U.S. SOFTWARE PRODUCTS MARKET

1988 - 1993

INPUT

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.

Continuous-information advisory services, proprietary research/consulting, merger/acquisition assistance, and multiclient studies are provided to users and vendors of information systems and services (software, processing services, turnkey systems, systems integration, professional services, communications, systems/software maintenance and support).

Many of INPUT's professional staff members have more than 20 years' experience in their areas of specialization. Most have held senior management positions in operations, marketing, or planning. This expertise enables INPUT to supply practical solutions to complex business problems.

Formed as a privately held corporation in 1974, INPUT has become a leading international research and consulting firm. Clients include more than 100 of the world's largest and most technically advanced companies.

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DECEMBER 1988

U.S. SOFTWARE PRODUCTS MARKET, 1988-1993

INPUT®

Market Analysis Program (MAP)

U.S. Software Products Market, 1988-1993

Abstract

This year's annual report provides analysis and five-year forecasts of the U.S. software product market for the period 1988-1993. The forecasts contained in this report segment the market into applications and systems software for mainframe, minicomputer, and PC/workstation platforms.

The five-year forecast period, using the base year of 1987, covers fifteen industry-specific and seven cross-industry applications software markets in addition to the three sectors of the systems software market. These three sectors are systems control, data center management tools, and application development tools.

The report also discusses issues and trends and provides recommendations on how vendors can take advantage of the forces driving the market.

The report contains 166 pages and 45 exhibits.

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Exhibits

Exhibits (Continued)

I

Introduction

Introduction

The *Software Products Market, 1988-1993* report is one of four annual updates provided as part of the Market Analysis and Planning Service. The four annual reports (one for each delivery mode) are:

- *Software Products Market, 1988-1993*
- *Processing/Network Services Market, 1988-1993*
- *Professional Services Market, 1988-1993*
- *Turnkey Systems Market, 1988-1993*

A
Purpose of This Report

This report reviews and analyzes the software market in three parts: 1) mainframe, 2) minicomputer, and 3) PC/workstations. Included in this reports are descriptions of the issues, trends and events driving these markets; a detailed five-year forecast of the markets and their subsets; a description of the forces that drive or inhibit the markets; a discussion of the leading vendors, their activities, and market share; and opportunities and recommendations for vendors to effectively leverage their presence in these markets.

B
Scope and Organization

The report presents market information on user expenditures in the various U.S. software markets that are noncaptive (expenditures that are competitively available or free to outside organizations). U.S. software markets are separated into applications and systems software segments, each of which is further divided by the two-digit level of industry identification provided by the federal government's Standard Industrial Classification (SIC) codes. These consist of fifteen vertical (industry-specific) and seven cross-industry sectors.

User expenditures are the dollars spent to procure the particular software product and may include markups based on the channel of distribution utilized. Companies, for example, that sell through a distribution channel (most micro software is sold in this fashion) receive roughly one-half the retail price. The other half supports the channel participant.

The report consists of six chapters and four appendices. These are:

- Introduction
- Executive Overview
- Market Size and Forecasts
- Issues and Trends
- Competition
- Conclusions and Recommendations
- Appendix A: Definitions
- Appendix B: Market Forecast Data Base, 1988-1993
- Appendix C: Data Base Reconciliation, 1987-1988
- Appendix D: Vendor Questionnaire

C

Information Services Industry Structure

Exhibit I-1 defines the scope of the information services industry that is tracked and analyzed by INPUT. There are six major delivery modes shown in the exhibit. In past years there have been only four. One change is that processing/network services, which was a single category, has now been divided into two. Similarly, professional services previously contained a submode for systems integration. The rapid growth of systems integration has prompted INPUT to create a separate market category and a report written separately for systems integration. Exhibit I-1 shows delivery modes and submodes tracked by INPUT. Annual market reports are written for each of the delivery modes shown and detailed discussions of all the submodes are included.

EXHIBIT I-1

INFORMATION SERVICES INDUSTRY STRUCTURE 1988

D
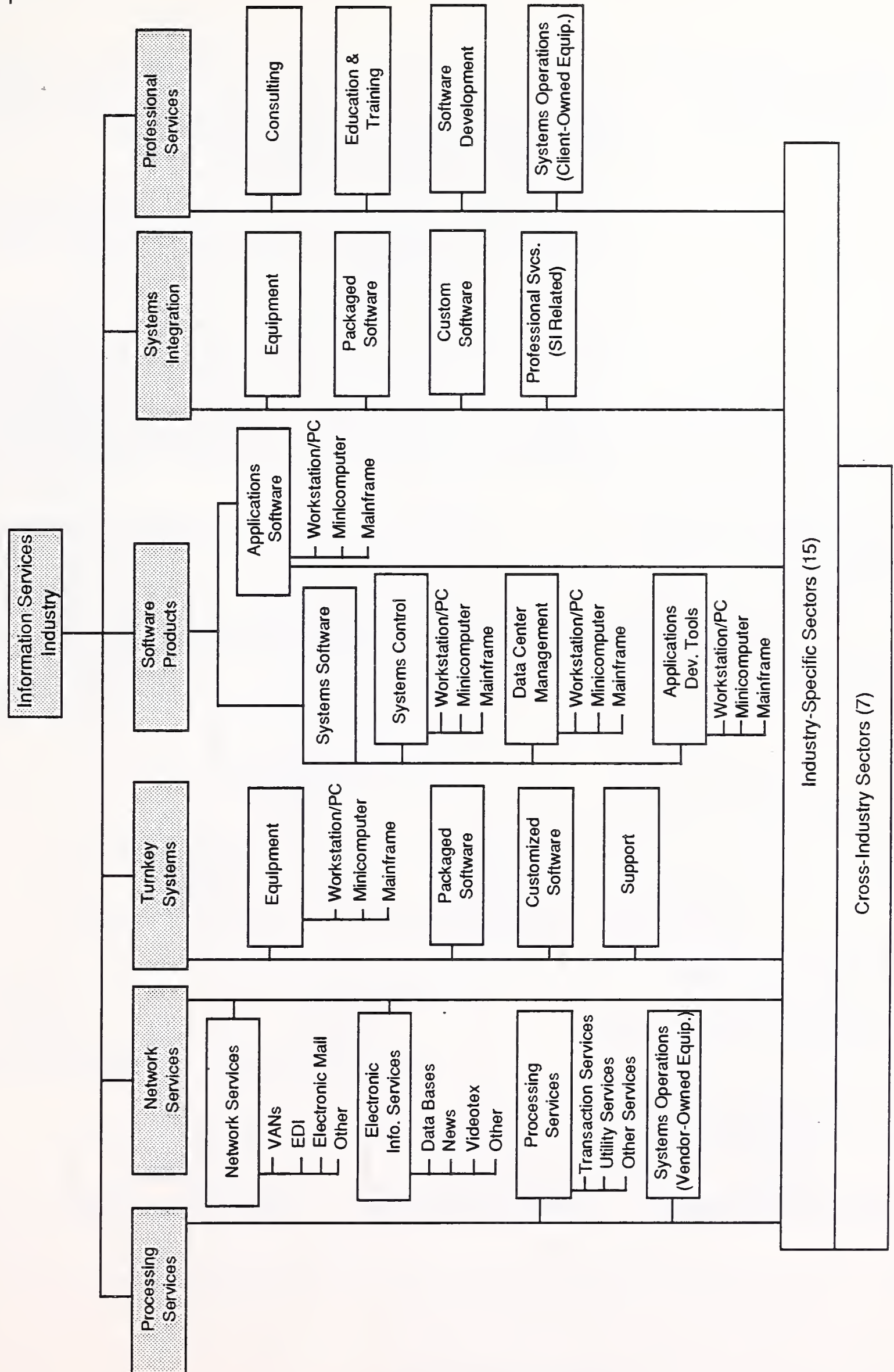
Software Products Market Structure

Exhibit I-2 portrays the structure of the software products market. It shows the software products market to be composed of two major categories: systems software and applications software.

Exhibit I-3 shows the systems software portion further structured into three main areas: systems control, data center management, and applications development (also known as applications enabling). Each of these areas is further described in terms of specific functions.

Exhibit I-4 shows the applications software portion structured into two main areas: cross-industry and industry-specific. Each of these areas in turn are broken down into sectors. Industry-specific sectors are the same as the fifteen sectors reported in the MAPS binders wherein vertical market information is provided. Similarly, cross-industry sectors are the same as those reported in the general MAPS cross-industry reports.

EXHIBIT I-2

SOFTWARE PRODUCTS MARKET STRUCTURE

```
                        Software
              ┌────────────┴────────────┐
         Systems                    Applications
         Software                     Software
              │                ┌──────────┴──────────┐
              │             Cross-              Industry-
              │            Industry              Specific
    ┌─────────┼──────────────────┐
 Systems   Data Center      Applications
 Control   Management       Development
```

MAD3

EXHIBIT I-3

SYSTEMS SOFTWARE PRODUCTS
MARKET STRUCTURE

Systems
Software

| Systems Control | Data Center Management | Applications Development Tools |

Systems Control
- Access Control
- Communications Monitors
- Micro-Mainframe Links
- Network Control
- Operating Systems
- Security Systems
- System Library Control
- Windowing Systems
- Other

Data Center Management
- Capacity Management
- Computer Operations
  Scheduling
- Data Center Management
- Disk Management
- Downtime/Repair
  Monitoring Management
- Job Accounting
- Performance Monitors
- Tape Management
- Utilities
- Other

Applications Development Tools

Program Development
and Production Tools

- Applications Generators
- Assemblers
- Automatic Documentation
- Compilers
- Debugging Aids
- Languages
  (All Generations)
- Systems Development
  Control
- Retrieval Systems
- Translators
- Other 4GL
  T CASE

Contingent on Management (handwritten)

Data Base
Management Systems

- Data Base Management
  Systems
- Data Dictionaries
- Other

EXHIBIT I-4

APPLICATIONS SOFTWARE PRODUCTS
MARKET STRUCTURE

```
                        Applications
                          Software
                              |
        ┌─────────────────────┴──────────────────────┐
   Cross-Industry                              Industry
                                                Specific
```

Accounting	Human Resources	Education & Training
• Accounts Payable	• Benefits	• Authoring
• Accounts Receivable	• Payroll	Languages
• Fixed Assets	• Personnel	• Computer-
• General Ledger	• Other	Assisted
• Purchasing		Instruction
• Other		• Other

Industry Specific

- Banking & Finance
- Discrete Manufacturing
- Distruibution (Retail & Wholesale
- Education
- Federal Government
- Insurance
- Medical
- Process Manufacturing
- Services
- State & Local Government
- Telecommunications
- Transportation
- Utilities
- Other

Planning & Analysis	Engineering & Scientific	Other Cross-Industry
• Budgeting	• Chemical/Biological	• Business Graphics
• Financial Planning	• Electrical	• Sales, Marketing &
• Forecasting	• Mechanical	Distribution
• Integrated Analysis Systems	• Piping	• Word Processing
• Modeling	• Nuclear	• Desktop Managers
• Spreadsheet Systems	• Statistics/Operations Research	• Other
• Project Management	• Structural Analysis	
• Other	• Other	

E
Research Methodology

INPUT methodology for data collection, analysis, and forecasting is shown graphically in Exhibit I-5. During the second quarter of 1988, INPUT conducted in-depth interviews with 910 Information Services Vendors, including nearly all of the largest 250 firms. The smallest of the 250 generated very small revenues per company.

Of the total 910 companies, the smaller 660 ranged in size from $250,000 to $20 million in revenues. Collectively, revenues from all 910 firms represented 70% of the total information services industry revenues.

In the minority of survey contacts of larger vendors where revenues were not available, INPUT estimated these revenues from its own contacts and secondary sources. This was done for all identified firms above $10 million in annual revenues. For smaller firms with revenues below $20 million (and not specifically covered in the survey), INPUT created its own estimates based on the number of such firms identified in each delivery mode, and the expected average annual revenue of such firms.

The sum of these surveys and estimates produced the initial vendor revenue estimates for 1987. From this figure, INPUT subtracted revenues identified as:

- International (non-U.S.)
- Captive within any organization
- Acquisition (only for growth rate calculations)

The revenue data in this report include only the following:

- U.S. revenues—Only revenues derived from products or services sold in the U.S. All foreign revenues are excluded.

- Information service revenue—Revenues from applications and systems software products only.

- Noncaptive revenues—Only revenues available to all vendors in a competitive marketplace are included. Revenues derived from sales to the partners of affiliated organizations are excluded.

- Calendar year revenues—Approximately 30% of the vendors surveyed have fiscal years that do not coincide with calendar years. Revenues of these companies have been adjusted to a calendar year basis for consistency.

- Rounding to the nearest $2 million for specific vendors was done to normalize for the lesser degree of accuracy where data was estimated by INPUT.

EXHIBIT I-5

INPUT RESEARCH METHODOLOGY

I. BASE YEAR SURVEY CALCULATIONS

Vendor Surveys

- 900 Vendors
- 250 Largest
- 1986,1987 Revenues
  - Growth Rates
  - Vertical & Cross-Industry Markets

Universe (20,000 Vendors)

Data Cleansing

- International Dollars
- Captive Dollars
- Acquisition Dollars
- Calendarizing

Projecting Sample to Universe

> $10 Million Revenues & Firms
$.25 - 10 Million Revenues
< $.25 Million Revenues

7 Delivery Modes

22 Vertical & CI Markets

Aggregation of Vendor Revenues

Adjustment for Distribution Channels

- Retail Software Sales
- Inter-Industry Transactions VARS

User Expenditures

1987 Base Year

II. FORECASTS

User Survey & Analysis (500 Interviews)

Forecasts

Industry Analysis

- Budgets
- Spending Plans
- Technology Needs
- Applications
- Driving/Inhibiting Forces

- Economy (Macro)
- Economy (Micro)
- Technology Impact
- Markets (22) Analysis
- Vendor Consolidations and Strategies

Reconciliation

- Markets vs. Delivery Modes
- Prior Years
- Other Segments

5-Year Forecasts Reports

- Overview
- 7 Delivery Modes
- 22 Vertical/CI Markets

- Revenues reported by private companies, subsidiaries of larger corporations, computer manufacturers, and CPA firms are generally subject to a wider margin of error than revenues of other companies.

Companies that are not exclusively involved in information services are identified as follows:

- If a division or its subsidiary markets all information services for a company and is generally known by the name of that group, then it is identified by that name rather than the parent's name.

- If more than one division or subsidiary markets information services, the information is included in, and identified by, the parent's name.

- Organizations are reported according to their legal status as of the end of December, 1987.

Companies have been classified according to the delivery mode of service from which they derive the largest proportion of their U.S. noncaptive information service revenues.

Total base year (1987) revenues are then separated into six delivery modes and twenty-two vertical/cross-industry segments for closer analysis and five-year forecast projections.

INPUT considers industry revenues to include two separate subsets of data: (1) user expenditures, which equate with market size; and (2) vendor revenues. For certain delivery modes, vendor revenues and user expenditures are fairly close. However, many microcomputer software products, for example, are marketed through indirect distribution channels, such as retail stores, OEMs, and VARs, where conversion factors must be applied to determine the total market size from vendor revenues. In addition, some software is sold by vendor into other information services sectors, such as processing and network services companies. This software could be used in these other information services sectors' data centers and never passed on to an end-user. INPUT deletes such intraindustry transactions for its user expenditures market.

The following table shows the various conversion factors used by INPUT to convert vendor revenues to end-user expenditures (market size) figures for each delivery mode:

Application Software	1.18 (reflecting retail stores, etc.)
Systems Software	1.10
Turnkey Systems	.99 (a reduction due to intraindustry transactions)
Systems Integration	.99 (a reduction due to intraindustry transactions)

Professional Services .99 (a reduction due to intraindustry
                            transactions)
Network Services   .99 (a reduction due to intraindustry
                            transactions)
Processing Services   .99 (a reduction due to intraindustry
                            transactions)

For the 1987 user expenditures defined, INPUT projects five-year market growth rates for each delivery mode and vertical/cross industry market, based on its own analysis of technology, economic outlook, vendor activity, and driving and inhibiting forces affecting each market.

F
Economic Assumptions

In developing the five-year forecast, INPUT has incorporated the following economic assumptions regarding the outlook for the total U.S. economy, and the impact on the software delivery modes within the information services industry. Details are in Exhibits I-6.

EXHIBIT I-6

GNP NOMINAL GROWTH RATE ASSUMPTIONS

	Percent						
	1987A	1988A	1989E	1990E	1991E	1992E	1993E
Real GNP	3.4	3.8	2.8	2.5	2.8	3.0	3.0
*GNP Deflator	3.3	3.4	5.5	5.0	5.0	4.5	4.5
Nominal GNP	6.7	7.2	8.3	7.5	7.8	7.5	7.5

*Year-to-Year Comparisons

It is assumed that software developers will continue to be able to pass along most of the wage-related and other inflationary costs pressures through price increases. Expectations for an acceleration in mergers and strategic alliances should contribute to pricing strength in the industry. Software investments are also generally viewed as enhancing productivity, and therefore software sales have historically tended to be relatively immune from more mild economic slowdowns. (Exhibit I-7 indicates INPUT's expectation for real and nominal growth rates in the systems and applications software products markets over the next five years.)

EXHIBIT I-7

GROWTH RATES BY DELIVERY MODE
(Percent)

SYSTEMS SOFTWARE

	1987A	1988E	1989E	1990E	1991E	1992E	1993E
Real Growth	26.7	17.6	16.5	16.0	16.0	15.5	14.5
Price Deflator	3.3	3.4	5.5	5.0	5.0	4.5	4.5
Nominal Growth	30.0	21.0	22.0	21.0	21.0	20.0	19.0

APPLICATIONS SOFTWARE

	1987A	1988E	1989E	1990E	1991E	1992E	1993E
Real Growth	20.7	19.6	16.5	15.0	14.0	15.0	15.0
Price Deflator	3.3	3.4	5.5	5.0	5.0	4.5	4.5
Nominal Growth	24.0	23.0	22.0	20.0	19.0	18.0	18.0

INPUT projects that the total information services market will expand at a 17% compound annual growth rate over the next five years, from $80 million in 1988 to $175 billion in 1993. For 1987, the information services market totaled $67 billion, representing a 20% growth rate over 1986. The 1987-1988 growth rate is projected at 18%.

The modest estimated decline in the annual growth rate reflects INPUT's projection of a slowing in real GNP growth over the next two to three years and the maturing of market growth in a number of generic application software market products. Real GNP growth is projected to decrease from the 3.8% annual rate in 1988 to a range of 2.5% to 2.8% over the next three years before returning to the 3% range in the early 1990s. The inflation rate, as measured by the GNP deflator, is expected to increase modestly between 1988 and 1993.

Primary expectations affecting INPUT's outlook for nominal GNP growth rates over the next five years include a continuing slowing in consumer spending (related to modest increases in real consumer income); further slowing in the rate of increase in federal defense spending (related to the need to reduce the federal budget deficit); product cycle maturation in certain key technology sectors, such as the low end of the personal computer market and in minicomputers; and higher interest rates, particularly in the near term and reflecting pent-up inflationary cost pressures.

Historically, the information services industry has been more resilient to slowdowns in real GNP growth (reflecting unit shipments) than have companies in the electronic components and equipment sectors. However, the ability to pass on inflationary pricing pressures is more varied in the information services industry, reflecting the particular labor/ material mix in the cost structure of individual delivery modes.

II

Executive Overview

II
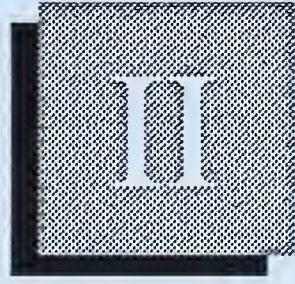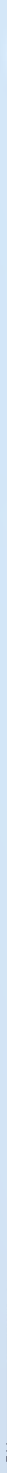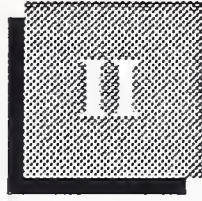
Executive Overview

A

Information Services Markets

Beginning with its 1987 market survey, INPUT subdivided the information services markets (which represent end-user expenditures) into seven delivery modes: processing services, network services, applications software, systems software, turnkey systems/VARs, systems integration, and professional services. This division represents an expansion in the number of delivery modes from four in 1986. Changes include a division of the software products markets into two submodes (applications and systems software products); the division of processing/network services into separate delivery modes; and the addition of the systems integration delivery mode, which reflected in large part a re-definition of companies formerly ascribed to professional services.

The total market for information services in 1987 was $67.4 billion. These figures includes systems integration hardware of approximately $2 billion, which was not included in INPUT's 1986 Information Services Market survey. Including systems integration software and hardware, total expenditures for information services in 1986 were $56 billion, which indicates that the information services market increased approximately 20% from 1986 to 1987.

INPUT is projecting an 18% growth rate in the information services market in 1988, with a five-year CAGR of 17% between 1988 and 1993. The modest slowing in the five-year growth rate forecast, compared with the annual increase of 27% from 1986 to 1987, reflects INPUT's belief that there will be a modest slowing in real GNP growth over the next two to three years, and a number of the generic software products groups will begin to reflect product life cycle maturation. Also, the stronger growth exhibited in 1987 reflected a recovery from the soft years in the technology markets from 1984 into 1986.

B
Software Products Market Size

When combined, applications and systems software were a $20.6 billion market in 1987. These combined categories represented the largest information services market in 1987, compared to $16.2 billion in 1986. As shown in Exhibit II-1, the systems software products market in 1987 was $9.9 billion, which reflected a growth rate of 30% over 1986. The applications software products market expanded from $8.6 billion in 1986 to $10.7 billion in 1987, indicating an annual growth rate of 24%.

Exhibit II-2 compares the software products market to the other delivery modes of the information services industry. Processing services was the single largest information services sector, with $16.8 billion in market revenues compared to $14.8 billion in 1986, reflecting an annual growth rate of 14%. However, because of its faster growth rate, the software products market will continue to be the largest segment in the information services industry over the next five years.

