McDonnell-Douglas the exclusive right to market PathNet to any organization outside of the U.S. Cerner entered the agreement with McDonnell-Douglas primarily to gain access to the international and U.S. government markets without expending substantial company resources and also to gain broader access to the U.S market. During 1987, Cerner recognized $1.5 million in revenues for products and services rendered under this agreement.

2. Cycare Systems, Inc.

a. Products/Services

Cycare Systems, Inc., incorporated in 1969, provides remote batch, on-line, and distributed processing services, turnkey systems, and professional services.

b. Markets Served

Cycare has approximately 1,500 + clients in 48 states and five Canadian provinces. Cycare primary customers include ambulatory care facilities, medical group practices, HMOs, and medical schools. Virtually all of Cycare's revenue was derived from the medical industry.

c. Company Strategy

In recent years, the company's business had gradually shifted from primarily providing remote batch and on-line processing services to emphasizing distributed processing and turnkey systems. While Cycare will continue to offer distributed and turnkey systems, the future emphasis will be on maintaining a service revenue base at least equal to systems revenue.

d. Recent Activity

Cycare acquired DataBill, Inc., a wholly-owned subsidiary of American Physicians Service Group, Inc. DataBill is a batch and on-line services and systems vendor with estimated revenues over $20 million in 1987. Cycare acquired 100% of DataBill, Inc. stock for $12 million.

e. Future Direction

Cycare management's revenue goal for 1988 is $100 million. To reach their objective, Cycare will expand its product line for small group practices, provide networking capability between large health care organizations, and physicians, and expand its market share through joint ventures.

3. HBO & Company

a. Products/Services

HBO & Company was formed in 1974 to provide turnkey systems and associated support services to the health care industry. As a result of the February 1985 acquisitions of Mediflex Systems Corporation and Amherst Associates Inc., HBO now provides application software products, processing services, systems operations, and custom programming professional services.

b. Markets Served

HBO provides a range of products and services to hospitals for patient, clinical, and financial management. The company's primary target market is the 3,000 short-term acute care hospitals in the U.S. of more than 100 beds.

Virtually all of HBO's revenue is derived from hospitals. A small percentage is derived from maintenance services provided by its subsidiary Medical Systems Support, Inc. to government and other clients.

One hundred percent of HBO's revenues is derived from the U.S.

c. Company Strategy

HBO re-examined its business and refocused its business strategies when the company's revenue and operating income growth rates declined in 1986. In 1986 HBO positioned itself for future growth by unbundling the pricing of its products, discontinuing the practice of discounting service agreements, selling its noninformation services, consulting business, reducing staff, and streamlining operations.

The results of HBO's cost-cutting efforts were a 13% increase of revenue over 1986 to $175 million. Net income was $13.3 million in 1987 compared to a net loss of $3 million in 1986. Operating expenses were $161 million in 1987 compared to $163 million in 1986.

d. Recent Activities

In February 1988 HBO sold its Computer Resources, Inc. subsidiary to Infomed of Princeton (NJ). Terms of the sale were not disclosed. HBO originally acquired a 83% equity interest in Computer Resources during 1984 and 1985. Headquartered in Pompano Beach (FL), Computer Resources provides minicomputer and microcomputer-based turnkey systems to home care agencies.

The STAR Financial system scheduled for availability in 1988 incorporates the same data base technology as the MEDSTAR and CLINSTAR systems and completes the Data General minicomputer-based STAR family of products. HBO also plans to make STAR products available for Digital Equipment and Hewlett Packard minicomputers.

e. Future Direction

HBO & Company will increase emphasis on its strengths in minicomputer-based turnkey systems and associated maintenance services. Maintenance services accounted for 33% of HBO's revenue in 1987.

The introduction of the STAR Financial system will contribute revenues to the company in 1988 and availability of STAR products for Digital and Hewlett Packard minicomputers will sustain the STAR product life cycle.

4. Keane, Inc.

a. Products/Services

Keane, Inc., founded in 1965, provides professional services to Fortune 100 manufacturers, banks, financial services firms, insurance companies, application software products, and facilities management services to hospitals. Through the KeaMed Hospital Systems Division, Keane markets Worry-Free Software products to small- to medium-sized hospitals (50 to 400 bed). Worry Free Software is a modular and integrated hospital information system that includes financial, patient care, and clinical systems. Keane is currently marketing the software for Wang VS minicomputers under Wang's Independent Sales Organization Agreement. Keane no longer actively markets software products for IBM System 36 or System 38 computers. Keane provides customization and implementation of each system including user training and documentation.