EXHIBIT II-1

SOFTWARE PRODUCTS MARKET BY TYPE
1986-1987

- Applications Software
- Systems Software
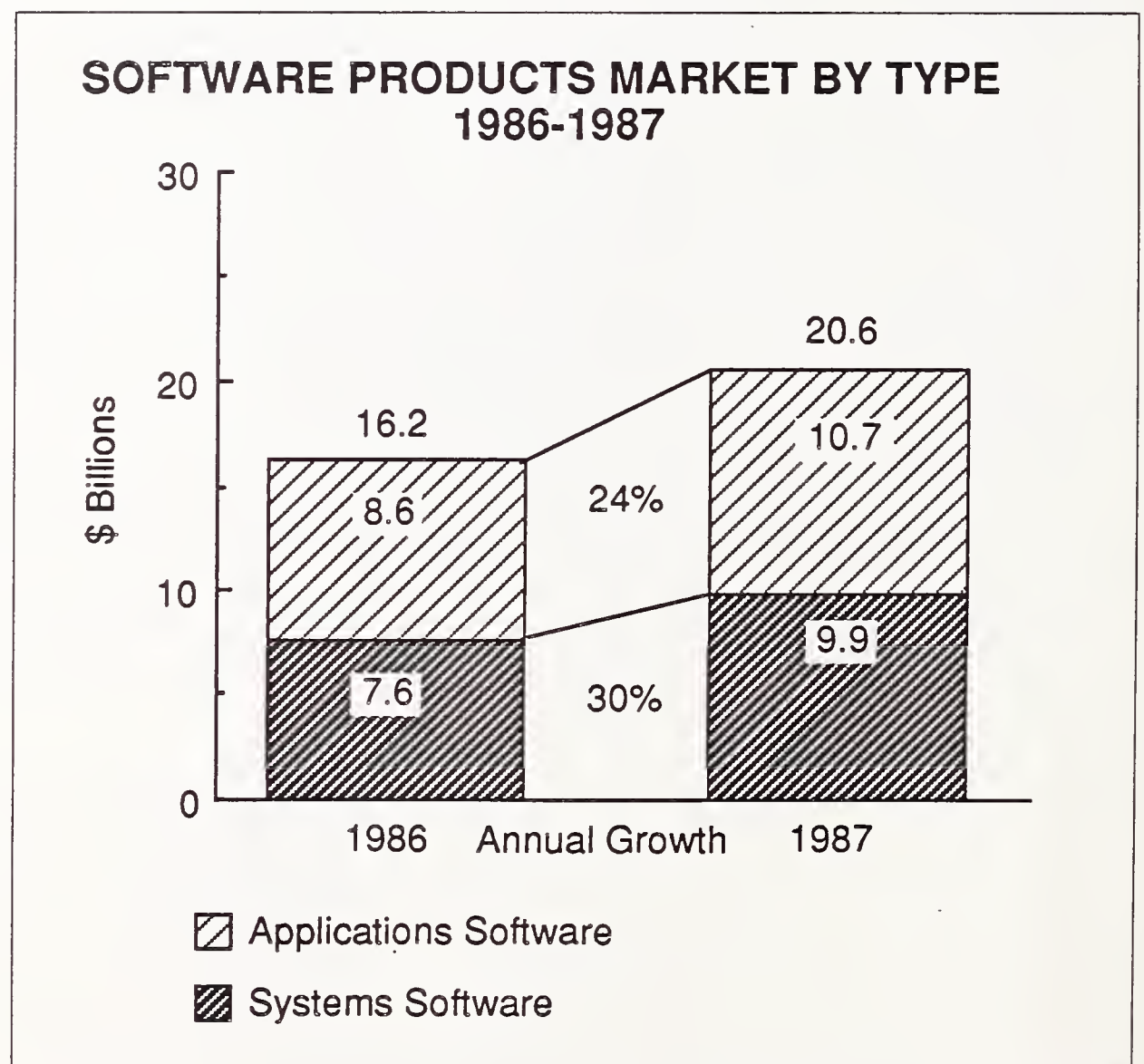
EXHIBIT II-2

USER EXPENDITURES
INFORMATION SERVICES, BY DELIVERY MODE
1988-1993

Delivery Mode	CAGR (Percent)
Processing Services	12
Network Services	23
Software Products	20
Turnkey Systems	10
Systems Integration	25
Professional Services	16

Processing Services: 18.9 (1988), 32.8 (1993)
Network Services: 6.2 (1988), 17.2 (1993)
Software Products: 25.1 (1988), 61.1 (1993)
Turnkey Systems: 9.5 (1988), 15.2 (1993)
Systems Integration: 4.8 (1988), 14.7 (1993)
Professional Services: 15.0 (1988), 32.2 (1993)

User Expenditures
($ Billions)

Legend: 1988, 1993

As shown in Exhibit II-3, the combined CAGR in the applications and systems software products markets over the next five years is projected at 20%, from $25 billion in 1988 to approximately $61 billion in 1993.

Of the six delivery modes in the information services market, software is projected to experience the third highest growth rate. Systems integration is expected to show a 25% CAGR over the next five years, and network services a 23% CAGR. This reflects the fact that the latter two represent less mature markets and are much smaller relative to the software products group. With the large installed base of standalone computers from a number of vendors, the major opportunity in the information services industry is to provide for network solutions. For software vendors, this means they should pursue strategic alliances with systems integration vendors as well as look to providing more network application software products.

EXHIBIT II-3

TOTAL SOFTWARE PRODUCTS EXPENDITURES
(Applications and Systems Software)
1988-1993

User Expenditures ($ Billions)

- ☑ Applications Software
- ☒ Systems Software

80 —

61.1

60 —

30.3

40 —

19%

25.1

13.0

20 —

30.7

12.1

21%

0 —

1988   CAGR   1993
              20%

Note: Numbers do not add due to rounding
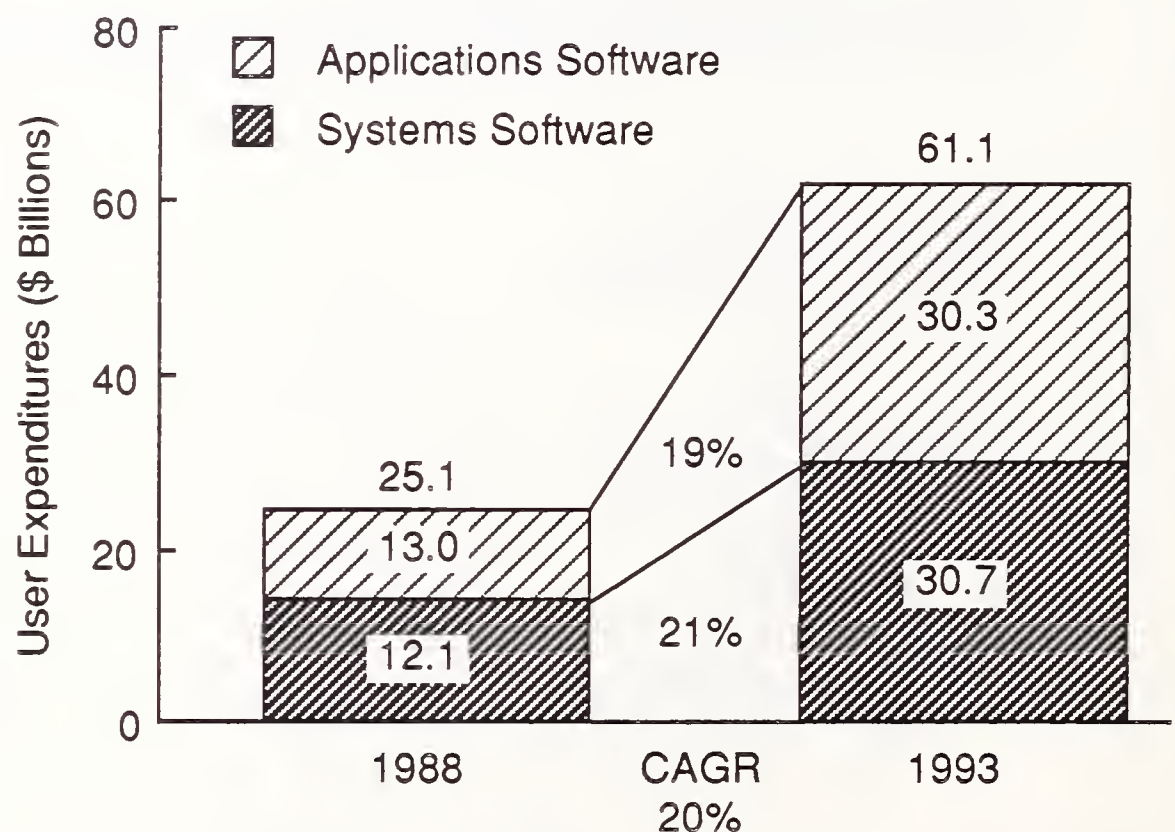
Exhibit II-4 shows INPUT's projections for software products growth by platform type.

EXHIBIT II-4

TOTAL SOFTWARE PRODUCTS
MARKET FORECAST
BY PLATFORM TYPE
1988-1993

CAGR

Mainframe 10.3 / 18.9   13%

Mini 8.2 / 17.2   16%

Micro 6.6 / 25   30%

0   10   20   30

$ Billions

▨ 1988
▨ 1993

C
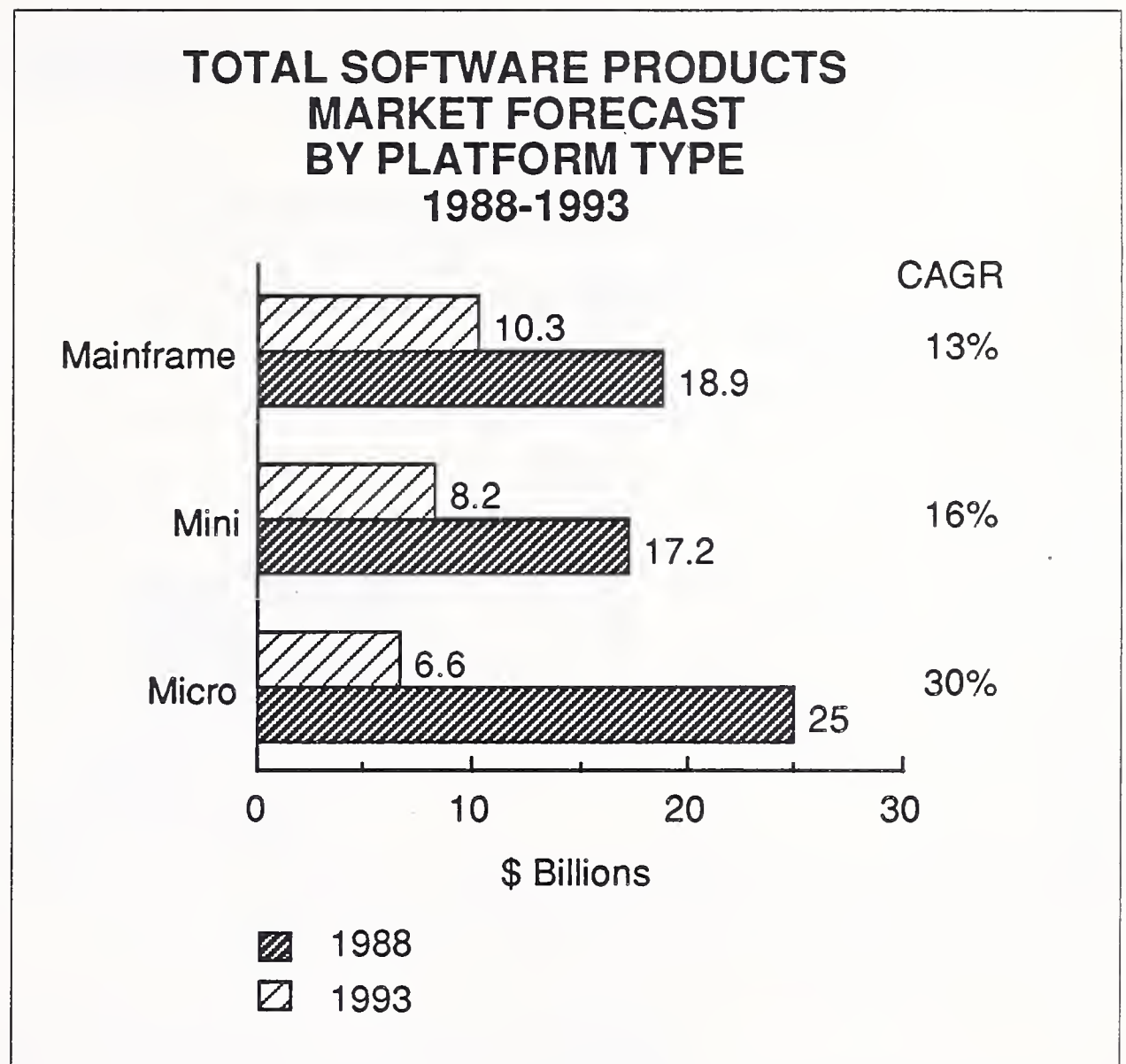
Applications Software Products Market, 1988-1993

As indicated in Exhibit II-3, the applications software products markets are projected to show a CAGR of 19% over the next five years, compared to the 21% CAGR projected for systems software products. This reflects INPUT's belief that several of the more generic applications software products markets (which are included in cross-industry markets) are becoming mature markets. Applications software market submodes are shown in Exhibit II-5.

The major growth opportunities in the applications software products group over the next five years will be: in the vertical (industry-specific) markets; as part of total solution product offerings (representing the bundling of software product groups); in systems integration solutions; in network applications; and in applications with embedded intelligence capabilities.

Of the various hardware platforms, workstations/PCs are expected to show the highest growth rate, as shown in Exhibit II-6. This high growth rate reflects the vast improvements in the cost/performance ratio in these

EXHIBIT II-5

**APPLICATIONS SOFTWARE MARKET SUBMODES
1988-1993**
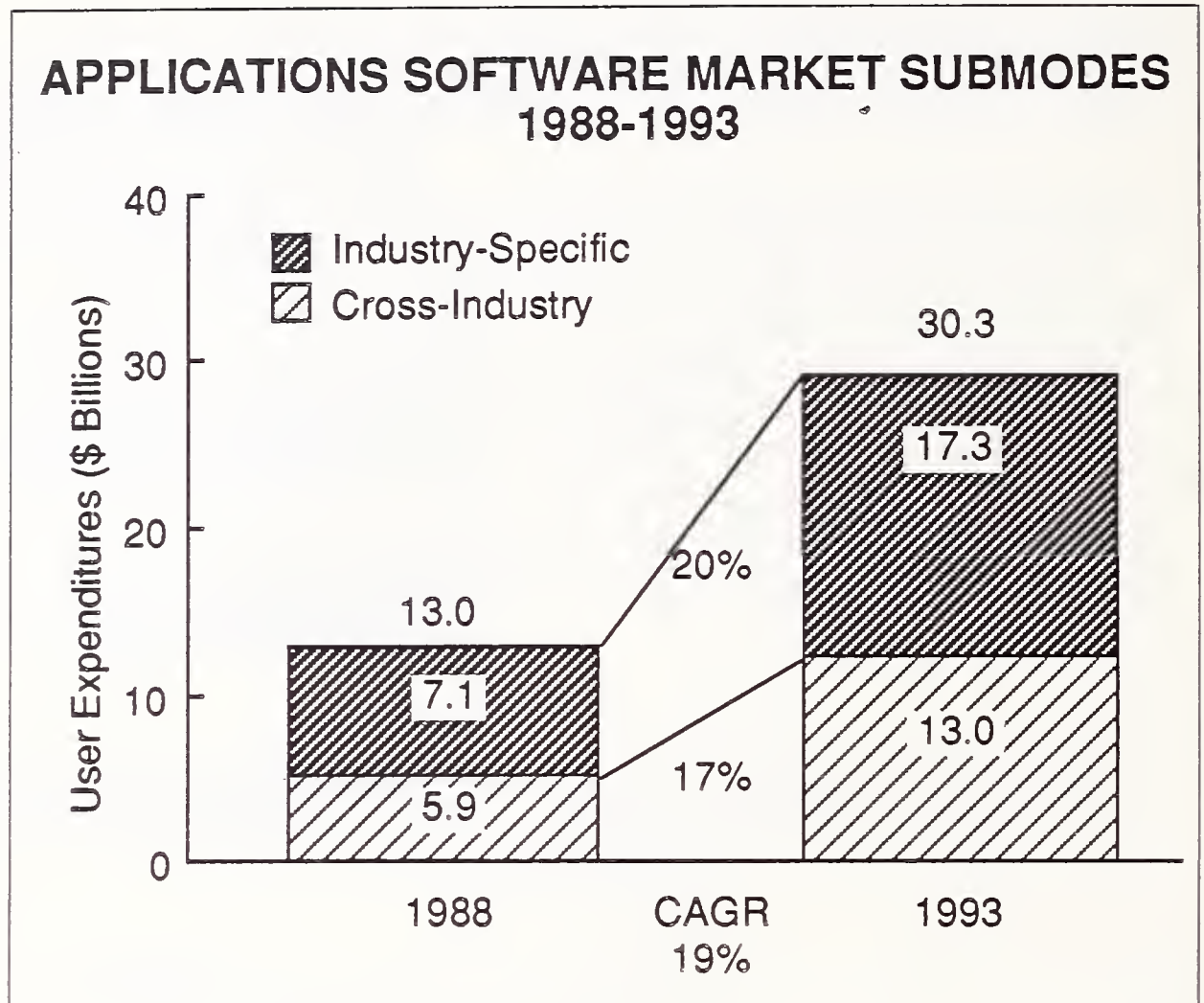
platforms over the past two years and the major reduction in cost per megabyte in small-format Winchester disk drives. Also, early on, work-station computer systems manufacturers stressed network solutions as well as open architectures (i.e., Sun Microsystems), trends that are expected to accelerate over the next five years.

EXHIBIT II-6

APPLICATIONS SOFTWARE PRODUCTS MARKET
BY HARDWARE PLATFORM
1988-1993

Year	Revenue by Platform ($ Billions)			
	Mainframe	Minicomputer	Workstation/PC	Total
1988	4.3	4.1	4.6	13.0
1993	6.8	8.0	15.5	30.3
Growth Rate (Percent)	10	14	28	19

D
Systems Software Products Market, 1988-1993

As indicated in Exhibit II-7, the fastest growing portion of the systems software market over the next five years is expected to be in application development tools. This reflects the tremendous need to improve the productivity of software product development, the increasing complexity of software product development requirements, and a parallel maturing of capabilities in application development technologies, such as CASE, 4GL/RDBMS, and the Expert Systems Application Development Environment, and much more sophisticated integration strategies. The more complete CASE solutions can significantly improve upon the quality of the product as well as the efficiencies of development (with reusable code). Industry studies suggest that approximately 70% of software programming today is concerned with program maintenance. Reverse engineering CASE products that have begun to appear over the past years significantly improve the efficiencies of software maintenance. The need for development of standards in the CASE community is also beginning to be seriously addressed.

Another opportunity for systems software developers exists in bundling established systems software products (such as RDBMS) with other types of systems software products as well as application software products.

Oracle, for example, has announced new products in financial applications that will be bundled with its RDBMS product, and has developed a joint marketing agreement with Verity, Inc., a sophisticated start-up company in the text retrieval market, which should lead to connectivity between the products of the two companies. (Verity has also signed other co-marketing agreements, including ones with Sybase and Informix in the RDBMS market.) Oracle has also announced plans to enter the office systems market (with an initial E-Mail product offering) and has established professional services and systems integration programs. This type of integration strategy represents the potential for extending its recent strong growth rate in the RDBMS market as this market begins to mature over the next five years.

EXHIBIT II-7

SYSTEMS SOFTWARE MARKET BY SOFTWARE TYPE 1988-1993
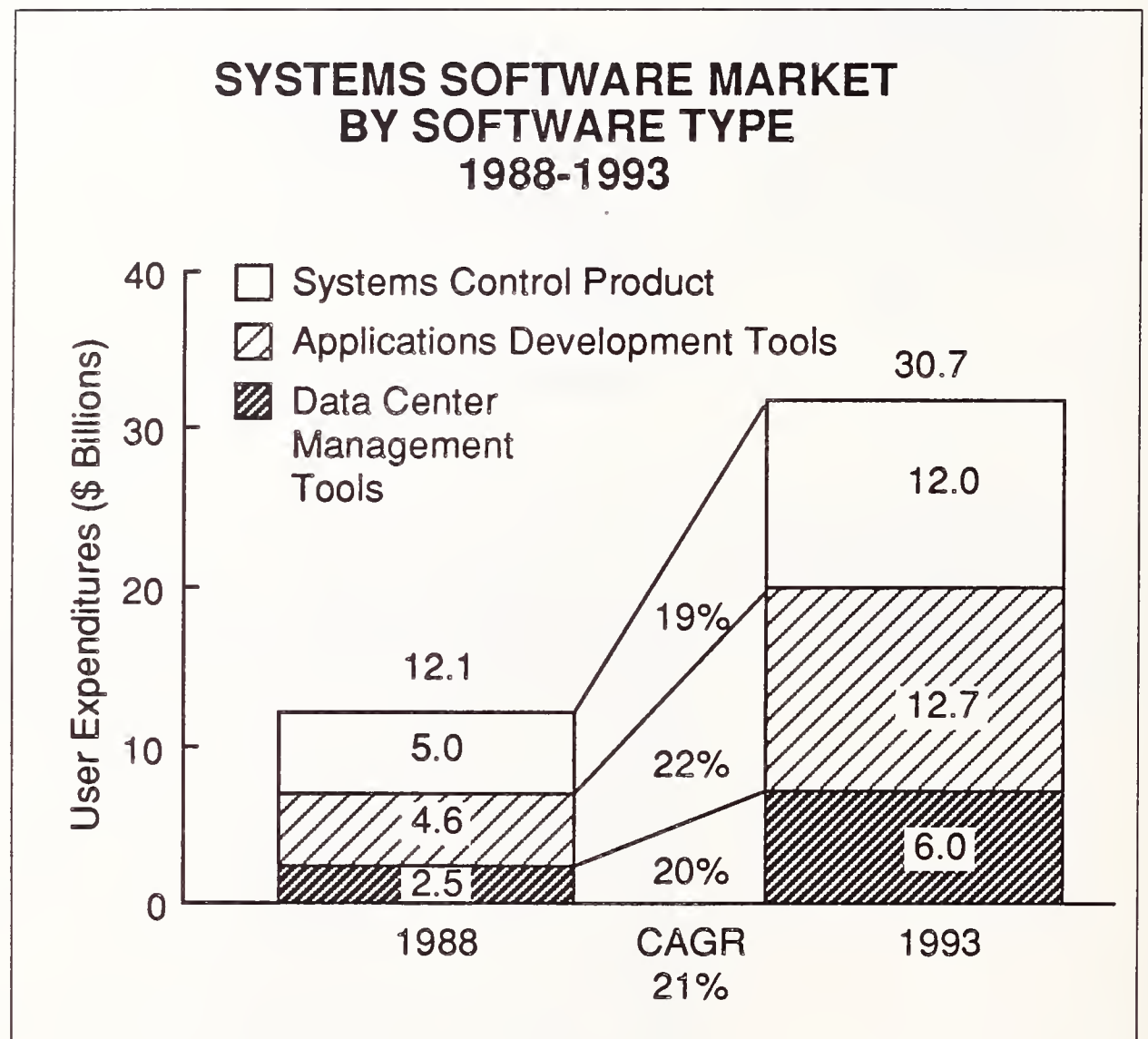
E
Conclusions and Recommendations

Exhibit II-8 summarizes the major conclusions of this report.

- Look to integrating application solutions, such as in the desktop publishing environment, and to bundling systems and software product offerings into a total solution product. Expand into the related support services markets, including professional services such as consulting, education and training, and possibly facilities management to maintain account control as well as to increase revenue growth. Products should be increasingly oriented toward the needs of the end user, including extensive on-line help programs and conceptually well-written documentation manuals.

- Evaluate potential alliances to increase marketing clout and to bring new products to market faster as product life cycles decrease.

- Open up systems architectures to encourage third-party software vendor partnerships. Move toward increased incorporation of standards in product offerings to increase product flexibility and thus market potential.

- Migrate product development to include an emphasis on workstation/ PC programs and distributed processing solutions. This includes evaluating program development tools that provide for multiplatform, multivendor portability.

- Look to the vertical (industry-specific) markets for higher growth potential in applications software products. For independent software developments, examine potential alliances with the leading computer systems vendors, many of which are now seeking rapid-entry paths in the industry-specific markets.

- Along with the trend to distributed processing computer/network architectures of the future, end-user access to computer programs will continue to increase significantly. Therefore, programmers must consider special needs of the nonprofessional computer specialist in new applications.

EXHIBIT II-8

22

CONCLUSIONS AND RECOMMENDATIONS

- Integrate Functionally to Increase Market Potential

- Increase Usage of Application Development Tool Technologies

- Establish Alliances to Strengthen Marketing Clout

- Work with Standards

- Expand Support Services Product Offerings

- Develop Distributed Computing Solutions

- Evaluate Product Opportunities in Industry-Specific Markets

- Emphasize End User Programming Solutions

Market Size and Forecasts

III
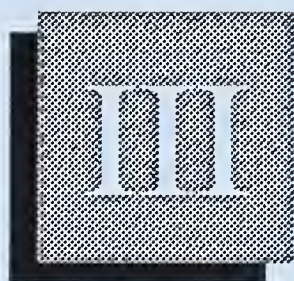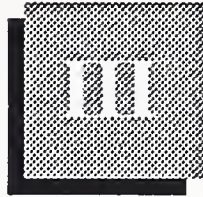
Market Size and Forecasts

A

Market Forecasts

1. Overall Market, 1988-1993

a. Overview

In the current report, INPUT subdivided the applications and systems software markets for the first time into all three major hardware platforms: mainframes, minicomputers, and PC/Workstations. In prior reports, the mainframe and minicomputer markets were commonly sized.

As indicated in Exhibit III-1, INPUT is estimating that the combined applications and systems software markets will expand from $25.1 billion in 1988 to $61.1 billion in 1993, for a CAGR (compound annual growth rate) of approximately 20%. This reflects a slightly higher growth rate than INPUT's projections of 17% growth for the entire information services market during the comparable period. Of the projected total market of $79.5 billion for information services in 1988, the software products market is projected to represent 31% (see Exhibit III-2).

Particularly strong growth is anticipated for workstation/PC software, reflecting the strong trend in computer processing to distributed solutions (see Exhibit III-3). Workstation/PC software sales are projected to increase from $6.6 billion in 1988 to $25.0 billion in 1993, for a CAGR of 31%. The much slower compound annual growth rate projections of 16% for minicomputer software and 13% for mainframe software reflect INPUT's slower growth rate expectations for minicomputer and mainframe platform shipments than for workstations over the next five years. INPUT is projecting a 3% compound annual unit growth rate in mainframe computer shipments over the next five years and an 8% compound annual unit growth in minicomputers during the same period. The market for workstation and high-end desktop PC platforms is projected to expand at an annualized rate of 30%, and the general personal computer is ex-

TOTAL SOFTWARE PRODUCT EXPENDITURES, 1988-1993
(Applications and Systems Software)

Overall CAGR = 20%

☑ Application Software
▨ Systems Software
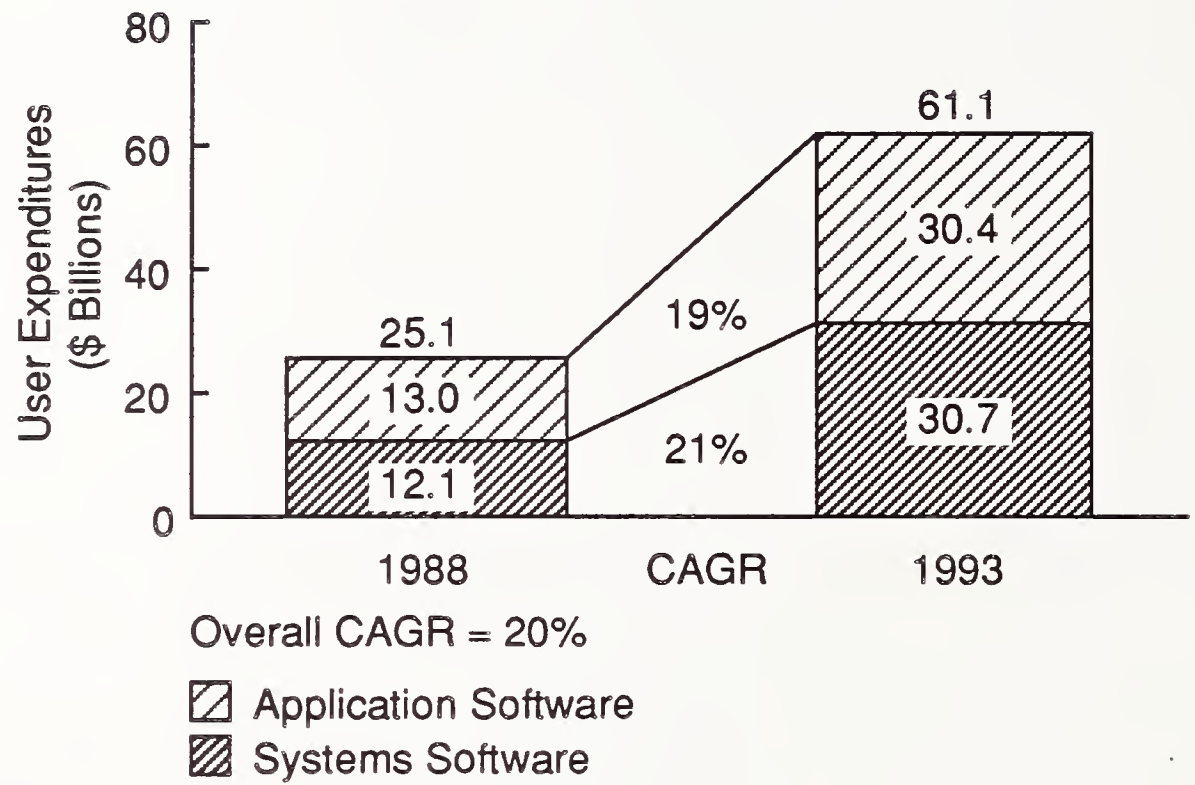
**PROJECTED INFORMATION SERVICES
MARKET BY DELIVERY MODE—1988**

Systems
Integration

Network
Services

6%

8%

Processing
Services
24%

Turnkey
Systems
12%

Systems
Software
15%

Professional
Services
19%

Application
Software
16%

$79.5 Billion
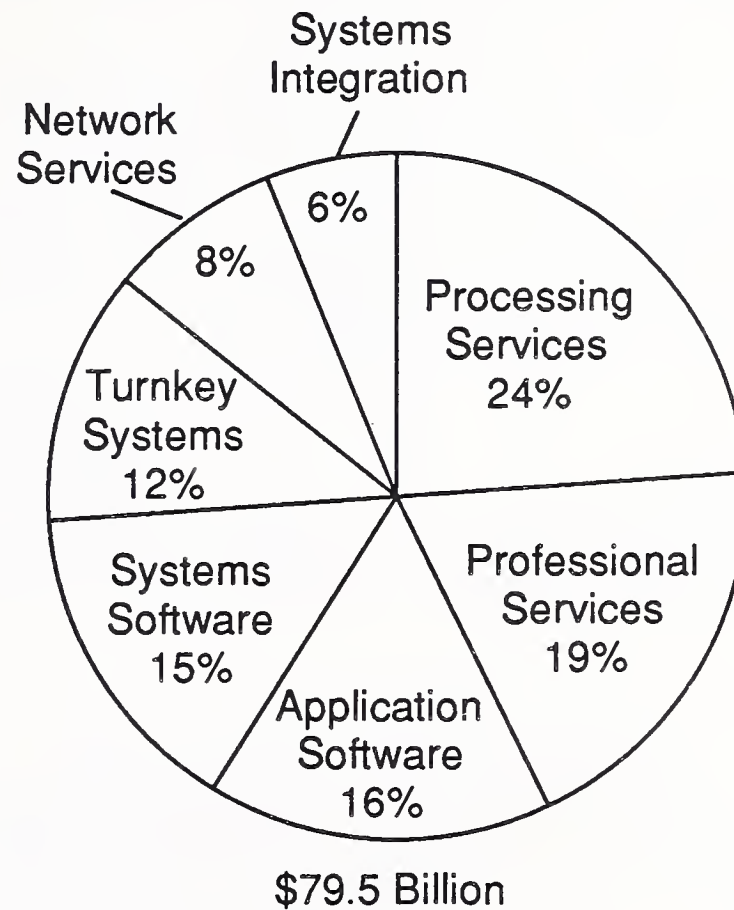
pected to grow at an approximate 13% compound annual rate. The major growth in the workstation/PC hardware platforms is projected to be for client/server network implementations.

b. Software Products Environment

The general software products environment is currently being buffeted by a confluence of internal and external forces that will have major impact on the direction of the software industry over the next several years.

As shown in Exhibit III-4, various internal and external factors affecting the software product environment include the following:

Internal Factors:

• Industry Specialization—Much of the strong revenue growth among the leading independent software developers in recent years has come from providing broad-based solutions targeted across a number of industry groups. A current focus, particularly of the larger computer systems

EXHIBIT III-3

SOFTWARE PRODUCTS MARKET FORECAST
1988-1993
BY HARDWARE PLATFORM

Overall CAGR = 20%

User Expenditures ($ Billions)

- Workstation/PC
- Minicomputer
- Mainframe

1988 — 25.1: 6.6 / 8.2 / 10.3

CAGR — 31% / 16% / 13%

1993 — 61.1: 25.0 / 17.2 / 18.9
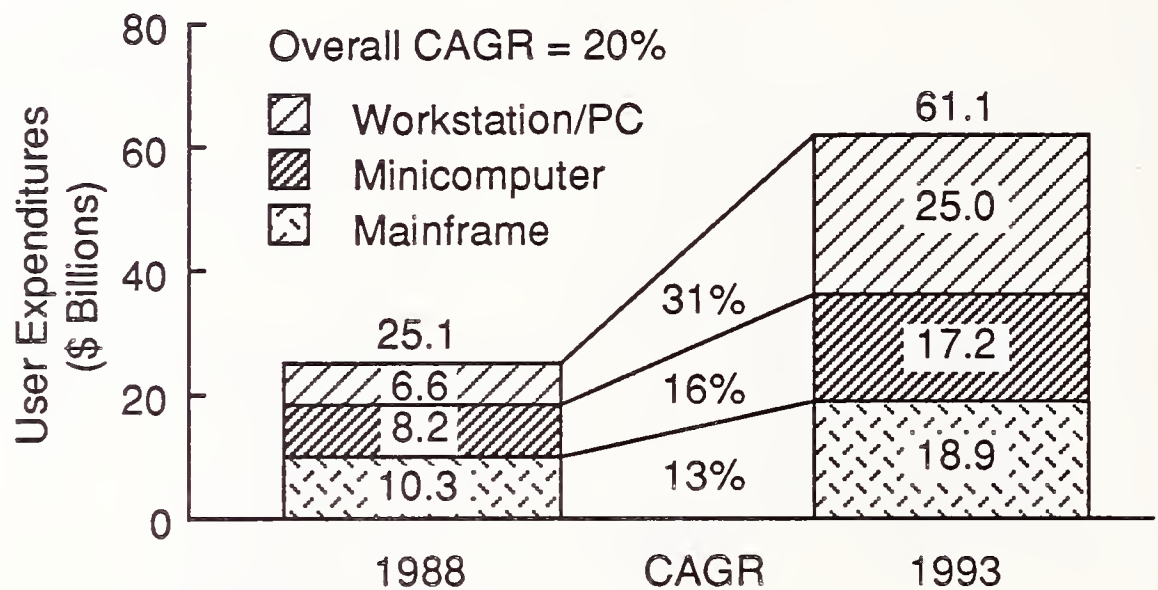
vendors seeking growth from the software markets, is targeted vertical markets. Application software vertical markets providing above average growth opportunities over the next five years include: transportation, telecommunications, wholesale distribution, retail distribution, insurance, and state and local governments.

- Product Development and Product Maintenance—Application development backlogs compounded by the need to maintain the existing software product (which industry studies indicate consumes up to 70% of the total programming effort) are continuing to deter revenue growth and profitability in the software industry. This is fostering a renewed interest within the software development community for the newer generations of application development tools, such as CASE, expert systems programming environments for embedding of knowledge-based solutions into traditional data processing applications, and 4GL/DBMS/Data Query languages and utilities.

- Mergers and Acquisitions—Several factors are fueling the increasing activity in mergers and acquisitions: a number of similar product offerings, which in a merger can lead to a reduction in overhead redundancies and the benefits of economies of scale; the cost benefits of buying niche product solutions rather than developing internally; and the failure of the stock markets to recognize value in many of the software products groups. Recent acquisitions by Apple Computer Corp. of niche players in the communications software markets repre-

    MAD3

sents one of the major strategies, to enhance network connectivity solutions.

• Alliance Building—The need to provide integrated solutions involving multivendor solutions as well as the desire to increase revenue from additional product offerings is fueling a period of unprecedented alliance building among independent software developers. This is also occurring among the leading computer systems vendors and the stronger independent software developers. It is becoming increasingly important for independent software vendors to build alliances with the longer-term players in the hardware industry and work with the operating systems that will survive an inevitable shakeout during the transition from proprietary to standard systems offerings (for longer-term viability).

• Distribution—Leading computer systems and independent software vendors are increasingly seeking out multiple distribution channels—such as VARs, cooperative marketing partners, and new OEM relationships.

EXHIBIT III-4

SOFTWARE PRODUCTS ENVIRONMENTAL STRUCTURE

Internal Factors

- Industry Specialization
- New/Hot Areas
- Product Development
- Enhancement and Maintenance
- Mergers and Acquisitions
- Alliance Building
- Distribution

External Factors

- User Needs
- Technology
- Business Environment
- Complementary Services

External Factors:

• User Needs—As end users become more knowledgeable computer users, they are requiring increasingly sophisticated application solutions. Users want to be able to access data and applications as well as share physical resources, oftentimes within a heterogeneous hardware environment. This will require solutions involving dynamic connectivity and cooperative processing. Also, users will want more control over shaping program development, which will increase demand for products, such as object-oriented programming environments which could help bridge the development process between user and program writer. In addition, users will want to be able to access integrated information management resources (image, voice, text, and graphics) through such user-friendly access methods, such as voice recognition computer systems. (See Exhibit III-5)

EXHIBIT III-5

USER NEEDS

• Application Sophistication

• Heterogeneous Hardware/Environment

• Dynamic Connectivity/Cooperative Processing

• Resource Sharing/Groupware

• Productivity: User and Programming

• Workstation Support

• Image Processing

• Voice to Text Product Solutions

• Technology—Software developers will be required to adapt their programs to a number of new computer systems technologies, networking architectures, and operating systems to capture the higher growth potential of the leading edge hardware and software technologies, including: the AS/400, PS/2, parallel processors, supercomputers, networking/LANS, optical disk storage, on-line transaction processing systems, the UNIX, Pick, OS/2 operating systems, server/client distributed processing models, and cooperative processing networking solutions. (See Exhibit III-6)

EXHIBIT III-6

TECHNOLOGY IMPACTS

- New Platforms/Devices
  - AS/400, PS/2, Parallel Processors, RISC-Based Workstations, Supercomputers

- Networking/LANs
- Improved Resources
  - Memory, Storage, MIPS
- On-Line Transaction Processing
- Operating Systems
  - UNIX, Pick, OS/2
- Server/Client Relationships
- Cooperative Processing

- Business Environment—An increasingly competitive marketing environment, with a more aggressive software effort from the large computer systems vendors (as evidenced in IBM's new Application Development Division) , will likely require many of the smaller independent software vendors to create cooperative marketing alliances with the larger computer systems vendors to compete effectively on a marketing level. The intensity of the new competitive environment is illustrated by the number of recent lawsuits among the leading software to protect "look and feel" characteristics of user interfaces and by the increasing level of cross-licensing, among industry leaders such as Microsoft, Ashton-Tate and Sybase, on a new PC-based relational data base server. This makes it increasingly difficult for the unallied independents to compete. The competitive impact from control over source/ object code involving de facto software standards such as AT&T's UNIX Systems V is also creating cooperative power blocs such as the Open Systems Foundation and the alternative Archer Group, recently renamed UNIX International. (See Exhibit III-7)

EXHIBIT III-7

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BUSINESS ENVIRONMENT

- Increasing Scale of Competition

- Source Code/Object Code Access

- Cross-Licensing

- Increasing Number of Lawsuits

- Development of Software Power Blocs

- Complementary Services—Leading vendors in the various software markets, in order to expand revenue growth, increase profitability, and maintain account control, have been steadily expanding product offerings into related software service areas such as: consulting, education and training, software development, systems integration, and software integration. Because many software product areas evolve into commodity-type offerings, with comparable product offerings by several companies, more emphasis on value-added servicing capability and customization is oftentimes required to maintain growth and profit margins. (See Exhibit III-8)

c. Leading Software Products Vendors

The ten leading software products vendors, including both computer systems vendors and independent software developers, and their combined systems and applications software sales are shown in Exhibit III-9. Most of the companies represented are the large computer systems vendors who are primarily systems software suppliers. The largest independent software developer is Computer Associates, whose principal systems software product offering is in data center management tools. However, the recent merger with ADR, brings Computer Associates a strong product offering in application development tools and also strengthens its position in the data base management systems products area. Computer Associates also has become a large player in the microcomputer software markets, a position which was strengthened by the relatively recent acquisition of BPI Systems, Inc.

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EXHIBIT III-8

COMPLEMENTARY SERVICES

- Consulting

- Education and Training

- Software Development

- Systems Integration

- Software Integration

- Customization

Of the other independent software companies listed, principal product offerings are in cross-industry applications, such as spreadsheets, graphics, and accounting.

The largest independent software vendors, as measured by combined application and systems software are included in Exhibit III-10. Market share is defined in this exhibit as a percentage of the total systems and applications software products market, including independent as well as computer hardware/software and other companies with products in non-software areas. It also includes only non-captive, U.S. software revenue sources. The rankings reflect 1987 statistics. 1988 mergers such as Computer Associates and ADR are not reflected in the market rankings.

Recent mergers in the mainframe systems software industry, including Computer Associates with UCCEL and ADR; and Morino Associates with Duquesne Systems, are causing significant shifts in market ranking among the independent systems software vendors.

The largest companies in the software industry are the suppliers of mainframe and minicomputer software due to the higher unit pricing relative to microcomputer software. This historically has been based on the rule-of-thumb practice of pricing software proportionally to the cost of the hardware platform. This historically has also created higher margins for the systems software vendors. However, the negative side of this practice is that it has been a contributing factor to the competitive success of the lower-priced workstation products (with multiuser UNIX system software) within the traditional minicomputer markets.

EXHIBIT III-9

LEADING SOFTWARE PRODUCTS VENDORS, 1987

Company Name	1987 Revenue ($ Millions)	Market Share (Percent)
IBM	3,099	15
Digital Equipment Corp.	935	5
Unisys	585	3
Computer Associates International, Inc.	415	2
Lotus Development Corp.	315	2
Hewlett-Packard	255	1
Wang Laboratories	240	1
Microsoft Corp.	396	2
Dun & Bradstreet Corp.	170	1
Ashton-Tate	170	1
Management Science America, Inc.	169	1

LEADING INDEPENDENT
SOFTWARE VENDORS—1987

Company Name	1987 Revenue ($ Millions)	Market Share (Percent)
Computer Associates	415	2
Lotus Development Corp.	396	2
Microsoft Corp.	240	1
Ashton-Tate	170	1
Management Science America, Inc.	169	1
Cincom Systems, Inc.	122	1
Novell, Inc.	120	1
SAS Institute, Inc.	113	1
Information Builders, Inc.	100	1
Word Perfect Corp.	96	1
Cullinet Software, Inc.	117	1

2. Applications Software

a. Market Forecast, 1988-1993

Applications software consists of two main categories: industry-specific
(vertical markets) and cross-industry. Industry-specific software ad-
dresses the functional needs of particular industries, such as discrete
manufacturing, with MRPII solutions and insurance, with underwriting
analysis, policy management and claims adjustment software packages.
Cross-industry application software provides solutions for common

functions in a number of different industries. Examples include accounting, education and training, and office systems applications software. Exhibit III-11 shows the size of these two market segments in 1987 and portrays INPUT's estimated growth rate in these two applications groups between 1988 and 1993.

Industry-specific applications expenditures in 1987 totalled $5.9 billion. They are expected to increase at a 20% CAGR over the next five years (1988-1993) from $7.1 billion in 1988 to $17.3 billion in 1993. Cross-industry applications software product expenditures in 1987 totalled $4.8 billion. INPUT projects spending in this sector to increase from $5.9 billion in 1988 to $13.0 billion in 1993, for a CAGR of 17%. The higher growth rate projected for industry-specific solutions reflects the fact that the cross-industry applications markets are more mature since the original applications development by the leading software developers was in this area. However, within the cross-industry group, various subsegments are projected to outperform growth in the industry-specific (vertical market) segments. These include the education and training, engineering and scientific, and office systems markets.