Keane also provides Extended Operations Support (EOS) facilities management services to hospitals. EOS includes the design, development, implementation, and management of client computer systems. Keane offers a line of both on-line batch and batch systems designed for interaction with each other, although each system can be purchased separately.

b. Markets Served

Keane has about 40 systems installed in hospitals and has provided facilities management to 16 hospitals.

c. Recent Activities

KeaMed Hospital Division revenues were $9.5 million, a 5% decrease from $10.2 million for 1986. KeaMed's business continued to be adversely impacted by economic pressures facing hospitals. While Wang-based software product business was profitable, IBM System 36 and System 38 business continued to experience losses. As a result, Keane management has phased out the System 36 and System 38 product lines and is now concentrating on the Wang VS-based applications.

d. Future Direction

Revenue for the six months ending June 20, 1988 reached $28 million, a 40% increase over $10 million in 1987. The increase in revenue can be

attributed to Keane's continued focus on those areas in the company's business that offer the highest rate of return. Keane will continue to concentrate its software marketing efforts on the WANG VS minicomputers

5. McDonnell Douglas Health Systems Company (MDHSC)

a. Products/Services

MDHCS provides turnkey systems, processing services, and associated professional services to the health care industry.

b. Markets Served

MDHSC serves more than 1,500 hospitals. HDHSC's integrated hospital system client base increased by 75% in 1987, to approximately 90 hospitals. The mini-based hospital system targeted to small hospitals has 90 clients. The patient care system has over 30 clients and the hospital financial control system has over 467 clients.

c. Company Strategy

The information systems company revenue in 1987 reached $1.2 billion, a 4% decrease over 1986, but operating losses were $2.4 million. The health systems business unit contributed $246 million in 1987, a 2% decrease from 1986. MDHSC strategy is to provide a full range of integrated products/services meet health care institution needs.

d. Recent Activities

In March 1988, the company sold the Physician Systems Company (PSC) unit to PSC management. PSC was formed in 1984 with the acquisition of Science Dynamics Corporation of Torrance (CA) and provides processing services and turnkey systems to medical clinics, physicians, HMOs, and medical schools.

McDonnell Douglas has reorganized the information systems group and dismissed 600 employees, the majority in sales and marketing.

e. Future direction

Systems Associates, Inc. announced that it will acquire MDHSC. The acquisition is expected to result in 1,000 layoffs reducing MDHCS total workforce to 9,000 employees. The sale of MDHSC will complete McDonnell Douglas Information Systems' divestiture of its health-related companies.

6. Meditech

a. Products/Services

Meditech, founded in 1969, provides system and application software products and remote computing and systems operations services to the health care industry.

b. Markets Served

The company provides its services to hospitals, private laboratories, prepaid health plans and also licenses its proprietary operating system and programming languages to OEMs and distributors. A library of applications products is available for standalone systems or through Meditech's network. Ninety percent of users license the software for inhouse systems and 10% use Meditech's processing services. Over 200 institutions use Meditech's products. Of these, 95% are hospitals, 2% are clinics, and 2% are prepaid health plans. Meditech's line of application modules is designed to be used independently or as part of an integrated system.

7. Shared Medical Systems Corporation (SMS)

a. Products/Services

SMS is the nation's leading provider of information services to the health care industry.

The company's products and services are provided to hospitals, clinics, and physician groups for financial, administrative, and patient management applications.

SMS currently provides remote computing, network and distributed processing services; application software products; turnkey systems; and various professional services, including proprietary network design, custom programming, and facilities management.

SMS is currently organized into four divisions and two subsidiaries as follows: Hospital Services Division, Laboratory Products Division, Turnkey Systems Division, Physicians Systems and Services Division, SMS International, and SMS Canada.

SMS provides over 100 applications to its hospital, clinic, and physician group clients.

b. Markets Served

SMS' products and services are provided to hospitals, clinics, and physician groups. The company's primary market is the approximately 3,200 nonfederal acute care hospitals, generally with 100 or more beds. SMS currently serves more than 1,200 hospitals and physician group practices. There are over 1,000 mainframes and minicomputers running SMS software installed at SMS client locations. SMS services over 400 medical practices representing over 8,000 physicians nationwide.

The majority of SMS 1987 revenue was derived from the U.S. INPUT estimates less than 5% was derived from international locations.

c. Company Strategy

INPUT estimates that approximately 50% of SMS' 1987 revenue was derived from remote and facilities management processing services. SMS has steadily expanded its product line to include a comprehensive range of medical services. SMS offers financial, administrative, patient care, and decision support systems on a remote computing basis, an inhouse turnkey system, or a combination of the two.

d. Recent Activities

SMS revenues for 1987 reached $390 million, a 4% increase over 1986. SMS management attributes the company's slowed growth in 1987 to management and product problems.