EXHIBIT III-11

TOTAL APPLICATIONS SOFTWARE PRODUCTS
MARKET BY PRINCIPAL SEGMENTS
1987-1993
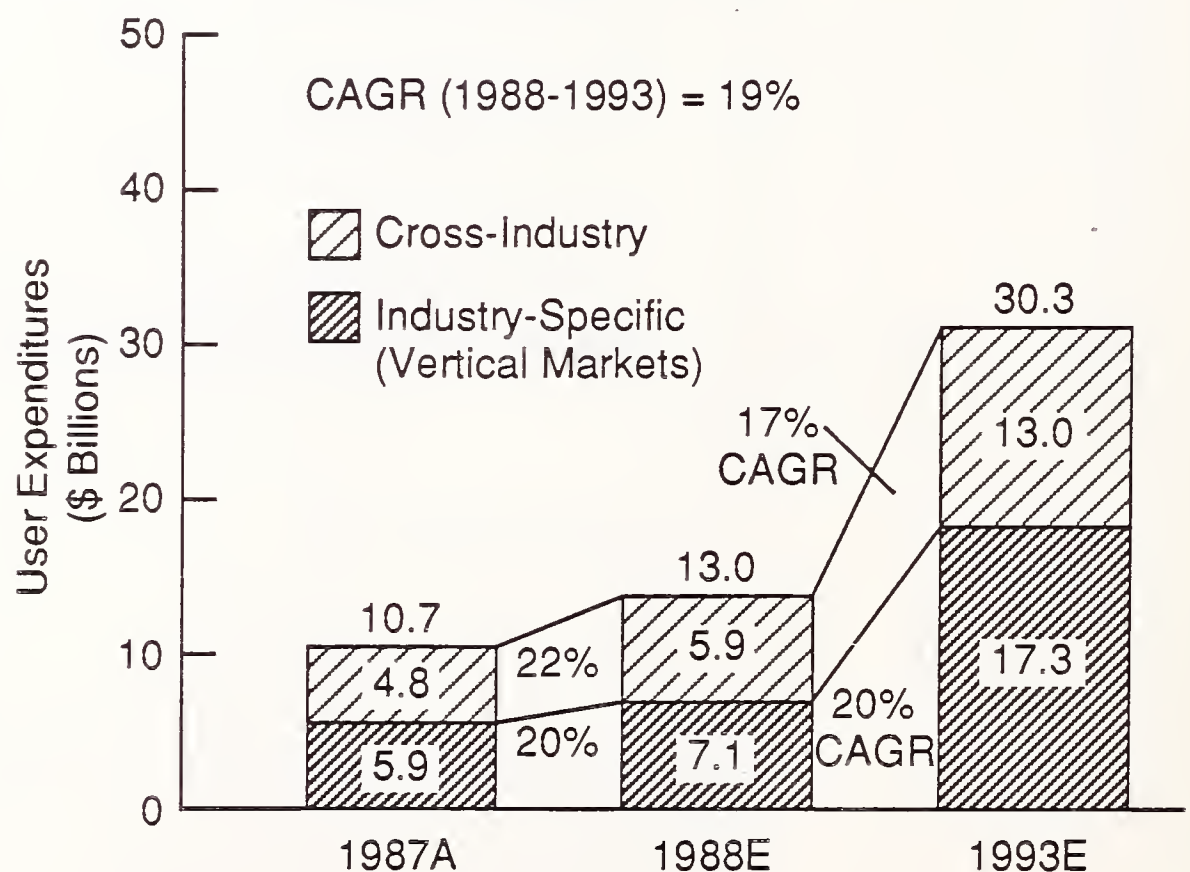
As indicated in Exhibit III-12, the total applications software market (for all three platforms) is expected to increase from an estimated $13.0 billion level in 1988 to $30.3 billion in 1993, for a CAGR of 19%. The market for workstation/PC applications is projected to grow at a compound annual rate of 28% compared to 10% for mainframe application software and 14% for minicomputer application software. In a distributed processing environment, much of the application processing is anticipated to be shifted to the workstation platform, particularly with the incorporation of the Intel 80386 and 80486, the Motorola 68030, and the new RISC chip technologies in the newer generations of workstation/PCs providing mini/mainframe processing power for many applications in a desktop environment. Leading workstation manufacturers such as Sun Microsystems responsible for pioneering the market for computer standards have established this group as computer industry trend-setters.

EXHIBIT III-12

APPLICATIONS SOFTWARE PRODUCTS MARKETS BY HARDWARE PLATFORM 1988-1993

Applications Software Product Markets	Revenue Source by Market Submode ($ Billions)			
	Mainframe	Minicomputer	Workstation/ PC	Total
1988	4.3	4.1	4.6	13.0
1993	6.8	8.0	15.5	30.3
Growth Rate (Percent)	10	14	28	19

Overall, including all three principal platform segments, mainframe, minicomputer, and workstation/PC, the applications software market will grow at a 19% CAGR over the next five years.

Applications software is growing at a slightly slower rate than the systems software markets due to the fact that the sale of systems software for each computer site can involve a number of add-on, complementary products, such as a variety of utility packages, teleprocessing and other types of communication software. Another factor contributing to this trend is the recent strength in the relational data base management and application development systems software products markets. These are trend factors that are expected to continue. However, as previously indicated, applications software products for vertical markets has been identified as a major targeted market particularly by the larger computer systems vendors who are pursuing growth through total solutions products and services marketing.

b. Driving Forces in the Applications Software Products Markets

In applications software products, factors which will continue to foster an above average growth rate, as shown in Exhibit III-13, include the following:

- CPU Population Growth—The large installed base of personal computers, in particular, will need additional applications. In the corporate market, many personal computers are being utilized for only one or two applications. The number of applications needs to be increased to improve the efficiency of personal computers.

- Standards—As standards such as UNIX, SAA and SQL are adopted, it will become easier to write software for a larger number of platforms. In addition, new standards in the area of application development tools providing common user and programming interfaces will increase software development productivity as well as provide for software portability.

- Workstation Power—The increasing power of the new workstation platforms is creating new market opportunities to write programs incorporating the new capabilities of these machines. In particular, the networking capabilities inherent in these computers is creating market opportunities for multitasking and multiuser applications.

- Industry-Specific Thrusts—Much of the applications software written in the 1970s was of the "plain vanilla" type. Now, the demand is increasingly for software to solve in-depth solutions.

- Executive Information Systems (EIS)/Other Emerging Niches—The need is developing to provide free-form access to corporate information sources, including data bases, particularly for corporate decision-makers. Comshare with its Commander software products is a leading participant in this market.

- Application Complexity—There is now a need to provide second and third generations of applications software for business, including more integration and embedded intelligence.

EXHIBIT III-13

APPLICATIONS SOFTWARE PRODUCTS MARKETS—DRIVING FORCES

- CPU Population Growth

- Standards—e.g., SAA, OSF

- Workstation Power

- Industry-Specific Thrusts

- Executive Information System (EIS)/ Other Emerging Niches

- Application Complexity

c. Inhibiting Forces in the Applications Software Products Markets

Inhibiting forces that will continue to negatively impact growth in the applications software products market, as shown in Exhibit III-14, include:

Mainframe Saturation—The market growth rate for large computer systems has been slowing for several years. Much of the future market opportunity will be for mainframe replacements.

Declining Software Prices—As the industry becomes more competitive, software prices are declining in the mini and mainframe applications software markets, in particular. However, the level of merger activity is likely to accelerate, leading to industry consolidation and a more stable pricing environment.

Product Life Cycles—The shortening product life cycles, related in part to decreasing life cycles in hardware platforms, is creating demand particularly for applications software upgrades. However, there is also the related issue of whether or not the independent applications software

developers are creating sufficient profits to support the high levels of research and development spending to compete in a crowded market.

Crowded Market Niches—Many applications products represent mature markets where only two or three players can succeed. In addition, major R&D expenditures will be required to remain competitive.

EXHIBIT III-14

APPLICATIONS SOFTWARE PRODUCTS MARKETS—INHIBITING FORCES

- Mainframe Saturation

- Declining Price per Copy

- Market Maturity

- Competition

d. Industry-Specific Applications (Vertical) Markets

i. Overall

In 1987 the industry-specific (vertical) markets accounted for 55% of the total applications software market and 28% of the total software products market. This compares with a 51% share of the applications software market and 27% of the total software market in 1986. In 1993 the proportions are projected represent a 57% share of the total applications software market and 28% of the total software products market. Cross-industry application software sales represented 45% of the total applications software market in 1987 and 24% of the total software products market. These proportions are expected to be 43% and 21% respectively in 1993, reflecting the faster growth expectations expected in the industry-specific applications area relative to the growth in cross-industry applications. This reflects, in particular, the increasing requirement for for mission critical applications for particular business environments.

However, systems software growth will continue to slightly outpace applications-specific software sales during the five years, fueled by the

strong growth trends developing in applications development tools, relational database management solutions, and data center management tools.

ii. Growth

As shown in Exhibit III-15, between 1988 and 1993, the fastest growing industry-specific market sectors will be telecommunications (32%) and retail distribution (31%), with the slowest growth in the industry-specific markets in academic education (11%) and in the federal government (14%) sectors. The high growth projected for the telecommunications and retail distribution markets reflect the strong market potential perceived in providing software products to the RBOCs, to facilitate their entry into new information services markets; and the need among retailers to continue to reduce their operating costs through the use of new software applications. The slower growth in the education and federal government markets reflects, in particular, anticipated budgetory constraints.

Based on 1987 user expenditures, the largest segments in the industry-specific applications markets were banking and finance, discrete manufacturing, medical, and insurance. In 1993, the ranking order is expected to remain the same.

Although the financial services vertical market is expected to remain the largest over the next five years, its growth rate at 18% is projected to be slightly lower than the 20% CAGR expectation for the total vertical market subsegment. This slower than average projected growth reflects INPUT's belief that the brokerage business could remain in a protracted slowdown over the next two to three years, and that a projected slowing in the U.S. economy will negatively impact banking and savings and loan asset growth related to home mortgage and commercial lending. In addition, there is perceived significant credit risk from the major recent lending activity of the larger money center banks and insurance companies for leveraged buyouts, particularly if there were a more severe economic slowdown than currently expected.

The outsourcing of data processing activity to reduce fixed cost expenditures could develop at the larger brokerage firms if a slowdown in the brokerage business continues for any length of time.

Discrete manufacturing industry-specific application software products include: CAD/CAM/CAE software; material resource and capacity financial software and human resource products; and computer-integrated manufacturing (CIM) solutions including plant-wide distributed controls. MRPII computer applications in the discrete manufacturing environment are considered to be widespread. The process manufacturing environment could provide more opportunity in this area.

EXHIBIT III-15

INDUSTRY-SPECIFIC (VERTICAL MARKET)
APPLICATIONS SOFTWARE MARKETS
1987-1993

Industry Sector	$ Millions			CAGR 1988-1993
	1987A	1988E	1993E	
Discrete Manufacturing	1,130	1,380	3,235	19
Process Manufacturing	145	180	435	19
Transportation	215	270	715	22
Utilities	145	185	410	18
Telecommunications	110	150	605	32
Retail Distribution	180	235	925	31
Wholesale Distribution	290	390	1,090	23
Banking and Finance	1,490	1,750	3,930	18
Insurance	455	570	1,680	24
Medical	570	670	1,520	18
Education	450	505	855	11
Services	270	340	860	20
Federal Government	180	230	440	14
State and Local Government	65	90	250	24
Other Industry Specific	130	160	360	18
Total Vertical Markets	5,825	7,095	17,310	20

e. Cross-Industry Applications Markets

i. Overall

As shown in Exhibit III-16, the total market for cross-industry applications is projected to grow from $5.9 billion in 1988 to $13.0 billion in 1993, at a CAGR of 17%. This rate is below the 20% rate projected for the total industry-specific but consistent with INPUT's projected growth rate expectations for the overall information services markets.

The slower growth rate in cross-industry applications products software reflects the inclusion of the more mature (generic) application market sectors, such as word processing, spreadsheet, and general accounting programs. This means that to a large extent cross-industry applications have already been installed. The generic nature of many cross-industry applications which solve problems common to a number of industries has also fostered their acceptance across a wide range of industries.

ii. Growth

As previously indicated, the three highest cross-industry growth segments are expected to be education and training (25%), engineering and scientific (25%), which includes approximately 17% of CAD and CAE applications, finite element analysis and certain architectural and civil engineering programs, and office systems (22%). These are the three cross-industry sectors expected to show the highest growth rate over the next five years.

The largest cross-industry segments in 1987 were accounting, planning and analysis and office systems. The largest in 1993 are projected to be: office systems accounting, and planning and analysis.

INPUT's *Software Product Market, 1987-1992* evaluates office systems in the other cross-industry specific markets. In the current report, office systems software has been separated from the other cross-industry specific segment. The latter now includes the high-end (non-corporate) segment of the electronic publishing market and cross-industry retail and wholesale distribution software as opposed to industry-specific applications.

The office systems markets are expected to benefit from emerging technologies targeted for the office systems environment, including text management, voice response/voice messaging, image/compound document processing, and Executive Information Systems (EIS). EIS are expected to show rapid growth along with the incorporation of more intuitive-type user interfaces in the PS/2 environment and with the implementation of distributed data base management solutions capable of providing transparent access to corporate-wide information resources.

EXHIBIT III-16

CROSS-INDUSTRY APPLICATIONS SOFTWARE PRODUCTS MARKET, 1987-1993

Cross-Industry Sector	$ Millions			CAGR 1988-1993
	1987A	1988E	1993E	
Accounting	1,270	1,515	3,165	16
Education and Training	110	140	445	25
Engineering and Scientific	310	400	1,230	25
Human Resources	690	760	1,050	7
Office Systems	970	1,240	3,295	22
Planning and Analysis	1,210	1,490	3,080	16
Other Cross-Industry Specific	285	330	735	17
Total Cross-Industry Markets	4,845	5,875	13,000	17

f. Leading Applications Software Vendors

Exhibit III-17 shows the leading applications software products vendors and their revenues and market shares. Market share percentages reflect a conversion of vendor revenues into end-user expenditures. The conversion factors used to convert vendor revenues to end-user expenditures appear in Chapter I (Research Methodology).

EXHIBIT III-17

LEADING APPLICATIONS SOFTWARE
PRODUCTS VENDORS—1987

Company Name	1987 Revenue ($ Millions)	Market Share (Percent)
IBM	775	9
Lotus Development Corp.	395	4
Digital Equipment Corp.	195	2
Dun & Bradstreet Corp.	170	2
Management Science America, Inc.	170	2
Unisys Corp.	165	2
Computer Associates International, Inc.	165	2
Hewlett-Packard	125	1
Wang Laboratories	105	1
Microsoft Corporation	105	1
Word Perfect Corporation	100	1
Ashton-Tate	95	1

3. Systems Software

a. Market Overview

Systems software provides the general operating and application development environment for the various hardware platforms. INPUT subdivides the systems software market into three major sub-modes. These include systems control, data center management, and application development tools and utilities.

INPUT continues to classify graphics and word processing tools as cross-industry office systems applications. As these tools become more and more integrated, this categorization may change. In this report, expenditures for Lotus are primarily in the cross-industry sector; whereas, the expenditures for Microsoft and Ashton-Tate programs are primarily in the systems software sector.

The overall market for systems software, as shown in Exhibit III-18 is projected to expand from $12.1 billion in 1988 to $30.7 billion in 1993 at a CAGR of 21%. This is above both the 17% CAGR projected by INPUT for the total information services market and the 19% CAGR expected over the same time period for applications software products. It also represents the third highest growth rate projection of the seven delivery modes identified by INPUT as constituting the information services market. The two delivery modes with higher growth rate expectations over the next five years include systems integration (25%) and network services (23%). The highest growth systems software markets are expected to be in applications development (22%) and data center management tools (20%). The applications development tool market is benefitting from new generations of tools which can be more easily integrated into traditional application development methods with the potential of significantly improving productivity. The data center management tool market is receiving stimulus from the need to provide network management tools for the PC LAN environment as well as to extend network management capability to an enterprise-wide scale.

The microcomputer portion of the system software market in 1987 was 14%, and is projected to increase to a 17% share in 1988 and a 31% share of the total systems software market in 1993. This reflects the relative cost/performance benefits of networked workstation solutions for a number of business solutions, and the expectations for strong growth in the distributed computer processing model. It also involves a continuation of a downward migration of systems software traditionally run on mainframe platforms to the 32-bit microprocessor based workstation/PC platforms (such as application development tools). It will retain most of the systems software functionality. In the future era of cooperative

**TOTAL SYSTEMS SOFTWARE PRODUCTS
MARKET BY SOFTWARE TYPE
1988-1993**

Overall CAGR = 21%

▨ Application Development Tools
▨ Systems Control Products
▨ Data Center Management Tools
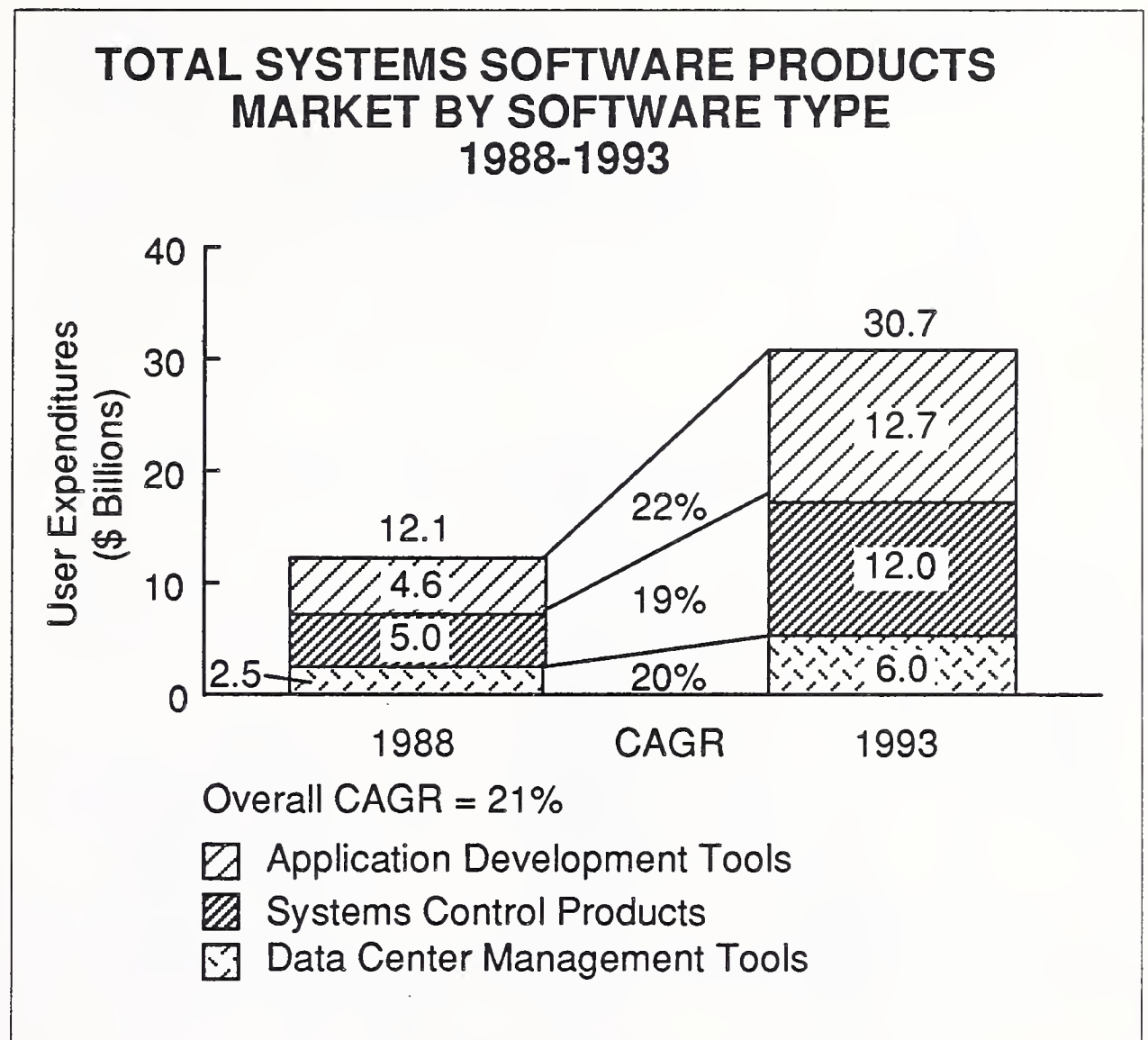
processing solutions, much of the application processing will be done at
the workstation platform with the minicomputer filling the role of a
network server/intelligent communications processor and the mainframe
used for computer-intensive scientific and transaction processing (data
base access) applications. In addition, dedicated workstations and
systems software solutions for specialized applications processing will
become more popular. Exhibit III-19 breaks down the market for the
three types of system software by platform size.

b. Driving Forces in the Systems Software Products Market

Exhibit III-20 summarizes the driving forces in this market.

• Staging for New Applications Software Growth—The increasing re-
  quirement for more complex applications software solutions is fueling
  the demand for new operating systems, data center management pro-
  grams, such as expert system based performance management tools,
  and new applications development tools.

• Data Center Management Tools—As data centers become more com-
  plex, with a trend to data center consolidation, one way to reduce man-

EXHIBIT III-19

**SYSTEMS SOFTWARE MARKET
1988-1993
BY SOFTWARE TYPE AND PLATFORM**
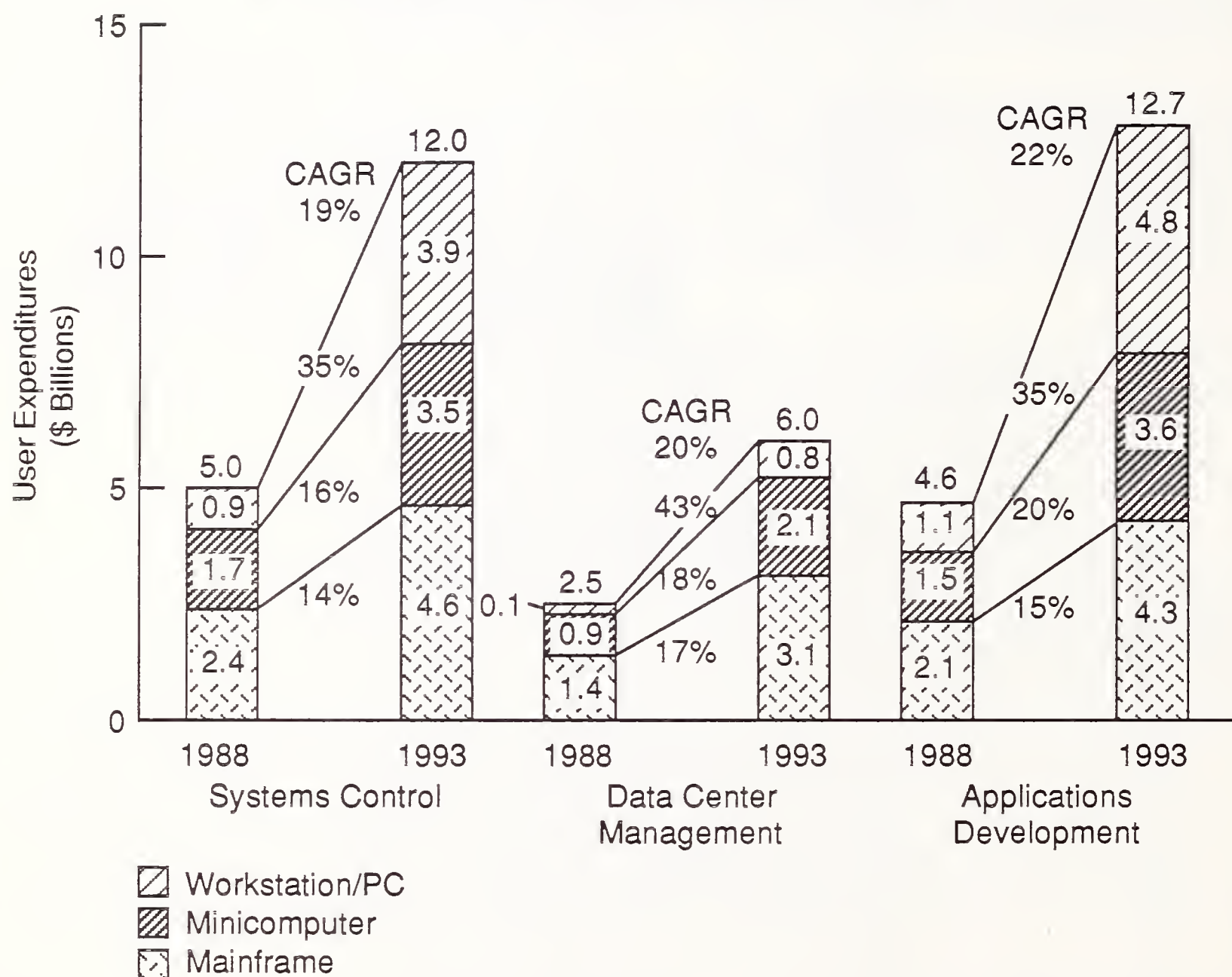
power costs is by investing in automation tools to more efficiently operate and tune system performance.

• Relational Database Management Systems (RDMS)—Most new computer system specifications today require the new relational data base management systems products.

- Systems Application Architecture (SAA)—The portability benefits of SAA will encourage independent software developers to create new software to meet the SAA requirements.

- Cooperative Processing—An ultimate goal of a truly distributed processing environment is cooperative processing capability, which maximizes the efficiencies of computer networks. This will require new generations of software products, particularly in the areas of network operating and management systems.

- Image Processing—To reduce the paper overflow and work flow problem, systems solutions such as image processing, involving optical storage solutions, will continue to gain acceptance.

- CASE/4GL—The need to improve software development productivity via 4GL languages and increasingly integrated structured programming methodologies, such as CASE, will continue to gain in popularity.

- Standards (SQL/UNIX,etc.)—Increasing emphasis on standards and open systems should fuel the demand for new generations of systems software that conform to the emerging standards.

- Consolidation—The trend to consolidation in the systems software industry (i.e., Computer Associates' major acquisitions in recent years) should contribute to pricing stability in the industry.

c. Inhibiting Forces in the Systems Software Products Market

Exhibit III-21 summarizes the forces inhibiting this market.

- Mainframe Saturation—The slowing growth rate in the mainframe computer market will have a dampening effect on the rate of market expansion for operating systems (systems control) software.

- Competition and Price Pressures—With the maturation of the markets for certain mainframe systems software products, weak competitors could create price instability.

- Declining Software Prices—The trend to lower software prices, particularly in the mainframe systems software area, should help stimulate demand.

- AS/400 DBMS Negated—The embedded DBMS functionality in recent releases of IBM systems software could reduce the market potential for third-party vendors in this market. Also, some uncertainty over IBM's long-range DB2 plans may delay decision-making by corporate customers until they see what IBM will offer.

EXHIBIT III-20

48

SYSTEMS SOFTWARE MARKET—
DRIVING FORCES

- Staging for New Applications Software Growth

- Data Center Management Tools

- RDMS

- SAA

- Cooperative Processing

- Image Processing

- CASE/4GL

- Standards (SQL/UNIX)

- Mainframe Vendors' Porting

EXHIBIT III-21

SYSTEMS SOFTWARE PRODUCTS MARKET—
INHIBITING FORCES

- Mainframe Saturation

- Competition and Price Pressures

- Declining Software Prices

- AS/400 DBMS Negated

d. Systems Control Software

Systems control software is the software that provides life to the hardware. It includes operating system software and operating system enhancements such as general system utilities, languages/compilers, disk/tape/file utilities, print utilities/spoolers, and peripheral drivers. Exhibit III-18 shows the system control market growing from $5.0 billion in 1988 to $12.0 billion in 1993, representing a CAGR of 19%. Although the market for systems control software is directly related to unit shipments of computer hardware, a significant portion of the market consists of systems enhancements.

- The workstation/PC portion will grow from 17% of the total systems control market in 1988 to 32% of the total systems control market in 1993. Expenditures will grow from $0.9 billion in 1988 to $3.9 billion in 1993, at a CAGR of 35%. This reflects INPUT's forecast of a 30% growth in the workstation platform market over the next five years and the anticipated strong growth of UNIX and OS/2 software in distributed processing environments. Communications software sales for protocol conversion and inter-LAN connectivity are also anticipated to continue on a strong upward growth path over the next several years.

- The minicomputer portion of the systems control market is projected to grow from $1.7 billion in 1988 to $3.5 billion in 1993, representing a CAGR of 16%. In prior years, INPUT combined minicomputer and mainframe systems software in its market forecast studies. In the 1987 *Software Products Market* report INPUT projected that the mini/mainframe market for systems control software would expand at a 28% CAGR. This more robust outlook last year was based on what appeared to be a longer-term resurgence developing in minicomputer platform sales. With the recent slowing in growth rates and shortfalls in revenue expectations at many of the minicomputer companies in 1988, INPUT's previous expectations for this market had to be revised. The minicomputer hardware market now appears to be growing at 6% to 8% annualized rate, with the workstation product making major inroads into the traditional minicomputer market. The minicomputer systems control market could, however, have a resurgence with the anticipated strong growth of department computing platforms. In particular, the minicomputer could become the server platform of choice for the larger department network environment.

- The mainframe portion of the systems control market is projected to grow at a CAGR of 14% over the next five years. Although mainframe platform unit sales are expected to grow at only a 3% annualized rate, there is considerable potential for operating systems enhancement products.

See Exhibit III-19.

The anticipated move to cooperative processing solutions involving peer-to-peer communications protocols such as LU6.2 will also stimulate the growth in systems control enhancement software.

e. Data Center Management Tools

Data center management tools and utilities include operating system performance monitoring, job scheduling, user control and resource chargeback systems, security/auditing systems, tape and disk I/O optimizers, and network management and communications monitoring programs. Some of the leading independent software vendors in this market include Computer Associates International, Altai Corp., Duquesne Systems, Inc., Cincom Systems, VM Software, Candle Corp, Boole and Babbage, Landmark Software Systems, Inc.

Significant market opportunities exist in providing inter-network management and monitoring software and utilities, particularly for workstation/PC-LAN-based configurations and for more fully automated data center management operation.

The data center management tool market will grow from $2.5 billion in 1988 to $6.0 billion in 1993, reflecting a CAGR of 20%.

• The workstation/PC portion will grow from 6% of the total data center management tool market in 1988 to 13% in 1993. Revenues will grow from $135 million in 1988 to $800 million in 1993, for a CAGR of 43%. Products for this environment include network management software and micro resource manager software.

• The minicomputer market for data center management tools is projected to expand from $0.9 billion in 1988 to $2.1 billion in 1993, for a CAGR of 18%. With the anticipated growth in distributed processing solutions, network management and monitoring programs which are a part of an intelligent (distributed communications control) network should be a major growth opportunity for minicomputer-based data center management software.

• The mainframe portion of the data center management tool market is expected to grow from $1.4 billion in 1988 to $3.1 billion in 1993, for a CAGR of 17%. Opportunities exist for the further automation of the monitoring process, inter-network control programs, and resource cost allocation programs for information services costs to various profit units throughout a company.

See Exhibit III-19.

f. Applications Development Tools

Applications development tools are projected to be the fastest growing segment in the systems software market. These include relational data base management systems (RDMS) and related 4GLs, computer aided software engineering (CASE) solutions, expert systems development environments, object-oriented programming and data base systems, as well as traditional third-generation application development programs and general utility packages.

A future direction and product development opportunity is for programs that will integrate the various application development technologies, including the capability for reverse engineering.

One of the major benefits of the newer integrated tools will be to greatly enhance the proficiencies of software maintenance.

- As shown in Exhibit III-19, the market for the workstation/PC portion of applications development is projected to grow from $1.1 billion in 1988 to $4.8 billion, for a CAGR of 35%. This reflects a trend in CASE technology to workstation/PC-based application development with front-end design/prototyping activities performed on the workstation and then uploaded to the mainframe for application code generation. Also, SQL-based data query and report generation tools are rapidly being transferred to the workstation/PC server-based DBMS environment, with endorsements from large software houses such as Ashton-Tate and Microsoft.

  The trend to client/server and peer-to-peer processing models, where the workstation does the front-end application processing and minicomputers and mainframes are utilized more for on-line transaction processing and network management will help facilitate the trend to the workstation/PC platforms for application development. Application development for IBM's system application architecture (SAA) environment will also be able to more effectively utilize workstation/PCs as development platforms because of the portability concept of the architecture.

- The market for minicomputer-based application development tools is estimated to grow from $1.5 billion in 1988 to $3.6 billion in 1993, for a CAGR of 20%. Much of the development in the minicomputer market relates to the increasing integration between minicomputer-based RDBMS and 4GL development tools. In addition, several CASE as well as expert systems shell application development programs utilize the VAX/VMS platform.

- The mainframe market for application development tools is projected to expand from $2.1 billion in 1988 to $4.3 billion in 1993, for a CAGR of 15%. Currently much of the development work in the fast-growing CASE systems environment is being done on mainframes. However, much of this future front-end CASE application development work is expected to be off-loaded to the workstation platform. The development of application software integrated with DB2 and other mainframe-based RDBMS will be a future growth area, and will likely be supported on mainframe platforms. Utilization of future SAA application development tools, however, may also push more of this back onto workstation/PCs.

g. Systems Software Company Market Leaders

As shown in Exhibit III-22, Computer Associates is the only one of the top five systems software vendors which is not a computer systems (hardware/software)vendor. This relates to the fact that historically systems control software, which represents the largest segment of the systems software market, has been largely a proprietary product offering of the computer systems vendors. The independent software developers in the application development tools and data center management tools markets are a much more important factor.

Exhibit III-22 converts vendor revenues to user expenditures to calculate market shares and determine market ranking. Conversion factors for vendor revenues to end-user expenditures are in Chapter I (Research Methodology).

LEADING SYSTEMS SOFTWARE
PRODUCTS VENDORS—1987

Company Name	1987 Revenue ($ Millions)	Market Share (Percent)
IBM Corporation	2,325	26
Digital Equipment Corp.	740	8
Unisys Corp.	420	5
Computer Associates International, Inc.	250	3
Hewlett-Packard Company	190	2
Ashton-Tate	170	2
Wang Laboratories	150	2
NCR Corporation	145	2
Microsoft Corporation	135	2
Cincom Systems	122	1
Novell, Inc.	120	1

IV

Issues and Trends

IV
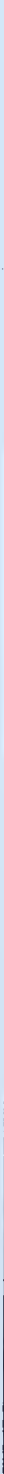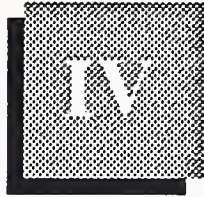
Issues and Trends

A

Industry Structural Changes

The software industry has been undergoing a basic structural change in recent years which involves a major expansion into related support services. In order to remain competitive as well as to obtain additional sources of revenues, software suppliers, including both independent software developers as well as computer systems vendors, have been steadily expanding their program offerings into the professional services (consulting, education and training) and more recently into the systems integration markets.

Exhibit IV-1 reflects INPUT's view of the information services markets in the 1990s, with the market for software products evolving to one part of an emphasis on integrated solutions.

EXHIBIT IV-1

IS MARKET STRUCTURE—1990s

Emphasis on Supporting Services

Software

Processing Services

Integrated Solutions

Professional Services

Turnkey Systems

Network Services

Supporting Services
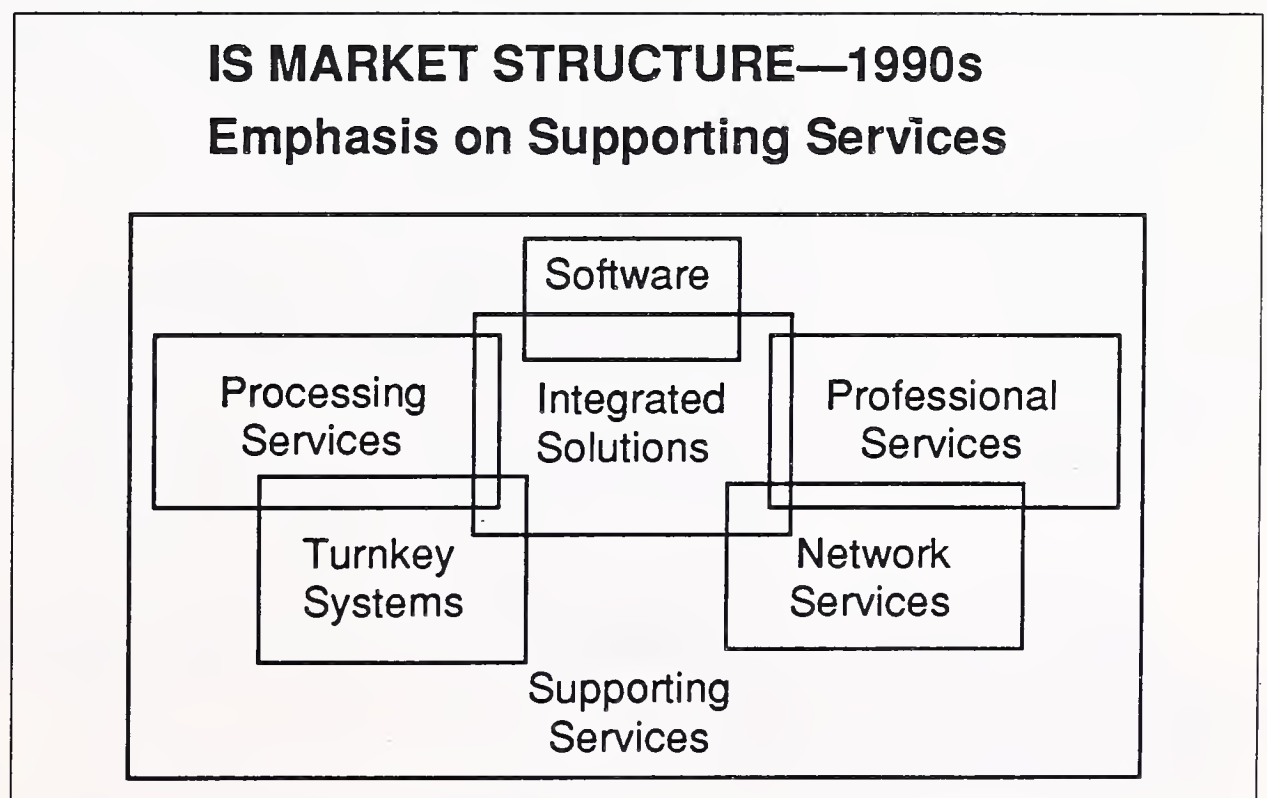
Increasing competition in the software industry from the the computer systems vendors in software markets will require software vendors to address the broad array of services which can be offered by the more fully integrated large computer systems vendors. For example, IBM's SAA-based AS/400 product offering, targeted for the departmental-based, vertical applications solutions markets, represents this new level of competition in the software markets. The turnkey systems solution embodied in the AS/400 product offerings includes bundled systems (operating, database, and communications) software, applications software, extensive education and training support, and networking solutions (integrated with IBM's other network and computer architectures).

With ease-of-use emphasized within the total integration solutions offering, processing services such as facilities management are also being emphasized under new product strategies.

In addition, with the trend to distributed processing solutions, oftentimes involving multi-vendor architectures as well as a number of integrated software/hardware technologies, such as image, integrated voice/data, communications, systems integration capabilities are becoming more important for capturing many larger Fortune 1000 and federal government contracts involving software solutions. Also fueling this trend is user demands for increasingly complex solutions.

To be able to offer the broad software and services product offering that will be required to compete in many market segments in the 1990s, independent software developers and computer systems vendors have been developing strategic alliances and in some cases establishing more secure positions through mergers. The leading independent software developers and computer systems vendors, in particular, have been rapidly filling in their product offerings through mergers with other major software companies or through cooperative marketing agreements with smaller independent software developers, who can provide leading edge, niche solutions.

Therefore, most competitors in the software products markets today must evaluate the emerging new power blocs which are developing in the industry and consider their future roles within the changing structural environment. In addition, with the rapid product obsolescence in many software market segments, major continuing investments in R&D expenditures will be required. If the new public stock offerings market continues to be as elusive as it has been for recent years for small technology companies, cooperative alliances with larger vendors (computer systems, professional services or other ISVs) may be a necessity for the smaller, innovative niche players who wish to become longer term viable companies.

Application development environments, such as SAA and Presentation Manager from IBM, DECWindows, NewWAVE from Hewlett-Packard, and Open Look from Sun Microsystems/AT&T, also provide another key competitive element that independent software developers must evaluate for future product offerings. It is very important, in particular, for the independent software developers to consider which hardware platforms and operating systems will survive an inevitable shakeout in the computer systems industry in the 1990s as hardware becomes more of a commodity product, and the operating systems markets trend more toward standard, open systems products.

Examples of the trend to integrated solutions selling, in addition to the IBM AS/400, include:

• Oracle has recently expanded its product offerings from RDBMS/4GL into the professional services (consulting, education and training); application software (financials, office automation), applications development (CASE, 4GL), and systems integration markets. A recent strategic alliance was struck with Natural Language, Inc. to provide an English-language front end to Oracle's RDBMS to broaden its solutions capability for the rapidly emerging EIS market.

• Digital Equipment Corporation has been rapidly expanding into more of a market-driven company with a much greater emphasis on software and software support services. Some of the targeted applications software markets appear to be such service industries as banking and insurance. DEC is also expected to announce a number of new products for the desktop computing market. Much of the new software product is coming from third-party providers, and moves into the microcomputer arena have been aided by recent alliances with Apple Computer Corp., Mips Computer Systems, Inc., Compaq Computer, and Tandy Corporation. DEC's major value added contribution to the solution sale is in their increasing internal capability for providing connections with competitive products from IBM, DEC, Apple, etc. To also foster third-party development activity for its DECnet/OSI network, DEC is providing application development tools such as the public availability of the specifications for CDA, its integrated architecture for creating and distributing compound documents. Leading independent software developers such as Ashton-Tate, Lotus Development Corp., and Computer Associates International, Inc., have also announced plans to develop programs that will work with DEC Windows.

• Computer Associates has become the largest independent software supplier with major strategic acquisitions in recent years, including UCCEL and ADR in addition to showing interest in Cullinet and MSA. The company has also broadened its operating systems support to DEC platforms as well as to the DOS-based microcomputer systems and has forged an alliance with UNISYS.

- Two of the larger remaining independent public companies in the mainframe systems software markets, Morino Associates and Duquesne Systems, recently announced their intent to merge.

- Arthur Andersen along with many of the other leading professional services firms have significantly broadened their information services offerings in recent years. Arthur Andersen, as a result, has also become a formidable competitor particularly in the systems integration market, with a well-integrated management consulting, software development, software applications, and education product offering.

- Companies such as General Electric which is in the processing services market, are also expanding into the software markets.

Exhibit IV-2 summarizes INPUT's assessment of the major structural changes taking place in the software industry.

EXHIBIT IV-2

STRUCTURAL CHANGE IN THE SOFTWARE INDUSTRY TOWARDS CONSOLIDATION

- A Smaller Number of Larger Vendors Providing a Broader Range of Integrated Offerings

- Support by Smaller Niche Vendors

- Solutions Selling

B
Leading-Edge Software Technologies

This chapter will deal with current directions in software technologies.

1. AI (Artificial Intelligence)—Revisited and Rejuvenated

One of the more significant current software development trends is the increasing use of artificial intelligence technologies in mainstream computer applications. This is a trend which should accelerate over the next decade. Reasons for the renewed popularity of AI technologies include the porting of the traditional AI programming languages, such as LISP, to less costly, general-purpose workstation/PC platforms and the

utilization of C programming languages with AI extensions (including C++, originally developed by AT&T, and Objective C, from Stepstone Corp.), which significantly expand the "availability" of the product as measured in hardware and programming costs and flexibility of use. This also reflects the vast improvements in CPU and memory price/ performance over the past ten years, which makes the use of AI programming technologies much more cost-effective.

Newer expert systems shell development programs written in the C language family, which incorporate AI-based rule-making and frame/ object technologies, represent a much more efficient and flexible tool for integrating knowledge-based/intelligent functionality into the traditional environment than the first generation of expert systems shell programs based on specialized AI languages and hardware platforms. Particular benefits include the ability to incorporate human reasoning/expertise into mission critical and other types of applications which require decision-based processing. In addition, when used as a CASE development tool, application prototyping can be significantly enhanced and developed software modules are oftentimes reusable which can also significantly improve programming efficiencies.

The first generation of AI vendors were start-up ventures of the mid-1970s. The software companies in this group for the most part failed to find a mass market for their standalone expert development system shells which were based on dedicated AI hardware platforms. The product was used more for university and corporate research on expert systems technology, and did not find the large commercial applications development market envisioned by their founders. Of this first generation of vendors, Intellicorp is one that has remodeled its product and marketing approach to more directly address the mainstream programming environment and thus probably has one of the better chances for long-term viability. While maintaining its programming language in the traditional LISP language, recent products introductions have been on standard platforms (workstations/PCs and IBM mainframe involving a joint development effort with IBM) with enhanced linkages to the C-based applications environment and interfaces to external data bases. Intellicorp's KEE expert system development product is still targeted for the high-end of the expert systems application development market, but its newer workstation/PC products also address the mid-range market for expert systems application development tools. The retention of LISP as its programming language represents a trade-off in favor of functionality (incorporating extensive use of object-based capability) versus embedded, integrated functionality. Graphic enhancements of the user interface have also enhanced ease of use. Future product offerings will also likely incorporate the C language.

A second generation of expert system application development products companies have appeared in the past few years, such as Neuron Data and Aion Corp. which have found success in providing expert systems technology for the development of production expert systems applications, with integrated data base access capability.

Aion Corp's Aion Development System (ADS) product is used more for application development prototyping as a front-end CASE tool based on personal computer development for mainframe application delivery. Extensive portability is provided across the IBM operating systems environments.

Neuron Data's NEXPERT OBJECT provides a relatively low-cost ($5,000 to $10,000) expert systems development environment with application portability and interoperability across the PC AT, RT PS/2 Macintosh, Sun Microsystem, Apollo, and VAX platforms, with programing interfaces to many of the leading data base management systems. It has been particularly successful in marketing to the process control industry for building expert intelligence capabilities into traditional process control applications.