SMS has invested in the future by increasing research development expenditures to $37 million in 1987, compared to $24 million in 1986.

In April 1988 SMS announced a research and development agreement with CliniCom and Scripps Memorial Hospitals, Inc. of La Jolla (CA) which will link the CliniCom hand-held terminal to the SMS Patient Management and Pharmacy Systems to quantify the clinicians needs for information at the bedside.

In March 1988 SMS and Atwork Corporation of Chapel Hill (NC) announced that they are jointly marketing three microcomputer-based nurse management information systems developed by Atwork and designed for integration into SMS' health care information systems.

SMS announced ALLEGRA, an integrated DEC VAX-based health care information system targeted primarily to community hospitals with 100 to 400 beds. The system supports clinical, financial, administrative, and decision support applications. ALLEGRA supercedes the company's SPIRIT system which had 35 clients.

e. Future Direction

SMS sees an active market for replacement of outdated financial systems. SMS is moving towards a network that is based primarily on satellite transmission. This network will include earth stations at both its Information Systems Center and each client location, with no primary dependence on land lines.

SMS' heavy investment in research and development, financial resources, and right market/product focus make it a formidable player in the health care information systems market.

8. TDS Healthcare Systems Corporation

a. Products/Services

TDS Healthcare Systems Corporation (TDS) provides processing services, software products, turnkey systems, and professional services to the health care industry in the IBM mainframe environment. TDS also markets and leases terminals.

The TDS Healthcare 4000 system is TDS' primary software product offering and is designed for hospitals with 300 or more beds. Professional services consulting available to TDS clients include cost/benefit analysis, on-site project management, software implementation, and training. These services are generally provided to clients in conjunction with purchases of software or turnkey systems. TDS provides remote processing services to its clients by offering access to TDS' network.

b. Markets Served

One hundred percent of TDS' 1987 revenue was derived from the medical/hospital industry. Currently, TDS serves more than 85 hospitals. TDS clients range in size from a 40-bed rural hospital to a 1,100 bed metropolitan medical center. TDS 1987 revenues were derived from the U.S., Canada, and the U.K.

9. Other Vendors

a. Global Health Systems

Global Health Systems, Inc. develops, installs, and maintains integrated patient record-based turnkey systems for ambulatory care facilities and hospitals.

b. Global Software, Inc.

Global Software, Inc. develops, markets, and supports IBM bases accounting application software products for clients across industries, as

well as vertical software products for the health care industry. The company derives 15% of its revenue from vertical products for the health care industry currently installed in over 40 sites. Global Software has strategic partnering relationships with several vendors including Baxter Travenol, Datacare, HBO & Company, and several Big 8 accounting firms.

c. IHC Affiliated Services, Inc.

IHC Affiliated Services, Inc. (IHC) develops, markets, and supports IBM System/38-based application software products for the health care industry. IHC also offers professional consulting and software development services associated with its software products. IHC's products are fully integrated and address the following areas: patient accounting, patient care, and financial. Revenues for fiscal 1987 were approximately $3 million and revenues for fiscal 1988 are projected to be $4.5 million.

On October 11 1988, GTE Information Services announced the acquisition of IHC, a wholly owned subsidiary of Intermountain Health Care of Salt Lake City (UT).

d. Management Science America, Inc.

Management Science America (MSA) founded in 1963 develops, markets, and supports a range of application software packages for use on medium- to large-scale mainframes. MSA provides an integrated line of patient accounting and information systems for hospitals with 300+ beds. There are currently over 200 health care customers. Approximately 4% of MSA's revenues are derived from the heath care industry.

e. National Data Corporation

National Data Corporation (NDC) was incorporated in 1967 to provide specialized data processing and facilities management processing services. The company currently provides various processing services, professional services, turnkey systems, and systems operations in the health care industry.

NDC's Health Care Data Services Division provides turnkey systems for pharmacy management to hospitals, HMOs, and independent and chain store pharmacies, and as a result of the Libra Group acquisition in 1984, offers health care professional services primarily to the federal government. Health Care Data Services' revenue increased 12% over fiscal 1986, to $28 million in 1987. Sales of the pharmacy management systems increased 44% to over $13 million in fiscal 1987.

f. Planning Research Corporation (PRC)

Planning Research Corporation (PRC) was founded as a private company in 1954 to perform system analysis and operations research for the Department of Defense. Beginning in 1964 as a public company, PRC began a rapid expansion and diversification program primarily through acquisition.

PRC Business Information Systems provides processing and related services and turnkey systems to real estate brokerage firms and to physician group practices. The PRC Medic Computer Systems Division provides turnkey-based management information systems to physicians in group practices. Sales by the division were $13 million in 1987. More than 150 new systems were installed during 1986 and Medic currently serves over 500 group practices.

g. Saztec International, Inc.

Saztec International, Inc. founded in 1976 as Saztec Corporation, provides a range of data base conversion and associated processing services to the telephone utility, electronic publishing, and health care industries. Saztec provides its services directly to individual hospitals or hospital systems, or by contracting with hardware, software, or other service companies providing services to the health care industry. Approximately 9% of Saztec 's 1987 revenues were derived from the health care industry.

h. Triad Systems Corporation

Triad Systems Corporation, founded in 1972, develops, markets, and manufactures turnkey systems for the automotive, retail, and dental markets. Through the Dental Division, Triad markets practice management turnkey systems to dental practices. Applications supported include receivables, billing, appointment scheduling, insurance processing, and word processing. In order to gain broader industry acceptance for their product, Triad has solicited endorsements and marketing relationships with major dental associations. Triad currently has over 700 dental systems installed. Sales reached $3 million in 1987.

IV

Information Systems Department Outlook

A

Driving Forces and Major Issues

The driving forces for medical information systems (IS) departments are summarized in Exhibit IV-1.

EXHIBIT IV-1

DRIVING FORCES FOR IS DEPARTMENTS

- Staffing
- Changing Government Regulation
- Multifacility Environment

The medical industry began acquiring computer systems when computer hardware prices dropped. The medical industry turned to inhouse systems as a way to cut rising operating costs. Soon after installing systems, the medical enterprises discovered additional costs and problems with automation, attracting computer professionals to operate their systems.

The demand for computer professionals has outstripped the supply. The medical industry is having difficulties in hiring computer professionals who demand competitive salaries. Also, computer professionals often don't live in rural areas where many of the nation's hospitals are located. Finally, computer professionals are often attracted to other industries such as computer services, transportation, and energy because the industries offer higher salaries and job visibility.

Changes in government regulation and creation of increasingly complex billing systems has placed greater demands on timely billing and reporting. The government's efforts to utilize electronic data interchange (EDI)

for claims transmission will force the industry to change the way they store, enter, and retrieve medical data. In the next three years, information services departments will spend additional resources to implement new and changing government medical benefits and regulations.

Hospitals are diversifying into other areas in health care such as rehabilitation centers, home health care, and other outpatient services. In a diversified product environment, systems must integrate inpatient and outpatient data. IS departments must be able to track a patient receiving treatment from different providers. IS departments must design and support a system that is capable of sharing information and meeting the needs of different health care professionals

Exhibit IV-2 summarizes the major issues for IS management in the medical industry. These challenges have not significantly changed from last year's report because of inability of vendors to quickly offer IS systems in response to the changing medical environment conditions, and the medical industry's inability to properly implement present systems. The medical industry is continuing to seek improvements and expansions of their IS functions.

EXHIBIT IV-2

MAJOR ISSUES FOR IS DEPARTMENTS

- Integrated Systems
- Centralized Patient Information
- Government Regulation

In recent years, INPUT has observed the IS departments' movement from strategic planning to actual implementation of IS systems. The availability of software products to address the DRG-based accounting requirements is helping but most vendors have failed to introduce integrated systems. IS departments must decide whether to purchase standalone systems as in the past, develop inhouse systems, or purchase integrated systems. In general, the trend for IS departments has been developing inhouse systems or purchasing an integrated system.

Centralized patient tracking and administrative systems continue to be a major issue for IS departments. Hospitals are providing outpatient services at an increasing rate and to remain cost-effective, hospitals must

be able to capture and track patient costs from one or more data bases at different locations. Greatly increased competition is forcing medical administrators to analyze the profitability of each service they offer.

The government continues to place significant pressures on administrators and IS departments. Government reports and management reports, claims processing, and changing medical benefits/rules are demanding significant support and resources from IS departments.

B

IS Budget Analysis

According to INPUT's survey of hospital's IS departments, the factors affecting IS budgets are shown in Exhibit IV-3.

EXHIBIT IV-3

FACTORS AFFECTING IS BUDGET

- Personnel Salaries
- Cost of Computerization

Over a third of a hospital's IS budget is spent on personnel salaries and fringes, as shown in Exhibit IV-4. The movement away from shared data processing services toward inhouse information systems is generating increased need for computer professionals. As the medical industry becomes more computerized, the medical level of expertise will catch up to other U.S. industries. As a result, the medical industry will find itself competing for inhouse computer professionals with the rest of the industry.