Only a few companies currently provide products for the AI end user market as opposed to tools for the professional software developer.

• Syntelligence, Inc., is one of the first companies to commercialize internally developed expert systems applications. Most expert system applications created from expert system application development tools have been used internally by corporations seeking a competitive edge through the use of a proprietary, knowledge-based system applications. Syntelligence, on the other hand, is marketing risk analysis application software developed from its own expert systems application development tools to the insurance and banking industries to be utilized for issuing insurance policies or making loans. Approximately 80% of the product represents what might be called a "generic" solution and the other 20% is customized for the individual customer. Pioneering ventures such as this will help determine the market potential for expert system applications.

• Portfolio management, process control, and office systems products with embedded intelligence features, are beginning to appear for the commercial market.

• Paperback Software Corp.'s VP Expert is a $100 personal expert system applications development shell which industry sources indicate has the largest installed base of any expert systems shell product. Because its rule-based structure can be fairly easily "programmed" by an end user, VP Expert has become a popular applications development

tool in the education and other professional markets for a variety of administrative/decision-making functions.

- Digitalk's Smalltalk/V is also gaining in popularity, particularly in the higher education market, where it is being used for teaching AI programming languages. It has also been used by academic experts to develop higher education simulation-based courseware applications. In addition, it is targeted for professional application developers to increase their efficiency in writing the newer generation of graphic-oriented user interfaces.

The potential exists for a major AI or AI-related industry based on the second generation of companies in the AI application development tools market and on companies such as Syntelligence which is pioneering a new type of off-the-shelf software with "embedded intelligence" features for the commercial end user (non professional programmer) market.

The traditional independent software developers and computer systems vendors are also incorporating a variety of "intelligent" features into recent product releases which were developed through the use of expert systems development tools either acquired through strategic alliances, company acquisition, and/or purchased from AI applications development tool companies.

Such AI applications include: process control applications involving expert rule-based decision capability; natural language front-ends for data base query also using expert system technology; automation of data center management and network control functions; multilinear-based personal information management systems (hypertext) which can integrate multimedia information sources; CASE front-end development/protyping systems (Aion Corp., Cullinet); full-text retrieval systems (Verity); decision support systems (Execucom); shared file structures for groupware applications, based on an object-oriented architecture (AS/400); and graphics-based computer interfaces (Smalltalk, Objective C).

A summary of recent trends in the application of AI technologies are shown in Exhibit IV-3.

2. Departmental Computing

There is an increasing trend among computer systems vendors to integrate vertical and horizontal applications with their systems software products (operating, communications and database management systems software) into departmental computing solutions. Much of the vertical software is coming from third-party developers. There is a major need by the computer systems vendors for third-party software developers as they accelerate their efforts to market application software. This is leading to

EXHIBIT IV-3

EVOLUTION OF AI TECHNOLOGIES AND SOFTWARE

First Generation AI Products/Technologies	Second Generation AI Products/Technologies	Future Generations of AI Products/Technologies
Dedicated LISP-based Expert System Development Environments	General Purpose Expert Systems Development Environments	Integrated Relational Database and Objects-Oriented Knowledge-Based Architectures
	Use of C Language and C Languages with Object-Oriented Extension	Objects-Oriented Database Architectures Incorporating Voice, Data, Video, Graphics, Data
	Expert Systems Development Tool for Embedded Applications	Built-in Intelligence into Traditional Application Such As Spreadsheets Word Processors, etc.
	Expert System Integrated CASE Tools	Multivendor CASE Tool Integration
	Commercialization of Decision Support Applications	
	Object-oriented Programming and Database Development Environments	
	Automation of Process Control Data Center Management Functions and Network Control	

an acceleration in the number and varieties of cooperative marketing relationships among computer systems vendors and third-party software developers. One of the major issues for the independent software developer is to determine what operating systems and platforms will dominate the future departmental computing environment.

With the integration of horizontal and vertical applications and communications software on the same server (minicomputer, workstation/PC) platform, multiuser and multitasking operating systems capability and hardware performance capability to act as an intelligent communications node become important selection criteria. At this point it would appear that minicomputers along with the standard workstation platforms will have a major role to play in this market with the increasing requirement to provide inter-network connectivity. In addition, UNIX will gain in popularity in this environment with its multiuser functionality as well as the capability for facilitating the development of client/processor cooperative network processing architectures.

3. UNIX

Nearly all the major computer systems vendors as well as several of the leading independent software developers have within the past year endorsed UNIX as a second operating system in addition to their own proprietary systems. In addition, several of the leading independent software developers in the microcomputer universe, such as Lotus Development, Ashton-Tate, Novell, and Oracle, have announced plans to offer UNIX-based software packages. This is providing the momentum behind UNIX that will make it a success in the commercial environment.

Recent industry studies suggest that UNIX will be the fastest growing operating system over the next several years. Whether or not UNIX functionally is a superior operating system is still debatable. The fact that it is an open system, in the process of becoming more of a unified standard in a computing universe that is now demanding standard implementations, bodes well for its future.

Also the federal government procurement process, which is requiring the use of UNIX in many contract bids, is a major incentive for computer systems vendors to provide such system support.

At present, there has been relatively small UNIX penetration in the mainframe platform commercial markets. However, mainframe computer architectures such as the Multiple Domain Feature (MDF) from Amdahl, which allows a single computer to run as many as four different operating programs simultaneously, are encouraging implementation of both UNIX and IBM-compatible operating systems in the mainframe environment, particularly for task specialization such as program development. IBM now also provides a comparable product offering.

A number of functional enhancements for the UNIX operating systems environment are now under development. These are being designed to correct certain inherent deficiencies in the various UNIX implementations, such as the lack of competitive real-time and on-line transactional processing capabilities as well as security weaknesses. The historical competitive strength of UNIX as an operating systems has been in the scientific application programming environment.

UNIX also offers a strong competitive alternative in a distributed processing environment with its software portability advantages.

More recently, UNIX is finding a niche on 80386 platforms, with products from companies such as the Santa Cruz Operations, Inc., with the SCO XENIX System V operating systems and application software. SCO also sells a software emulation product, called SCO VP/ix that allows users to run DOS applications on the SCO XENIX System V operating system.

Hunter Systems Corp. has an interesting new applications specific UNIX compiler product, called XDOS, which provides software developers, retailers, and even end users with the capability to recompile their DOS applications such as Lotus 1-2-3 into UNIX. Products such as this could accelerate acceptance of UNIX in the microcomputer world in that it helps preserve the value of existing DOS systems.

4. User Interface Management Systems (UIMS)

To increase computer usage by promoting system software independence and ease-of-use, new graphical user interfaces will be incorporated into a number of different product offerings appearing over the next year. The developers of these interfaces will also be working hard to promote their product as a standard. These also include the use of window environments for multitasking functionality. The newer object-oriented programming languages can help software vendors create graphical interfaces and thus should gain in popularity as a result of this trend.

Current examples of UIMS products include: MIT-developed X/Windows; IBM's Presentation Manager, which is part of IBM's SAA program; the Macintosh interface; Apollo's Open Dialogue; Open Look from AT&T and Sun Microsystems; New Wave from Hewlett-Packard; Metaphor Computer Systems bundled UIMS and proprietary database software; and Nextstep from NeXT Corp. Such products will significantly enhance the capability for software portability and the development of cooperative processing solutions.

5. Stackware (HyperCard-hypertext), Text Retrieval Products

The market for text/document retrieval products over the next several years could begin to rival the current market size of DBMS software. Text/document retrieval systems provide advanced search capabilities for textual documents in library research and office text generation and storage systems environments.

The HyperCard (hypertext) stackware product from Apple computer is becoming a popular text indexing/retrieval programming system, particularly in higher education.

One of the most advanced text retrieval systems currently available is TOPIC (TM) from Verity, Inc. It incorporates an expert system shell for a relatively easy expert system development applications environment. This system allows development of an indexing capability for searching a topic on a conceptual basis, and includes a weighting system for retrieval of the most appropriate/relevant documents.

The STAIRS (TM) product from IBM currently has the largest share of the text retrieval market along with the BASIS product from Information Dimension's which also incorporates an English-like query language.

To date, some of the more prevalent usages for text management systems include; litigation support, technical and corporate library automation, electronic publishing, and records management support for federal government agencies.

6. Application Development Tools

There are a number of new product developments in the applications development tools market which significantly enhance the growth prospects for this market over the next several years:

- The availability of quality PC code generators and compilers is making it possible for traditional mainframe code generator products to be ported to PC platforms. Sage Software recently introduced a PC version of its APS mainframe code generator which uses the Cobol/2 compiler from Micro Focus, Inc. to compile APS for the PC. IBM has also licensed the same compiler for use with its PS-DOS 3.3 and OS/2 operating systems.

- Neuron Data's NEXPERT OBJECT expert system development environment allows for the development of knowledge-based, embedded intelligence solutions with cross platform portability for the Macintosh, PC AT and PS/2, Sun Microsystem, Apollo Computer and VAX/VMS platforms.

- The number of integrated (front and back-end code generation) product offerings is increasing with fully integrated data dictionary and project management capabilities.

- Reverse engineering CASE tools, which utilize the advanced capabilities of the data dictionaries/repositories, have also been announced by some of the integrated CASE suppliers.

IBM has recently signed a licensing agreement with Transform Logic, a supplier of CASE products for the IBM mainframe environment. Transform Logic's CASE product will purportedly be incorporated into Cross Systems Product (CSP), IBM's application development/4GL product for the DB2 environment. Joint development work to further tailor the acquired software technology is also planned. Transform Logic is a potential leader in the reverse engineering CASE market along with those such as CGI Systems and KnowledgeWare. KnowledgeWare has also indicated it is working with IBM in developing CASE products. Transform Logic and KnowledgeWare have advanced capabilities in integrated data dictionaries /repositories which greatly enhance the efficiencies of software maintenance. These new alliances with IBM and leading CASE vendors indicates an increasing level of interest by IBM in CASE technology. Currently, industry sources suggest that IBM's product offering in application development tools is not as strong as is its product offering in other systems software areas. DEC has also recently established CASE alliances.

CASE tools are available which integrate expert systems development tools into the more traditional CASE application development and code generation environments. KnowledgeWare and Aion Corp. are examples of companies bringing expert systems technology to the CASE environment.

4GLs are also being integrated into the CASE environment. Cullinet is providing this capability with its IDMS/ARCHITECT product, and Informix is also working on such a capability. Cincom has also announced a CASE alliance program to integrate its Mantis 4GL language. These integration programs link the 4GLs with the CASE data dictionaries or repositories. 4GLs can add to the CASE environment such capabilities as improved prototyping capability for front-end CASE solutions and for back-end CASE, programming, testing and maintenance tools.

RDBMS and CASE tools are also now being integrated. Relational Technology has a joint development project with Cadre Technology, Inc., to integrate Relational Techology's Ingress RDBM with Cadre's CASE tools. Cadre's design tools will be used as a front-end to an INGRESS database, and INGRESS will be used as a data dictionary/ repository which can be shared across a network.

Major efforts are underway to establish standards among CASE tools offerings. The EDIF exchange format standard and the Integrated Resource Dictionary System (IRDS) data dictionary standard are two leading ones under evaluation. This also relates to a major effort underway to integrate the CASE product capabilities of a number of leading vendors. Supporting this effort is the Integrated Programming Support Environments (IPSE) which provide for CASE product integration. This includes: the Software Backplace from Atherton Technology; the Portable Common Tool Environment (PCTE), which is popular in Europe; and the Dept. of Defense's Common Ada Programming Support Environment Interface Set (CAIS). Currently CASE tools operate on different hardware platforms, operating systems, and various data bases.

7. Object-Oriented Technologies

Object-oriented computer technologies could become one of the most significant new software technologies of the next decade. A product of the artificial intelligence world, object-oriented technologies are now becoming a part of a number of more mainstream computer applications.

Object-oriented technologies include object-oriented programming languages and object-oriented data/file structures. Objects represent physical entities, abstractions and processes which are classified by inherited attributes.

Object-oriented programming technology comes out of the traditional AI languages (Smalltalk, LISP, PROLOG) environment. The original Smalltalk language also represents the origins of the Macintosh interface. Smalltalk/V from Digitalk,Inc., is a more recent bit-mapped implementation of a subset of Smalltalk. These object-oriented programming languages are gaining in popularity particularly in the higher education market for teaching AI technologies as well as among application programmers for developing proprietary graphic-oriented user program interfaces.

More recently C languages, with developed object-oriented extensions, such as C++ and Objective C, incorporated in the NeXT Workstation, are also becoming "mainstream" AI programming languages. The incorporation of an object-oriented C language in the NeXT Computer and the Nextstep user interface could be a significant catalyst for bringing object-oriented programming into the mainstream computing technology. The Objective C language bundled into the NeXT workstation was licensed from Stepstone Corp.

In addition to helping to develop easier-to-use, application interface structures which can also enhance software portability, object-based languages (OOPS) along with object-oriented database architectures also

provide the capability for integrating sound, data, voice, text, and video into common information management structures through their multilinear inheritance structures in programming multimedia applications and data base structures.

Object-oriented architectures are also being used to integrate various CASE environments (i.e., Atherton Technology).

8. Image Processing (Compound Document Creation, Processing and Retrieval)

Image-oriented products are beginning to make significant inroads into such industries as insurance, banking, medical, manufacturing, and the federal government. Many of the current programs involve replacement of microfilm storage techniques. One of the most elaborate image processing installations was made recently at the USAA Insurance Corp., which was a systems integration implementation by IBM. Wang Laboratories currently has one of the broadest, most fully integrated product offerings for image-oriented storage and retrieval.

9. Mapping Software

The Geographic Information Systems (GIS) market, which involves the conversion of data bases into map presentations, is one of the faster growing components of the market for computer graphics applications.

Two leading independent companies in this market include the GeoBased Systems subsidiary of Infocel, Inc. and Etak, Inc.

The principal GeoBased Systems product, known as Command Center, is a turnkey solution, which includes a software program called LandTrak (TM) that produces detailed colored maps and reports from various data base sources. A major current user of this system is law enforcement.

Etak is a leading developer of geographic information systems technology for fleet management and vehicle navigation. Principal products include the Navigator (TM), which is a computerized map system and visual display for automobiles, that moves in concert with the direction and speed of the car; and the newer Geocoder (TM) product, which is a desktop data base management system that allows users to access EtakMap (R), Etak's digital map data base, an extensive digital database which covers most of the cities in the U.S. Providing Geocode with a street address results in an automatic accessing of longitude and latitude on EtakMap and then shows the exact location on a workstation screen.

A principal use of Etak's product is for applications involving route optimization for trucking and other types of transportation companies.

10. Executive Information Systems (EIS)

This newer form of decision support software, which allows executives summary access to both corporate database environments as well as to a variety of public information sources is becoming a popular front-end for more structured DDS technology. EIS provides an access system, whereas DDS is based on an interactive systems model.

Leading independent software vendors in this market include: Comshare, Inc. (Commander EIS); Execucom Systems Corp. (IFPS/Plus); and Pilot Executive Software (Command Center).

11. RISC Microprocessor Technology

There will be an increasing need for application software for the anticipated accelerated introduction of workstations based on RISC (Reduced Instruction Set Computing) microprocessor architectures, such as the Sun SPARC, AMD 29000, and Intel 80960. A number of the new RISC processors are being optimized for UNIX system. The PICK operating system and the RISC architecture are also very compatible, and thus the RISC environment may provide an opportunity for application software developers working with PICK.

C
Market Trends

1. Mergers/Acquisitions

The merger and acquisition activity along with strategic alliances activity has continued to accelerate over the past two years. The following lists only some of the mergers involving some of the larger companies in the software industry within the past two years:

- Computer Associates bought Uccel for $800 million, the largest software company merger in 1987.

- Computer Associates bought Applied Data Resources, Inc., for $170 million in 1988. Industry sources suggest that CA has also recently contemplated acquiring MSA, Cullinet Software, and McCormack and Dodge Corp.

- In 1988 NYNEX bought AGS Computers, a systems software and professional services company.

- In 1987 Informix acquired Innovative Software, a developer of integrated office automation software.

- Ashton-Tate in 1987 acquired Ann Arbor Software, a desktop publishing software company.

- In 1988 Apple Computer acquired Orion Network Systems and Network Innovations, developers of communication software solutions.

- In 1988, 3Com acquired Communications Solutions to strengthen its communications software offerings.

- In 1988, Software Publishing bought Office Solutions, a developer of word publishing software.

- In 1988, Oracle bought Falcon Systems Inc. to strengthen Oracle's image processing product line.

- Lotus Development recently closed a deal for PS Publishing, Inc., a start-up company that is developing two programs for the Macintosh, which indicates Lotus' renewed interest in the Macintosh applications software markets. PS Publishing is developing an advanced desktop publishing program, called PS Compose, which will have the capability to work easily with typesetters, which offer better printing quality than most desktop computer printers.

2. Alliances

Alliance activity, including the development of strategic relationships, joint development efforts and co-marketing activities, has been particularly active over the past two years. Examples of a few of these alliances are listed below:

- Apollo Computer, Hewlett Packard, and Northern Telecom have formed a joint venture, called Corporate Networks Operation, to provide network consulting, design and custom integration services. Sun Microsystems has a similar arrangement with Infonet, Network Equipment Tech., Timplex, and BBN Corp. Both Sun and Apollo supply and support network software and services to other vendors who provide a proprietary product but want to connect their proprietary products with Sun and/or Apollo workstations.

- Sybase and Verity, and Informix and Verity announced joint marketing agreements for their RDBMS products and Verity's document search and retrieval software program. The RDBMs also plan to develop software bridges to integrate their products with TOPIC.

- Several CASE vendors have formed alliances with established 4GL companies. These are designed to allow 4GLs to coexist in the CASE environment.

- The Santa Cruz Operation, Inc., a leading factor in the 80286 and 80386 markets for UNIX/XENIX operating systems and applications

software has developed a number of alliances with software and computer systems vendors, including Microsoft and Wang Laboratories for software product exchange.

- IBM has licensed software technology from Metaphor Computer Systems, Inc., and NeXT Inc. to increase programmer productivity and end user ease-of-use.

- DEC and Ashton-Tate, and DEC and Relational Technology have recently signed joint development and distribution agreements to allow dBASE IV to work with DEC's Rdb and to allow Relational Technology's Ingress toolset to work with Rdb.

- DEC and Cullinet Software recently announced a cooperative marketing program under which the companies will jointly market Cullinet's Enterprise: Builder, Enterprise: Generator and Enterprise:Expert integrated application development tools for the VAX computing platform. Cullinet's Enterprise: Expert is also the recommended development tool for DECvoice, DEC's recently announced enterprise-wide voice-processing text-to-speech and voice recognition products.

3. Open Systems Architectures

Multisystem connectivity is now becoming a requirement for selling into the corporate computing environment. To implement such a strategy, open system architectures in the form of portable software and standard network interfaces are becoming increasingly important. The success of Sun Microsystems, with its open system computer and network architectures, is evidence of the competitive advantage of such an approach.

Use of standards will become a competitive requirement for both independent software vendors and computer systems vendors. What de facto standards to support is a more difficult decision for independent software developers. In particular, it is very important to evaluate the new common program interface programming environments, such as IBM's SAA.

The implementation of open systems solutions could also lead to an acceleration in merger and other types of alliance activity to compete through breadth of product offering.

4. Blurring of Products and Services Markets

In order to increase account control as well as to sustain higher growth rates associated with new product introductions, independent software and computer systems vendors are expanding rapidly into related support services with value-added pricing programs. This is particularly true in certain vertical markets where "total solutions" marketing has become the "hot" new delivery approach. This is particularly evidenced in IBM's AS/400 new bundled product offerings for a number of vertical markets.

Information Associates, Inc., a leading supplier of higher education administrative software reflects the trend to expanded support services among software developers. In addition to a wide variety of higher education administrative packages software products, the company has expanded into consulting and facilities management, custom programming, and education and training support.

At the same time, traditional professional services and systems integration suppliers have been rapidly expanding product offerings into the software systems and markets. This is particularly evident in the expanding product offerings of the "Big Eight" accounting firms.

5. Cooperative Processing Models

Future distributed processing models will provide cooperative processing solutions, which include transparent access to distributed applications as well as data, communication, and printer resources across and among various computer platforms and operations systems.

Included below are current products which incorporate elements of a cooperative processing model:

- Apollo Computer's Network Computing System (TM) is an application development technology for implementing a cooperative/distributed processing environment. Introduced in early 1987, it is an open networking product family which provides an architecture for network-wide sharing of computer programs and other resources. To promote its open network systems strategy, the company has licensed the application development technology to H-P and IBM, among others.

- Sun Microsystems has also recently announced the Network Software Environment (NSE), a network CASE system for software developers working on large scale projects involving heterogeneous machines. Sun has indicated that in two years the system will provide access to all the major operating systems environments that support Sun's Network File Systems (NFS) architecture.

- IBM's SAA, including the LU6.2 communications protocol, which will ultimately provide a single system view of an enterprise-wide information system.

- DEC's DECnet Architecture involving common communications and software standards across its various hardware platforms

- SQL-based relational data base management systems

- Cullinet's new Application Development Environment (Enterprise Series), which, when completed, should allow for an application developed on one platform to run on a number of different platforms and across operating systems in a cooperative processing mode.

- Such client/server processing models as the Sybase SQL Server™

- Future communications servers which will communicate with each other through the incorporation of OSI protocols.

6. Standards

As previously mentioned, support for leading standards in the information services industry in the following hardware and software product areas will be a requirement for competitive viability in the longer-term. Standards which are in the process of development include the following:

"Standards" in Progress

Screen	Windows, Presentation Manager, NeWS NewWave, Nextstep, GEM, Display Postscript
Graphics	DMS, CGM, CGI, TIFF, PICT
Communications	OSI, SNA, Ethernet, FNS, Token Ring, TCP/IP
DBMS	Codd's Rules, SQL, DB2
Printers	Postscript
Programming Interfaces	IBM's SAA, DEC's Compound Document Architecture (CDA)
Operating Systems	MS-DOS, OS/2, VM, MVS, UNIX, DEC VMS, PICK

Various industry studies indicate that UNIX could represent the strongest growth rate among mainstream operating systems over the next five years. The PICK Operating System is also continuing to gain acceptance in the minicomputer environment, its traditional platform base, and more recently in the RISC workstation environment.

A recent alliance between IBM and Seattle/OS, a PICK operating system supplier/distributor, provides an IBM endorsement of the PICK operating system with its incorporation in IBM's PC RT product, along with AIX, IBM's version of UNIX. The PICK open architecture software can run

Pick coresident with AIX on the PC RT. AIX also reportedly incorporates certain interface technologies which can enhance coresident functionality with other operating systems. Seattle/OS is currently the exclusive dealer for IBM products which incorporate the PICK operating system.