The medical IS department's personnel budget is expected to increase through 1990 because salaries in private industry are, on the average higher, than the medical industry. To remain competitive, the medical industry will have to grant salary increases to protect their personnel investment.

The medical IS departments will face reluctant funding by corporate management for IS projects without demonstrated advantages in terms of cost savings and/or revenue preservation. The medical industry is concerned with the additional annual operations expense a system incurs, the majority of which is personnel.

EXHIBIT IV-4

IS BUDGET— DISTRIBUTION AND GROWTH, 1987

	1988 (Percent)	1993 (Percent)	1988 Growth
Personnel	46	48	4
Hardware			
Mainframe	16	15	-5
Minicomputer	7	8	5
Microcomputer	4	4	8
Mass Storage	4	4	4
Total Hardware	31	31	0
Communications	5	5	6
External Products and Services			
Professional Services	1	1	10
Processing Services	0	0	0
Applications Software	5	6	20
Systems Software	3	3	10
Turnkey Systems	2	2	10
Software Maintenance	2	2	10
Hardware Maintenance	2	2	10
Other	4	4	0
Total External	19	20	10
Total Budget	100	105	5

Personnel costs represent an increasing share of a medical IS budget. IS departments will need to increase personnel productivity by consolidating scattered systems into a single information system to develop economies of scale or contract with professional consultants for specialized projects.

C

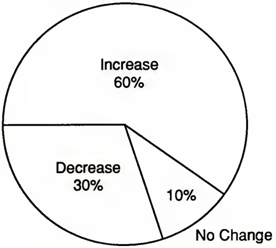
Application Development Trends

The focus of application development programs in the medical industry is summarized in Exhibit IV-5 to Exhibit IV-8.

The application development backlog continues to increase in the medical sector as shown in Exhibit IV-5. The medical industry is adopting a total integrated IS approach for revenue preservation and cost control, as a result of changes in the Medicare program and the transition from information "processing" to information "management."

EXHIBIT IV-5

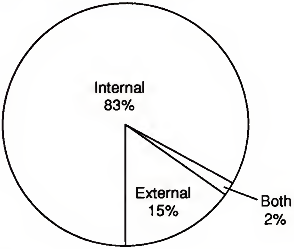
APPLICATION BACKLOG GROWTH



To preserve market share, medical IS departments are developing applications internally as shown in Exhibit IV-6.

EXHIBIT IV-6

SOURCE OF APPLICATION DEVELOPMENT RESOURCES



The majority of medical IS departments are enhancing or maintaining, through custom development, their existing systems as shown in Exhibit IV-7 and Exhibit IV-8. The trend toward inhouse development continues because of the need to control costs. The medical IS departments practice of enhancing their existing systems is expected to persist because of vendors' inability to offer integrated systems which can demonstrate clear cost savings.

EXHIBIT IV-7

ALLOCATION OF APPLICATION DEVELOPMENT RESOURCES

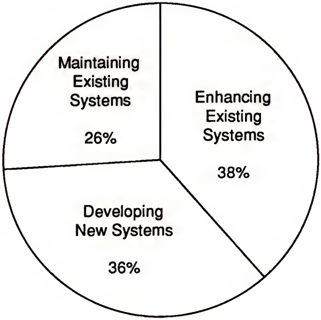


EXHIBIT IV-8

TYPE OF APPLICATION DEVELOPMENT

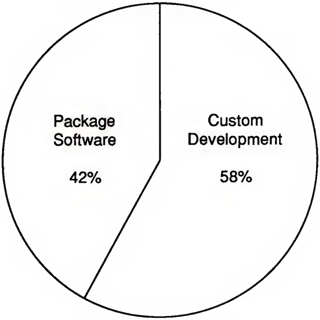


Exhibit IV-9 lists areas of computing technology being planned by the medical industry in 1988.

EXHIBIT IV-9

MEDICAL INDUSTRY— NEW TECHNOLOGY

- Networking Connectivity
- Artificial Intelligence (AI)/Expert Systems
- New Data Entry and Storage Technology

There is a growing demand to connect information systems with outside providers, including affiliated outpatient clinics and physician offices. Networking technology has a high level of interest in the medical industry due to:

- Hospitals' many departmental systems
- Hospitals' expansion to outpatient services
- Physician-alliances
- Growth of hospital and nursing chains

The interest in networking connectivity and lack of standards will create telecommunications challenges for IS departments while providing opportunities to contribute to cost-effectiveness.

In the long-term, AI/expert systems for medical applications hold a great deal of promise. Software that assists physicians with patient diagnosis and clinical decisionmaking are emerging. Presently, only a few vendors are marketing commercial applications but there are a number of products in development. The need to improve productivity at all levels of the medical industry will spur the growth of AI/expert systems in the near future.

New data entry and storage technology are enabling the medical industry to enter and store data at a lower cost. The medical industry has a constant need to access data for specialized disciplines such as obstetrics, therapeutics, general medicine, and surgery. Despite the lack of a standard front-end interface and file interchange format, the medical industry's appetite for stored data will fuel the data entry and data storage industries. Supporting software systems will also be crucial in this growth.

The trend towards bringing computers to the bedside for patient monitoring and diagnosis is driven by the need to improve the productivity of medical professionals and provide on-line patient data for cost control. The introduction of voice recognition and light pens will eventually replace many handwritten physician orders, medical records, and nurses notations. The integration of text, imaging, and AI/expert systems is expected to help medical professionals in diagnosis and treatment.

V

New Opportunities

The opportunities for information services vendors are summarized in Exhibit V-I.

EXHIBIT V-1

OPPORTUNITIES FOR IS VENDORS

- Integrated and Clinical Systems
- Physician-Outpatient Facilities-Hospital Networking
- Outpatient Facility Information Systems

A

Hospital Segment

Most hospitals are expected to install integrated systems to replace their fragmented existing applications. Before the introduction of the prospective payment system, hospital's information systems monitored the financial and administrative tasks of billing and collections. Separate systems were then established for departmental management functions. The prospective payment system is forcing hospitals to change how they manage information. Whereas previous systems were separate, systems must now be integrated. Hospitals must be able to account for what it costs to deliver medical services rather than what they paid for the medical services. Medical information systems which exist today are not designed to capture cost data.

Hospitals cannot function well with separate systems for financial operations, patient care, and nursing management, etc. A single integrated system increases efficiency and quality of care by redirecting the handling of data from information processing to information management. The changing medical environment requires an integrated information system, on a single computer system or a network of computer systems, and a single data base.

Integrated systems and clinical systems will be integrated into the hospital's medical information system. Point-of-care information systems will use bedside terminals and workstations to update the patient data base and allow rapid access by physicians and nurses. The computerization of clinical operations is expected to follow. However, clinical labs are considered as a decentralized function of a hospital's information system. The challenge confronting hospitals is the integration of clinical information systems with its financial/patient system.

The nationwide increase in the number of HMOs and rapid growth rate forecast throughout the 1990s represent a lucrative segment of the health care industry. Because of fixed reimbursement payments to hospitals by HMOs, participating hospitals require a comprehensive interconnected information system. Hospitals will be seeking information systems providing immediate feedback on the profitability of participating in an HMO plan.

B

Physicians Segment

The rapid development of networking capabilities is offering many alternatives for linking physicians and other health professionals into the hospital's information system. The ability of physicians to tie into the hospital's information system from any location will enable a physician to monitor a patient's progress and reduce the time spent traveling and communicating between the physician's private practice and the hospital.

Hospitals are installing personal computers in physicians' offices. Hospitals are responding to physicians' interest in performance evaluation and obtaining quality of care and productivity measurements. Physicians are using this information to evaluate how their patients compare with other physician's patients in terms of length of stay, severity of illness, and hospital charges. The collaboration between a hospital and its physicians can be seen as a way to build patient volume and increase its referral base. Information systems that tie physicians to the hospital strengthen loyalties and increase the chances that physicians will practice primarily at the hospital.

C

"Other" Medical Segment

New health information services will emerge to conform with the changing sites of health care delivery. New types of delivery systems are emerging such as ambulatory care centers and home health care. These new alternative delivery systems or outpatient facilities will provide new markets and opportunities for information system vendors.

Increasingly, hospitals are diversifying their product lines enabling the hospital to offer a continuum of care. In a multiple facility environment, a patient may move between inpatient and outpatient status. Future systems will require the integration of inpatient and outpatient systems. Information on a patient must be current and accessible regardless of where the patient receives services.

The information system must be designed to support the multiple-entity medical environment and should be integrated, allowing the sharing of information among a variety of health care professionals and in a variety of locations.

VI

Conclusions and Recommendations

The challenge for information service vendors is to provide a fully integrated system that meets all aspects of a hospital's operations. Hospitals do not want a wide variety of different systems; they want systems that tie together all their needs and allow them to cope with the informational requirements for regulatory agencies and an intensively competitive environment.