The PICK operating system was an original model for the bundled operating system environment (now being introduced by IBMs in the OS/400 and OS/2 Extended Edition products) with integrated data base management and natural language query capability. Competitive advantages of PICK are its multiuser and ease-of-programming capabilities. The principal acceptance to date has been in the smaller business (commercial) environment. In addition, PICK is a completely transportable system. For example, a benefit to IBM of incorporating PICK in its RT platform is that existing application programs written for the PICK operating system on other platforms will be easily transportable to the RT.

Announcements of current and or future support of DB2/SQL compatibility from leading independent data base software vendors (Software AG, Applied Data Research, Cincom Systems, Cullinet, Oracle, Sybase, Relational Technology, Informix) has established this relational data base model as a de facto industry standard.

7. Internationalization

Computer Associates International received more than 40% of its dollars from sales abroad in 1987 and approximately 47% of Oracle's revenues in fiscal 1987 were from international sources. Autodesk, Inc., has also founded major opportunities in non-U.S.markets in recent years, which considerably extends the market potential for its AutoCAD product line.

Beginning in 1992, with the formation of the Common European market, Europe will displace the U.S. as the world's largest single market. Increasingly then, U.S. software developers will be required to look to expanding into an international marketing arena to maximize their product potential. This will require, among other things, internationalization of product offerings for particular buyer requirements.

8. Project Management Software

Newer generations of project management software can be used to support company-wide integration and support for several platforms (mainframe, mini, and workstations/PC). Such solutions allow for the management of a single project, many projects, or all projects within an organization.

Mitchell Management Systems (Thortec International, also marketed by IBM) provides such functionality. On a company-wide basis, it can perform a "real time roll up" which can provide the exact status of any and all projects at a given time.

A future application for project management software would be to use it as a principal feed-back mechanism for implementing company-wide financial and other administrative controls.

Project management software offerings for PC platforms have also found strong acceptance within the past two years, as evidenced by the success of such packages as Software Publishing's Harvard Project Management package and Computer Associates' Super Project(R) Expert.

Project management software solutions in an integrated CASE offering is another important new application for project management systems. Future offerings could provide for an integration of various CASE environments throughout an organization.

Many new project management products support the C/SCSC (Cost/ Schedule Control Systems Criteria) format, which is designed to meet the requirements of certain government contracts. New programs are now available for the workstation/PC environment, including SuperProject Expert and Harvard Project Manager.

Several of the newer project management software releases now support import/export functions from popular database and spreadsheet programs.

There is also the potential for significant enhancement of the functionality of the current generation of project management software through the use of artificial intelligence technology.

Project management software oftentimes requires a great deal of customer support to implement. Project management vendors of large systems thus have had to provide significant customer support activity to be successful.

9. Bundled Solutions

IBM's AS/400, 4GL/RDBMS, Integrated Financial and Office Applications/RDBMS, and IBM's OS/2 Extended Edition are a few examples of the trend to providing bundled software solutions.

There are a number of important issues for independent software developers related to the trend to bundled software solutions. For independent PC communications and data base systems software companies, IBM's

OS/2 Extended Edition bundled communications and database systems software product offering represents a shift in the competitive structure in these two markets. New product offerings from Oracle and Walker Systems which closely bundle financial and other applications software with RDBMS solutions are reflective of a significant change in the competitive environment in the financial applications markets for both minicomputer and mainframe products.

A summary of the leading trends in the software markets identified in this reports are shown in Exhibit IV-4.

EXHIBIT IV-4

LEADING SOFTWARE MARKET TRENDS

- Merger/Acquisition
- Alliances
- Open Systems Architectures
- Products and Services Markets Blurring
- Cooperative Processing Models
- Standards
- Internationalization
- Company-wide Project Management Software
- Bundled Solutions

D
Principal Software Industry Issues

1. Issues in the Use of AI Technologies

The issues in the use of AI technologies include the following:

- A need for standard object-oriented languages—Xerox is promoting the Xerox Common LISP Object-Oriented Standard Proposal, also known as Commonloops, which is a set of extensions to Common LISP as a standard way of implementing object-oriented programming within Common LISP. Common LISP is a de factor standard among the several LISP dialects.

- Liabilities associated with the use of expert systems technology which draw upon the expertise of one or a few individuals whose expertise was used in building the expert system application—This poses the most risk in environments where there is the risk of a loss of life based on a decision made by the expert system application, such as in medical diagnosis. To date, there have not been any noteworthy cases. However, a related case, which could establish some precedent for software liability issues was that brought against Lotus Corp. which supposedly involved a "bug" in their 1-2-3 spreadsheet technology which the lawsuit alleged contributed to an operating loss at a particular company. That case was resolved in favor of Lotus.

  - One way AI companies are dealing with this potential liability is to offer products that do not make a final decision but rather only offer suggestions or alternatives.

2. IBM's Applications System Division (ASD)

The formation of a separate corporate division by IBM with the mission to spur internal development as well as to procure third-party application software alliances is bound to make a major structural impact on independent developers of applications software over the next several years. As many types of applications as well as systems software become more commodity-type products in the future, marketing clout is become increasingly important. As such, independent software developers should carefully evaluate the pros and cons of pursuing strategic alliances with the computer systems vendors who can be expected to be the major competitive forces in the 1990s. This also involves choosing certain operating systems as well as hardware platforms to support which will have the greatest potential for future market acceptance.

3. Open Software Foundation (OSF)

The strong competitive spirit evidenced between the Open Software Foundation and Unix International (formerly the Archer Group), the two industry consortiums seeking to develop a single Unix standard, suggests how important UNIX is becoming particularly to the computer systems vendor community. There is clearly momentum building among computer systems for the support of UNIX as the principal operating system alternative to their proprietary systems offerings. It also suggests the perceived importance of supporting an open systems programming environment.

OSF/1, which will be an operating system based on AIX, the IBM version of UNIX, is now scheduled for initial availability in late 1989 or early 1990.

Issues surrounding the OSF systems offerings include their ability to be cost competitive with System V Release 4, longer-term viability of a consortium structure, individual member support for their own proprietary interfaces in addition to that of OSF, and compatibility with the existing System V UNIX implementations from AT&T.

Unix International members plan to implement the AT&T/Sun System V, Release 4 which is scheduled to be available in 1989.

4. Standards

One of the principal issues related to the use of standard systems and architectures, which is implicit in the creation of the open system foundation, is equal access to upgrades of the standard product. This also relates to access to the source code for those who decide to build product that utilize the standard system.

Still another issue is the fact that it is can be easier for the larger players to establish their products as de facto standards in an end user world that is now seeking standard solutions. This has been evident in the mainframe data management systems environment with the success of IBM's relational data base DB2 product where many of the mainframe systems vendors with alternative proprietary DBMS architectures have lost significant competitive ground.

In the future, with the expected increased adoption of standards by independent software and computer systems vendors, there is also the issue of product categories quickly becoming commodity items. In the minicomputer relational data base market, companies like Oracle, who early on adopted the SQL standard as well as provided compatibility with the DB2 environment, have now seen a number of startup companies in their market develop similar strategies.

In a world of standard solutions, the rate of product obsolescence will accelerate. To maintain longer-term competitive leadership, companies may be obliged to speed up their rate of R&D spending to accelerate the pace of new product introductions which have some type of value-added pricing capability to maintain product margins. Oracle, for example, over the past year has made a number of product announcements which provide the company access to additional markets including: office automation, financial applications, professional services and systems integration. It has also made a number of strategic alliances which involve joint marketing of additional product. A key competitive factor may be that if the new products are bundled with well-established standard products, a significant value-added component may be included as a benefit to the end user of the integrated capabilities—such as a common data base for the various applications.

Another current issue that must be addressed by independent software developers is whether or not to write software utilizing the tools that will be available from IBM to conform to the SAA architecture. Management Science America (MSA), for example, one of the leading mainframe applications software companies has recently announced that all its future systems will conform to SAA because they see SAA becoming a de facto standard.

Writing to the SAA architecture, however, provides compatibility, at least at this point only within the IBM platform environment. There are also the many programming interface environments being proposed by other computer systems vendors such as Hewlett Packard, Sun/AT&T, and DEC as well as software vendors such as Microsoft with its Windows programming interface.

There is still a need to develop common applications programming environments which address the need for full hardware and software independence. Apollo's Network Computer System (TM) provides one such model.

5. Conformance Testing

The implementation of standard systems by various computer systems and software vendors alone does not guarantee interoperability among various vendors products. This has lead to the development of conformance testing consortiums (including vendors and end users) which provide testing services to insure compatibility. Two leading conformance testing groups are the Corporation for Open Systems (COS) and X/Open. COS is developing conformance testing products for the implementation of OSI, MAPS and TOPS network protocols, and X/Open provides product endorsements in the use of UNIX standards.

6. Application Development Tools

A persisting question is why there hasn't been a higher rate of acceptance of CASE tools by the IS community. One issue here is that of a perceived job threat, particularly with the use of code generators.

However, there also exist a number of different types of applications tools that make standardization of the development process difficult. These include: traditional utilities and application code generators that support third generation language application development; 4GLs; 4GLs/ DBMS (hierarchical); 4GLs/RDMS; 4GLS/SQL/RDBMS; 4GLs/embedded third language codes; CASE front-end and CASE back-end; and I-CASE, integrated CASE/4GLs for a variety of platforms and operating systems. CASE tools and 4GLs also need to be able to work with a number of different data bases and data dictionaries/repositories.

There need to be integration strategies and standards implemented so that tools and programs do not become obsolete and also allow for the integration of traditional manual and structured programming companywide. This lack of standards and integration capability appears to be one of the significant deterrents to more rapid acceptance of automated application development processes.

One benefit of 4GLs bundled with standard RDBMS is that they provide for greater portability than third generation languages.

7. Data Center Management Tools

More complex data center management tool solutions are required, with the ability to monitor the increasing number of distributed processing operations. Current leaders in this market include Computer Associates; Altai Software, Boole and Babbage, Duquesne Systems, MVS Software and Unison Software. Eventually, data center management systems could completely eliminate the need for manual intervention of an operator. Expert systems rules technology could be utilized to both monitor and correct data center management problems. Knowledge-based (AI) systems, which can analyze more complex data management situations and significantly reduce the expertise needed to identify a problem and create an appropriate response are now entering the market. One such product is Boole and Babbage's rule-based DASD Advisor product, based on Aion Corp.'s AI CASE technology.

Other automated operations products currently on the market include: Netview from IBM, OPS-MVS from MVS Software, AF-Operator from Candle Corp., and AutoMate/MVs from Duquesne Systems.

There is also a need for more data center tools which specifically track the costs of individual users. These could be integrated with company-wide project management software systems and become a part of chargeback procedures for strategic cost recovery of IS services. This could also help to track inefficient usage of data processing facilities. Leading vendors of such products currently include: for IBM systems— Computer Associates, Morino Associates, Inc., Applied Technology, VM Software, Raxco, Inc, Signal Technology; for DEC platforms—Raxco, Inc., Signal Technology, and Gejac, Inc.

8. Security

The recent virus epidemic has highlighted the basic security problems that continue to exist in managing both individual data centers and large computer networks. In particular, the recent INTERNET/ARPANET virus pointed out a security weakness in the UNIX operating systems environment. Recent product introductions from Sun Microsystems and others in the UNIX market are now addressing these issues.

- Sun Federal, a subsidiary of Sun Microsystems, recently introduced SunOS Multi-level Secure, a UNIX operating system with multi-level security for the Sun-3 and Sun-4 workstations Apollo has a secure UNIX operating system under evaluation by the National Computer Security Center.

- A new anti-viral product called Tracer which was designed to complement existing memory-resident virus-checking programs was recently introduced by Interpath Corp.

- Data security software currently under proposal by the major standards organizations for adoption as a global standard for electronic data security is the RSA Public Key Cryptosystem (TM) from RSA Data Security Corp. It is a digital privacy and authentication system which was developed by the founders of RSA Data Security at MIT. The security algorithm embedded in RSA's product, called RC2, which was developed in cooperation with the NSA, is available for license to software developers for incorporation into electronic mail types of applications. RSA technology allows senders and receivers of electronic mail messages to protect the content of messages through encryption and to authenticate both contents and recipients of a message. It could also be used to prevent computer virus problems on networks similar to the virus that occurred on ARPANET. The RSA public key encryption system uses a combination of a public and private key password system.

9. Network Management Software

Internetwork management compatibility among various network management products continue to be a major issue. IBM's new network management products with added LU6.2 support to Netview are beginning to address this issue. In particular, this peer-to-peer attachment to Netview-based mainframes helps third-party communications vendors to create two-way communication with IBM's network management software.

10. Microcomputer User Upgrades

A recent article in the San Jose MERCURY NEWS in California's Silicon Valley pointed out that users are facing some significant new cost and usage issues with some of the latest releases of such popular programs as WordPerfect, Microsoft Word, Ashton-Tate's dBASE IV, MacDraw, and the anticipated Lotus 1-2-3. Upgrade costs compared to previous releases have substantially increased, and there are new types of compatibility issues with previous releases, involving program interoperability as well as the addition of new commands and keystrokes, all of which are leading to considerable discussion on the merits of upgrading.

11. Lawsuits

The software copyright debate plus the increasing intensity of competition in many software product areas is leading to a new family of lawsuits related to the "look and feel" issues of graphics-based interfaces as well as database and spreadsheet clones in the microcomputer markets.

These include: Apple Corporation's suit against Microsoft and Hewlett-Packard regarding Windows and NewWave's similarities with the Macintosh interface; Ashton-Tate's suits against Fox Software concerning Fox's FoxBase data base products and the Santa Cruz Operation for a Unix-based version of the FoxBase data base product sold by SCO; and Computer Associates suit against Altai Corp., one of its leading competitors in data center management software following the announcement of merger interest between Goal Systems International and Altai.

Such lawsuits are emerging as a new marketing tactic with the potential for delaying competitive product introductions and forcing competitors to divert cash resources into defense of such suits.

12. Fujitsu-IBM Binding Arbitration Procedure

The arbitration method used to settle the IBM claim against Fujitsu could set a precedent in the computer industry for future intercompany software dispute adjustments. Before this occurs, the methodology should be more thoroughly examined for its strengths and weaknesses.

13. Shelfware (Program Obsolescence)

A problem with trying to justify software purchases on a return on investment basis is that too often software ends up not being used over the true life of its competitive viability. Rather it ends up as shelfware, not being used due to the complexity of the software product and lack of good documentation. With the high turnover in computer operations personnel, those originally trained on a system may leave, and if the software is too difficult to use, it is oftentimes shelved. It is very important that software developers provide strong documentation as well as other types of educational and training support for their product.

14. Japanese CASE Project (Sigma Project)

Along with its Fifth-Generation Language Project, Japan has its Sigma Project which is striving to enhance the application productivity of its Unix software developers. This CASE project includes the building of a database of modular designs that third-party developers can use for building software applications.

E
Future Software Market Opportunities

1. Distributed, Heterogeneous Data Base Systems

A requirement for the next generation of relational data base systems technology will be the distributed, heterogeneous database model, incorporating a client/server architecture. Many of the data base management systems software companies have announced development programs in this area. More complete distributed data base solutions will require such capabilities as global data dictionaries, enterprise-wide network management (either on a centralized or decentralized basis), open system architectures, synchronous update capability which supports total network-wide data integrity, and common user interfaces. In addition, the utilization of the SQL data base language is an important factor in providing for multi-data base access.

A major benefit of such data base structures is the capability to include the large number of PC-based data bases into a company-wide data base structure which will significantly reduce current problems related to data integrity and data redundancy.

2. Object-Oriented Data Base Management Programs

A number of different transmission media (data, voice, text, video, graphics) will become commonplace in future environments. To integrate these various media for compound document storage and retrieval requirements, a major new generation of data base technology may be required in the next decade. Object-oriented data base management technology which utilize multilinear structural relationships, could combine these various media with much less programming effort than with today's relational and hierarchical structures. Companies currently working on object-oriented data base solutions include Ontologic, Inc., which markets Vbase (a combination of object-oriented programming language and data base architecture) for engineering applications, and the Servio Logic Development Corporation, which sells the Gemstone object-oriented data base program. Ontologic is also currently developing interfaces for VBase and the popular relational data base management systems.

3. Videotex Applications

Prodigy (TM), a product of a joint effort between IBM and Sears, is an example of a software package that may begin to ignite the home videotex market. The market for software products providing home access to on-line databases and shopping services will also be stimulated by the entry of the RBOCs into the home information services delivery markets.

4. Computer-Aided Training

With the need to retrain adults for the rapidly changing skill requirements of future job markets, computer-aided training will be a major market in the future. Interactive VSAT (Very Small Aperture Terminals) and future ISDN technologies might be used to complement such training approaches by providing more cost-effective distribution of education and training programs along with providing computer programs on a subscription fee basis.

5. Mission-Critical Applications

A new domain for corporate computer applications of the future will increasingly be for mission-critical applications, as opposed to back-office general accounting type applications. Such mission-critical solutions involve external relationships of companies with their customer, suppliers, vendors, and regulators as well as proprietary solutions that are critical to the on-going well being of a company. Open systems architectures will be important for implementing externally-related application solutions, in particular.

V

Competition

V
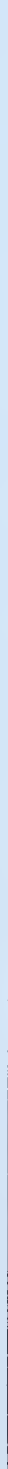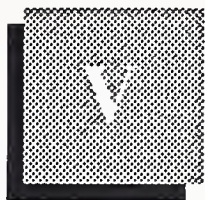
Competition

A
Overview

The competitive level in the various software markets has amplified considerably over the past two years, particularly in the systems software products group, due to a number of large mergers, success associated with the implementation of data base management systems software standards, as well as to structural shifts in market share of hardware platforms among the larger computer systems vendors.

Growth opportunities in systems software exist, particularly in application development and data center management tools.

In the applications software products markets, companies marketing to the workstation/PC markets represent the major growth scenarios within the software industry, as measured by internally-generated product.

Vertical market (industry-specific) solutions represent the strongest growth potential in the applications software industry.

Overall, marketing and financial strengths are becoming much more crucial to longer-term competitive viability in the various software markets.

B
Leading Vendors

The following profiles include several of the leading independent software companies. They reflect companies with a strong competitive position in their respective markets and include primarily the larger players. Cullinet Software, Inc. is included as a potential strong turn-around candidate with its new strengths in DEC-based product offerings, as well as to innovative new application development tools.

Profiles on the smaller software companies with strong competitive product offerings are included in INPUT's several industry-specific and cross-industry annual reports.

COMPANY PROFILE

ADOBE SYSTEMS INCORPORATED
1585 Charleston Road, P.O. Box 7900
Mountain View, CA 94039

Adobe is a software technology company that designs, develops, and markets systems software used in laser printers, typesetters, displays, and other raster output devices to print integrated text and graphics for electronic printing and publishing applications.

The company's principal product, Adobe's PostScript interpreter, executes page descriptions generated from application programs that support the Post Script page description language to produce documents containing multiple typefaces and graphics. Adobe continues to expand its Type Library with over 200 typefaces, some of which are provided as standard in PostScript-equipped printers, and others which are available separately for downloading.

With OEM customers which produce over 30 different printers, the PostScript page description language has become a graphics language standard.

The PostScript interpreter normally resides on a controller board in the laser printer or other raster output device.

In 1987 Adobe introduced the Display PostScript system for computer monitors which extends the PostScript page description language to workstation platforms. This was recently incorporated into the new computer from NeXT, Inc., and has also been endorsed by DEC and IBM. Display PostScript has the potential for becoming a systems software standard for the development of screen displays by independent application software developers and computer systems vendors. A standard would reduce the need for application developers to write various versions of their software for different computer screen environments.

Also introduced in 1987 was Adobe Illustrator, an application software product which is a computer-assisted illustration tool for producing high-quality art and illustrations.

Adobe markets its PostScript systems software products to computer, printer, and typesetter (OEM) manufacturers.

Adobe Illustrator is marketed to the end user through software distributors.

Since one of Adobe's goals is to promote the PostScript language as an industry standard, Adobe has placed the PostScript language in the public domain.

In November 1987, Adobe announced signing of contracts with Fujitsu Limited for PostScript interpreters for Japanese and Western languages, with NEC Corporation of Japan for Adobe's Kanji PostScript interpreter, and in mid-1988 with Matsushita Corp. of Japan. These contracts with the largest computer suppliers in Japan significantly expands the international market potential for Adobe's PostScript.

In January 1988 the company announced the Adobe Illustrator 88 program which brings color and more sophisticated professional tools for more advanced applications in technical publications and color textbooks.

In June 1988, Adobe announced that R.R. Donnelley the largest U.S. printer, had become another licensee of PostScript.

In mid-1988, Adobe introduced Illustrator 88 for the Macintosh Plus, SE, and II. As an upgrade to the Adobe Illustrator product, the company provides an auto-trade feature for automatically turning templates from scanned art or clip art into PostScript art. It also has a blend command for making graduated colors and an average command for automatically calculating and drawing the stages or transforming one object into another.

In September 1988, Adobe announced for shipment at year end an Adobe Illustrator, Windows version, PostScript language-based drawing package for the IBM personal computer environment.

In 1988 Adobe Systems also signed an OEM agreement to license the Display PostScript system to Digital Equipment Corporation for use under Digital's DEC windows windowing system and with IBM Corporation.

Adobe will expand its system software technology into related electronic printing markets and will develop new products for selected end user markets. Particular new product opportunities include color laser printers, Japanese software (with graphic Kanji characters), and facsimile machines.

Other future product offerings should also expand the number of typefonts supported.

COMPANY PROFILE

COMPUTER ASSOCIATES INTERNATIONAL, INC.
711 Stewart Avenue
Garden City, NY 11530-4787

Computer Associates International, Inc. (CAI) was incorporated in 1974 and commenced operations in 1976. As a result of ongoing internal development and numerous acquisitions, the company currently markets and supports more than 100 software products worldwide. CAI's product line includes systems software, relational data base management systems, and application software for use on mainframes, minicomputers, and microcomputers.

In September 1988 CAI announced that it agreed to acquire Applied Data Research, Inc. (ADR) from Ameritech for $170 million. ADR, a provider of systems software products to cross industry markets, had revenue of approximately $172.9 million in 1987.

In November 1988, Computer Associates announced the details of its development plans and strategic direction for mainframe data base management systems. It reflects the company policy in regard to future product direction of the two data base management systems offerings, CA-UNIVERSE and CA0DATACOM/B (which was acquired in the ADR merger).

Computer Associates' new product data base management CA-DATA-COM/DB II, which will compete with IBM's DB2 and SQL/DS products, will provide complete upward compatibility for CA-DATACOM/DB and CA-UNIVERSE clients. CA-DATACOM DB II will be based on the architecture of CA-DATACOM/DB. It will evolve from enhancements currently being made to CA-DATACOM/DB and CA-UNIVERSE. CA-DATACOM/DB II will support the complete SQL dialects of both DB2 and SQL/DS.