Increasingly hospitals are moving into alternative health care delivery and joint ventures with physicians. Vendors need to move outside the hospital environment by providing systems to a variety of provider functions in remote locations. Vendors who can offer networked systems among hospitals, outpatient facilities, and physicians are likely to outperform their competitors.

As the health care industry expands its services, the number of users (physicians, nurses, pharmacists, technicians, etc.) and locations will increase, along with their information needs. The health care systems of the future will become increasingly complex and support various needs. In a diversified environment, standalone systems will be replaced by comprehensive information management tools.

A

Appendix: Definitions

Definitions of medical terms used are as follows:

- *HMOs (Health Maintenance Organizations)*—A patient pays a predetermined monthly fee for a range of health care services rather than paying for individual services rendered.
- *PPOs (Preferred Provider Organizations)*—These provide discount rate health care to plan members in exchange for prompt payment and a guaranteed patient base.
- *DRGs (Diagnosis Related Groups)* - System that catalogs illnesses requiring hospitalization and determines the length of stay and treatment guidelines for hospitals and physicians. The medical provider receives the same payment for every patient in a given DRG, no matter what the actual of length of stay and regardless of what real expenses are incurred.

B

Appendix: Forecast Data Base

EXHIBIT B-1

MEDICAL SECTOR FORECAST USER EXPENDITURES BY DELIVERY MODE 1987-1993

Sector by Delivery Mode	$ Millions								CAGR 1988-1993 (Percent)
	1987	Growth 1987-1988 (Percent)	1988	1989	1990	1991	1992	1993	
Total Medical Sector	2,767	17	3,218	3,761	4,391	5,125	5,997	7,031	17
Processing Services	899	15	1,026	1,155	1,299	1,461	1,643	1,848	13
Transaction Processing Services	425	12	475	528	586	650	722	802	11
Systems Operations	474	17	551	627	713	811	921	1,046	14
Network/Electronic Information Services	316	24	392	507	647	825	1,051	1,337	28
Electronic Information Services	201	24	247	310	382	468	569	685	23
Network Applications	116	25	145	197	265	357	482	651	35
Application Software Products	569	18	672	786	923	1,082	1,281	1,522	18
Mainframe	266	11	294	324	358	397	438	483	10
Minicomputer	199	15	229	263	303	341	391	447	14
Workstation/PC	104	44	150	198	262	344	452	592	32
Turnkey Systems	606	10	665	750	842	936	1,036	1,144	11
Systems Integration	117	40	164	207	260	326	404	498	25
Professional Services	260	15	299	355	419	494	581	682	18

EXHIBIT B-2

MEDICAL SECTOR—HOSPITAL FORECAST USER EXPENDITURES BY DELIVERY MODE 1987-1993

Sector by Delivery Mode	$ Millions								CAGR 1988-1993 (Percent)
	1987	Growth 1987-1988 (Percent)	1988	1989	1990	1991	1992	1993	
Total Hospital Segment	2,186	16	2,546	2,980	3,481	4,067	4,761	5,583	17
Processing Services	710	15	815	919	1,035	1,166	1,314	1,480	13
Transaction Processing Services	336	12	376	418	463	514	571	635	11
Systems Operations	374	17	439	501	572	652	743	846	14
Network/Electronic Information Services	250	24	310	404	518	661	843	1,071	28
Electronic Information Services	158	24	196	249	308	379	462	556	23
Network Applications	91	25	115	155	210	282	381	515	35
Application Software Products	450	18	531	621	729	855	1,012	1,203	18
Mainframe	210	11	232	256	283	313	346	382	10
Minicomputer	157	15	181	208	239	269	309	353	14
Workstation/PC	82	44	118	157	207	272	357	468	32
Turnkey Systems	479	10	524	592	663	737	814	897	11
Systems Integration	92	40	129	163	205	257	319	394	25
Professional Services	205	15	236	281	331	390	459	539	18

EXHIBIT B-3

MEDICAL SECTOR—PHYSICIAN FORECAST USER EXPENDITURES BY DELIVERY MODE 1987-1993

Sector by Delivery Mode	$ Millions								CAGR 1988-1993 (Percent)
	1987	Growth 1987-1988 (Percent)	1988	1989	1990	1991	1992	1993	
Total Physician Segment	498	15	574	666	774	900	1,049	1,228	16
Processing Services	162	12	181	201	225	250	279	312	12
Transaction Processing Services	77	11	85	94	105	116	129	143	11
Systems Operations	85	12	96	107	120	134	150	168	12
Network/Electronic Information Services	57	22	69	87	110	139	177	225	27
Electronic Information Services	36	20	43	52	62	75	90	108	20
Network Applications	21	25	26	35	48	64	87	117	35
Application Software Products	102	18	121	141	166	195	231	274	18
Mainframe	48	11	53	58	65	71	79	87	10
Minicomputer	36	15	41	47	55	61	70	81	14
Workstation/PC	19	44	27	36	47	62	81	107	32
Turnkey Systems	109	10	119	135	151	168	186	204	11
Systems Integration	21	40	29	37	47	59	73	90	25
Professional Services	47	15	54	64	75	89	105	123	18

EXHIBIT B-4

MEDICAL SECTOR—"OTHER" MEDICAL FORECAST USER EXPENDITURES BY DELIVERY MODE 1987-1993

	$ Millions								
Sector by Delivery Mode	1987	Growth 1987-1988 (Percent)	1988	1989	1990	1991	1992	1993	CAGR 1988-1993 (Percent)
Total Other Segment	83	18	98	115	135	159	187	220	18
Processing Services	27	15	31	35	40	45	50	56	13
Transaction Processing Services	13	12	14	16	18	20	22	24	11
Systems Operations	14	17	17	19	22	25	28	32	14
Network/Electronic Information Services	9	24	12	15	20	25	32	41	28
Electronic Information Services	6	24	7	9	12	14	18	21	23
Network Applications	3	25	4	6	8	11	14	20	35
Application Software Products	17	18	20	24	28	32	38	46	18
Mainframe	8	11	9	10	11	12	13	14	10
Minicomputer	6	15	7	8	9	10	12	13	14
Workstation/PC	3	44	4	6	8	10	14	18	32
Turnkey Systems	18	15	21	24	28	32	37	42	15
Systems Integration	4	40	5	6	8	10	12	15	25
Professional Services	8	15	9	11	13	15	17	20	18

C

Appendix: Reconciliation of 1987-1988 Forecast

Several changes contrast the 1988 medical sector forecast, with the 1987 forecast as shown in Exhibit C. First, INPUT forecasts a reduction of the application software market in 1992 reflecting lower revenues from vendors that were previously estimated. Variances between the 1987 and 1988 professional services market can be partially attributed to the inclusion of systems integration software expenditures in the 1987 forecast.

EXHIBIT C-1

MEDICAL SECTOR
DATA BASE RECONCILIATION OF
MARKET FORECAST BY DELIVERY MODE
($ Millions)

	1987 Market			1992 Market			CAGR 87-92	CAGR 87-92
Industry Sector	1987 Forecast	1988 Forecast	Variance (%)	1987 Forecast	1988 Forecast	Variance (%)	1987 Forecast (%)	1988 Forecast (%)
Total Medical Sector	2,820	2,655	6	5,910	5,590	6	16	16
Processing/Network Services	1,290	1,215	6	2,620	2,690	-3	15	17
Application Software Products	590	570	4	1,420	1,280	11	19	18
Turnkey Systems	630	610	3	1,020	1,040	-2	10	11
Professional Services	310	260	19	850	580	47	22	17

Note: INPUT's 1987 Professional Services forecast includes Systems Integration software revenues.

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About INPUT

INPUT provides planning information, analysis, and recommendations to managers and executives in the information processing industries. Through market research, technology forecasting, and competitive analysis, INPUT supports client management in making informed decisions.

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INPUT OFFICES

North America

Headquarters
1280 Villa Street
Mountain View, CA 94041
(415) 961-3300
Telex 171407 Fax (415) 961-3966

New York
280 North Central Avenue, Suite 303
Hartsdale, NY 10530-1894
(914) 682-8880 Fax (914) 682-8479

959 Route 46 East, Suite 201
Parsippany, NJ 07054
(201) 299-6999
Telex 134630 Fax (201) 263-8341

Washington, D.C.
8298 Old Courthouse Road
Vienna, VA 22182
(703) 847-6870 Fax (703) 847-6872

International

Europe
Piccadilly House
33/37 Regent Street
London SW1Y 4NF, England
(01) 493-9335
Telex 27113 Fax (01) 629-0179

Paris
29 rue de Leningrad
75008 Paris, France
(16) 44-80-48-43
Fax (16) 44-80-40-23

Japan
FKI, Future Knowledge Institute
Saida Building,
4-6, Kanda Sakuma-cho
Chiyoda-ku,
Tokyo 101, Japan
(03) 864-4026 Fax (03) 864-4114