CAI management attributes the company's revenue growth to the licensing of greater numbers of products, both developed and acquired.

Since 1982, CAI has made 15 acquisitions.

CAI is organized into five divisions as follows:

- The Systems Products Division (SPD) markets and supports the company's systems software products in North America. In addition, there

is a dedicated sales force for sales to federal government data centers and national accounts.

- The Applications Products Division (APD) markets and supports the company's financial applications, graphics, project planning, data base management systems, decision support, and programmer productivity software in North America. APD is organized into 20 regions.

- The Micro Products Division (MPD) markets the company's microcomputer software products in the U.S. and Canada. This division is organized into four regions served by 13 sales offices that market directly to distributors and dealers. MPD has dedicated corporate and direct sales forces that market the company's microcomputer products and support services to large corporate clients, OEMs, government clients, and educational institutions.

- The Far East Products Division (FPD) and European Products Division (EPD) serve as the distribution arms for SPD, APD, and MPD products outside North America. They oversee the company's subsidiaries in 20 foreign countries, as well as the company's independent distributors in those countries where CAI does not have its own operations.

CAI's major competitors, by product area, include the following:

- Systems software: IBM

- Application software: IBM, Management Science America, and McCormack & Dodge

- Microcomputer software: Lotus Development, DAC Software, and Peachtree

Approximately 77% of CAI's fiscal 1988 revenue was derived from software product licenses and 23% from maintenance fees.

A further breakdown of fiscal 1988 revenue by division is estimated as follows:

Systems Products Division	44%
Applications Products Division	14%
Micro Products Division	8%
International Divisions	34%
	100%

CAI currently offers more than 100 software products. The company has over 8,500 mainframe and minicomputer product installations and has sold more than one million copies of its integrated accounting and productivity microcomputer software products.

CAI's products are used by clients in the manufacturing, banking, insurance, retail, and education industries, as well as government agencies. More than 85% of the Fortune 500 corporations use one or more of CAI's mainframe packages.

In the area of data base management systems, graphics, and applications software for the micro, mini, and mainframe computer, the customer base ranges from small business users to Fortune 500 companies.

Revenues from independent distributors accounted for less than 1% of CAI's fiscal 1988 revenue.

Approximately 61% of CAI's fiscal 1988 revenue was derived from the U.S. and Canada and 39% from Europe, Australia, and other international sources.

For each of the last two fiscal years, approximately 40% of CAI's revenue from mainframe products was derived from business outside North America. In fiscal 1986, this percentage was approximately 30%, Western Europe is, by far, the company's most important foreign market.

COMPANY PROFILE

CINCOM SYSTEMS, INC.
2300 Montana Avenue
Cincinnati, OH 45211

Cincom Systems, Inc. was incorporated in Ohio in 1968 as a contract programming firm specializing in data base and interactive systems software. The company now provides software products in five major areas: relational data base management, manufacturing applications, application development tools, information center tools, and network management.

Cincom's fiscal 1987 revenue reached $132.4 million, a 38% increase over fiscal 1986 revenue of $95.6 million. INPUT projects 1988 revenue was between $165 and $170 million for a 27% growth rate from the previous year.

Between 1980 and 1987 Cincom has invested over $100 million in research and development in its TIS/XA product line.

In 1987, 69% of revenue came from either new or enhanced products, Cincom expects 80% of its 1988 revenues to be derived from new or enhanced products.

Management attributes its growth in 1987 to three areas: the acceptance of SUPRA; a movement towards decentralization and acceptance of DEC VAX machines in the manufacturing industry, contributing to the acceptance of Cincom's CONTROL:Manufacturing™ product; acceptance of MANTIS internationally.

In June, 1988 Cincom announced a computer-aided software engineering (CASE) alliance with Index Technology Corporation of Cambridge (MA), D. Appleton Company of Manhattan Beach (CA), and Aion Corporation of Palo Alto (CA) in order to provide users with a unified set of CASE and other application development tools which address the entire application life cycle.

On November 19, 1987 Cincom announced an alliance with Nixdorf Computer AG, Padervorn, West Germany. The agreement relates primarily to the development and marketing of each company's respective products. Nixdorf Computer provides technological expertise in portable distributed data bases and UNIX operating systems. Nixdorf's marketing and service network serves 44 countries.

Also in 1987, Cincom announced a computer integrated manufacturing (CIM) alliance with the following leading CIM vendors: Litton Industrial Automation Systems, Intergraph, John A. Keane and Associates, and Systonics. The first product to stem from this alliance was an interface from CONTROL:Manufacturing to Epic Data's data collection system.

In 1985 Cincom joined Digital Equipment Corporation's (DEC) Cooperative Marketing Partners program for their TIS/XA product line.

Competitors include Cullinet, Applied Data Research, Software AG, ASK Computer Systems, and IBM.

One hundred percent of Cincom's fiscal 1987 revenue was derived from software products and associated support services. Revenue from Cincom's software products was segmented as follows:

Data base	48%
Application Development	24%
Network Management	16%
Applications	12%
	100%

In 1978 Cincom began developing "The Information System Extended Architecture" or TIS/XA. TIS/XA is an underlying architecture designed to address the complete needs of today's data processing centers without the need for extensive systems integration procedures when adding new components to an existing system under the TIS/SA architecture. Another important characteristic of TIS/XA is to free the user from vendor/environmental lock-in by acting as an insulator between the applications in use under TIS/XA and the hardware it runs on. TIS/XA consists of the five major components: relational data base management, business control for the manufacturing environment, application development tools, office automation tools, and network management.

Relational Data Base Management

- SUPRATM is an advanced relational data base management system designed for the IBM environment. SUPRA is available for IBM 30XX, 43XX or compatible processors running under MVS, MVS/XA, VM/CMS, DOS/VSE, VSE/SP 2.1, CICS. SUPRA is a combination of the following elements:

- SPECTRA is non-procedural data base query and application development tool with full insert, update, and delete capabilities. The system increases flexibility by supporting external files.

- NORMAL is a data base design tool that automates the process of data normalization. Based on information entered about dependencies, primary keys and domains, NORMAL reconstructs the data views into third normal and generates the appropriate files and navigation strategies.

- MANTIS is a fourth-generation application development tool that is completely integrated with the company's data base management systems.

- SUPRA also provides system utilities in three areas including directory maintenance, physical file management, and a data base design analyzer, DBAID, used to test data views before using them in the production environment.

ULTRA Relational DBMSTM is essentially the DEC VAX version of SUPRA, but does not contain the NORMAL facility. ULTRA does, however, contain the additional ability to access DEC RMS files.

Both SUPRA and ULTRA are geared towards transaction processing and high volume environments.

Business Control for Manufacturing

- CONTROL:Manufacturing is a modular manufacturing control software system. CONTROL contains the following modules: Bill of Materials Routings, Material Control, Master Production Scheduling, Material Requirements Planning, Shop Floor Control, Purchasing, Cost Management, and Order Management. Additional modules are available to tailor the system to job shop, repetitive, or process manufacturing environments. Those additional modules are: Lot/Serial Number Traceability, Engineering Change Control, and Project Manufacturing Control.

- CONTROL:Financial™ is a financial applications package designed for the manufacturing environment and is fully integrated with CONTROL:Manufacturing. The modules currently available for CONTROL:Financial include: Accounts Receivable, Accounts Payable, and General Ledger.

In 1986 approximately 80% of Cincom's CONTROL product installations were based on IBM mainframe processors, and 20% on DEC VAX processors. In 1987 a complete reversal was experienced and only 20% of new product installations were based on IBM processors and 80% were based on the DEC VAX.

Application Development Tools

• MANTIS, is available for IBM, DEC VAX, WANG VS, Honeywell Bull, and ICL environments. MANTIS can be used in conjunction with Cincom products and can also access VSAM, IMS, ADABAS, and DB2 files.

• MANTEXTTM is a mainframe, free form, text processing system that enables users to access corporate files for the creation of business documents and corporate mailings.

• MANGRAFTM is a business graphics tool that provides output from on-line applications using centralized production data base information. MANGRAF is only available in some of Cincom's foreign markets, and is in the process of being phased out.

Office Automation Tools

• SPECTRA (previously mentioned)

Network Management

• NET/MASTERTM is a network management system for VTAM environments that provides single operator control of a multiple CPU, multiple site, and multiple application network. NET/MASTER consists of the following components:

  - Network Control Language is a 4GL designed for the customization of network presentation, operation and security.

  - Operator Control Services provides operators with a single console view of system operations even for remote network operations.

  - Access Component is the network security component, and may be used in conjunction with other commonly used security systems such as ACF2, RACF, TOP SECRET, and others.

  - Multiple Application Component provides concurrent access to multiple applications and allows operators to manage and control subsystems such as CICS, TSO, IMS/DC, and others.

  - Advanced Network Management Component allows operators to monitor sessions, hardware and network status. Networks can be partitioned into "spans of control" for different operators. All network activity may be logged and the log may be browsed on-line.

  - SYS/MASTERTM Component allows operators to automate many routine tasks for local and remote systems in the network.

- Transfer Component provides for transmission of bulk data cross domain in a VTAM network.

• PC CONTACT is an integrated, interactive, upload/download communication link between IBM 370 architecture processors and the family of IBM personal computers. PC CONTACT allows users to extract corporate data from the mainframe host using MANTIS. The information can then be downloaded to a PC diskette. Similarly, the user can upload data from the PC back to the mainframe host.

In 1988 Cincom is planning to release versions of its current product line to run under the UNIX operating system. Cincom is also planning to break into the CASE marketplace in 1988. Cincom management says it is looking to form additional alliances in the network management area in the near future.

Cincom markets its products to Fortune 500 companies across all industries.

Cincom is an international entity with 52% of its revenue being derived from foreign operations and 48% from U.S. operations.

COMPANY PROFILE

CULLINET SOFTWARE, INC.
400 Blue Hill Drive
Westwood, MA 02090-2198

Cullinet Software, Inc., founded in 1968, develops, markets, and supports data base management software; artificial intelligence software; application software for manufacturing, human resources, distribution, project tracking, banking, and finance applications; information center management software products and application development tools.

In September 1986 Cullinet announced its "3x3 Architecture," the company's strategy for its future marketing efforts targeting three sets of products—data bases, development tools, and applications—over three hardware platforms—corporate mainframes, departmental computers, and microcomputers.

Fiscal 1987 revenue was $174.9 million, an 8% decline from fiscal 1986 revenue of $189.3 million. Net losses were $27.6 million, compared to net income of $13 million for fiscal 1986. In the second quarter of fiscal 1989 ended October 31, 1988, Cullinet posted an operating and a pretax profit for the first time in more than two years. This was based on record second quarter revenue of $52.5 million, which represents an increase of 7% over second quarter revenue in fiscal 1988.

Acquisitions made by Cullinet during 1987 include the following:

In April 1987 Cullinet acquired Distribution Management Systems, Inc. (DMS) of Lexington (MA) for approximately 1.7 million shares of Cullinet common stock. The acquisition has been accounted for as a pooling of interests.

DMS provides distribution management software products and Application Expert, and expert system application development tool.

DMS had approximately 100 employees at the time of the acquisition and revenue of $5.8 million for the fiscal year end April 30, 1987 (restated).

DMS now operates a wholly owned subsidiary of Cullinet.

Cullinet's major competitors are listed by product line:

* Data base management software competitors include IBM (IMS, DB2, and DL/1), Applied Data Research (Datacom), Software AG (ADABAS), and Cincom Systems (TOTAL).

* Audit software competitors include Pansophic Systems (Easytrieve) and TSI International (Audit Analyzer).

* Application software competitors include McCormack & Dodge (D&B) for financial applications, Hogan Systems and Computer Associates for banking applications, and ASK Computer Systems for manufacturing applications.

* Microcomputer software competitors include Lotus Development Corporation and Ashton-Tate.

Approximately 62% of Cullinet's fiscal 1987 revenue was derived from its data base management software products, 32% from application software products, and the remaining 6% from information center products.

Cullinet offers an integrated line of data base management and related systems software products. Its major component is IDMS/R, a high-performance relational data base management system for large integrated on-line customer applications. The company's other integrated data base, audit/retrieval, applications, and information center software products operate as modular systems based on IDMS/R.

IDMS/R runs on IBM 360, 370, 30XX, 43XX, 9370, and compatible computers. Versions are available for OS MFT, OS MVT, OS/VSI, OS/VS2 (SVS), OS/VS2 (MVS, MVS/XA), DOS/VS, DOS/VSE, and VM/CMS operating systems. In May 1987 Cullinet announced a three-year cooperative agreement with Fujitsu Limited to supply and market IDMS/R and related applications on Fujitsu's FACOM-M series of mainframes.

IDMS/Architect, introduced in March 1986, is a family of PC-based computer-aided software engineering (CASE) tools for data base and applications software development.

IDMS/Architect is designed for IBM and compatible microcomputers.

AUTOMATE PLUS, the first IDMS/Architect product, is a graphics-based design tool.

Application Expert, developed by Distribution Management Systems, is an artificial intelligence-based expert system tool for application development. The product is available for IBM and compatible mainframes and DEC VAX series computers.

The Implementation Workbench, introduced in March 1986, is a series of tools designed to support the installation of Cullinet's on-line applications.

In the fall of 1988 Cullinet announced its New Enterprise Computing Program, which includes a strategy for data base systems, applications development tools, and applications based on the client/server network architecture. Initial products in this program include Enterprise Builder and Generator development tools.

Versions will be available for all of Cullinet's application products.

KnowledgeBUILD, introduced in January 1988, is an applications generator for creating high-performance applications on DEC VAX systems.

Cullinet provides industry-specific software products for manufacturing, distribution, and banking applications as well as cross-industry products for project tracking, human resources, and financial applicatons.

Cullinet began marketing applications software in 1981. The company rewrites, modifies, and enhances the products it acquires and fully integrates them with its IDMS/R product line.

In the manufacturing area Cullinet offers the following products:

- The Cullinet Manufacturing System is an on-line, net-change, closed-loop MRP II system. It consists of eight modules that may be implemented individually or in any combination including: Bill of Material, Inventory Control, Material Requirements Planning, Shop Floor Control, Master Production Scheduling, Purchasing, Cost Control, and Order Entry.

- The Cullinet Manufacturing System—Repetitive for IBM mainframes and the Repetitive Manufacturing System for DEC VAX computers (acquired from Computer Strategies) are targeted to companies involved in high-volume, repetitive manufacturing, such as auto manufacturers and government and defense contractors.

- As a result of the acquisition of Computer Strategies, Cullinet also offers the following products for DEC VAX systems:

  - Automotive Release Control System
  - Quotation Management System
  - Repetitive Purchase Order Control
  - Focus Forecasting System
  - Level Load Production Planning

In March 1987 Cullinet and Epic Data Corporation entered into a CIM Strategic Marketing Agreement whereby both companies are committed to provide integrated data collection and software applications for shop floor control and inventory management.

In September 1987 Cullinet and CADAM, Inc. signed a CIM marketing and joint development agreement to permit CADAM attribute data to be exchanged with the Bill of Materials module of the Cullinet Manufacturing System.

Cullinet's products are used by companies in a variety of industries including manufacturing, petrochemical, steel, financial and banking services, insurance, health care, legal services, utilities, education, entertainment, aerospace, communications, retail, wholesale and distribution, transportation, and government.

Cullinet clients range from small, growing companies to Fortune 1000 firms.

COMPANY PROFILE

DUQUESNE SYSTEMS, INC.
Two Allegheny Center
Pittsburgh, PA 15212

Duquesne Systems, Inc. (DSI), founded in 1970, provides productivity enhancement systems software products for IBM and compatible mainframes and IBM 9370 minicomputers. The company's products, which are designed for the MVS and VM operating systems, are organized into three integrated groups: the Performance and Optimization Group, the Operations Productivity Group, and the Terminal Productivity Group.

Recent acquisitions made by DSI include the following:

• In March 1986 DSI acquired the Single Image Software (SIS) systems software product line from Updata Software Company for $12.2 million.

  - SIS products, which include Multiple System Manager, Multiple System Integrity, and Global Console Director, generated approximately $7.6 million in revenue for the year ending September 30, 1985.

  - The operations of the SIS product line have been merged into DSI's Operations Productivity Group.

• In March 1987 DSI acquired the NetSpy software product from VTAM Development Group for a cash payment plus contingent payments based on the product's future sales performance. Total acquisition costs are estimated at $1.6 million. NetSpy, a network performance response time monitor, is marketed through DSI's Performance and Optimization Group.

In December 1988 Duquesne Systems Associates and Morino announced an intention to merge.

Fiscal 1987 revenue reached $37.7 million, a 55% increase over fiscal 1986 revenue of $24.2 million. Net income for the year was $8.1 million, a 62% increase over $5 million for the previous year.

Of the $13.4 million revenue increase in fiscal 1987, $6.8 million was derived from existing products and $6.6 million was due to acquisitions.

Major competitors include Morino Associates, Boole & Babbage, and Candle Corporation.

Seventy-nine percent of DSI's fiscal 1987 revenue was derived from systems software license fees. The remaining 21% was derived from software maintenance contracts.

DSI's productivity enhancement systems software products are designed to run on IBM and compatible mainframes and IBM 9370 minicomputers under MVS and VM. There are currently over 7,500 product installations in over 2,500 computer sites worldwide.

DSI's product line consists of three product groups as follows:

Operations Productivity Group products are designed to simplify large, complex, corporate data center operations. This product group contributed 47% to fiscal 1987 revenue.

Performance and Optimization Group products optimize disk subsystem performance and measure, analyze, and report on the use and efficiency of data center resources. This product group contributed 27% to fiscal 1987 revenue.

Terminal Productivity Group products improve the operation of terminal networks. This product group contributed 26% to fiscal 1987 revenue.

DSI's current product offerings are shown in the exhibit.

Significant developments by product group include the following:

• Operations Productivity Group

During 1988 DSI merged its Shared Device Management and Single Image Software product lines to form the Global Resource Manager product line. These products were introduced to the VM operating system in 1988.

Global Tape Manager replaces Shared Tape Allocation Manager and Multiple System Manager.

Global Data Integrity replaces Shared Dataset Integrity and Multiple System Integrity.

Global Console Manager replaces Superconsole and Global Console Director.

AutoMate/MVS, introduced in October 1987, is an entirely new product. It is the first of DSI's products that address the area of automated operations.

- Performance and Optimization Group

DASDMON 1.7, released in October 1987, has a new component, Data
Set Placement Manager, that analyzes the DASDMON measurement
data and makes specific recommendations to the customer regarding data
sets that should be relocated to improve overall disk performance.

A new version of NetSpy was released in May 1987 that provides an
interface to session managers (such as TPX).

- Terminal Productivity Group

During fiscal 1987, the company advanced its TPX and STX products to
offer customers effective base products with several options for custom-
izing network operations. TPX, which provides quick switching between
many on-line applications for MVS of VM environments, can now be
used as a single or multiple session manager with such options as broad-
casting, data compression, and terminal command automation.

STX, which gives users access to public and private data bases, has been
enhanced to let IBM terminals access information from non-IBM main-
frames. It now lets users of IBM terminals emulate other terminals such
as DEC's VT100 to gain access to more data services.

DSI's systems software products are cross-industry products.

Approximately 315 of DSI's customers are Fortune 500 Industrial or
Fortune 500 Service companies.

Approximately 60% of fiscal 1987 revenue was derived from the U.S.
and 40% from international sales. Of the $15 million in foreign revenue,
over 74% was derived from customers in Western Europe.

COMPANY PROFILE

MCCORMACK & DODGE CORPORATION
1225 Worcester Road
Natick, MA 01760

McCormack & Dodge Corporation (M&D), formed in 1969 and acquired by Dun & Bradstreet in 1983, develops, markets, and supports software products for financial, human resources, and manufacturing resource planning applications. The company also offers software tools for application development, micro-to-mainframe links, and report writing.

M&D's fiscal 1987 revenue reached an estimated $151 million, a 24% increase over estimated fiscal 1986 revenue of $122 million.

M&D management attributes revenue growth to strong domestic sales and significant gains in the international market, including Australia, France, and the U.K.

M&D's annual sales have increased 40 times in ten years.

Since its acquisition by Dun and Bradstreet in 1983, M&D's revenue has grown on average by more than 30% per year.

The company has operated profitably since inception and achieved record net income in fiscal 1987.

In March 1988, M&D acquired Neller Software's Austpay Australian payroll/personnel package. Terms of the purchase were not disclosed.

Introduced by Neller Software in 1983, Austpay is installed throughout Australia and New Zealand at more than 50 customer sites, including L.M. Ericsson, Mitsubishi Motors, and Air New Guinea. The system runs on IBM, DEC, ICL, and Fujitsu computers.

The Austpay business will become part of McCormack & Dodge Australia Pty. Ltd., M&D's Australian operation headquartered in Sydney. All nine former Neller Software employees who worked on Austpay development and support will join M&D Australia and will work to integrate Austpay with M&D's Millennium execution environment.

Initial target markets for Austpay are Australia and New Zealand. M&D will consider selling Austpay in other international markets in the future.

In early 1988 M&D announced an agreement with GE Information Services whereby M&D will incorporate electronic data interchange (EDI) capabilities into two of its software products.

Upcoming releases of PO:Millennium (Purchase Order) and the PIOS Purchasing Management module will allow the users to create EDI-formatted purchase orders directly from within those applications.

Users will be able to send electronic purchase orders straight into EDI*T, GE Information Services' EDI translation software. Formatted electronic documents can then be transmitted via GE Information Services' EDI*Express network into the EDI mailboxes of their suppliers.

M&D is currently organized into the following business units.

The Financial Systems Business Unit markets and supports the company's Millennium mainframe financial/accounting software products and the Satellite Series product line.

The Human Resources Business Unit markets and supports the Millennium human resource management product line.

The Application Tools Business Unit markets and supports Millennium application tools and its micro-to-mainframe link, Interactive PC Link.

The Distributed Systems Business Unit markets and supports the PLUS line for financial/accounting products for DEC VAX and IBM System 36 and 38 computers and PC MinLink, a micro-to-minicomputer link.

The Manufacturing Systems Business Unit markets and supports the PIOS and C/PIOS manufacturing control systems.

M&D also has foreign subsidiaries in Australia, Belgium, Brazil, Canada, France, Japan, The Netherlands, New Zealand, Singapore, Spain, and the U.K.

As of November 30, 1987 M&D had approximately 1,700 employees. The company currently has approximately 1,800 employees.

M&D's primary competitor is Management Science America. Other competitors include Computer Associates International, Cullinet, and Data Design Associates.

One hundred percent of M&D's revenue is derived form software products and associated support services. The company has more than 7,500 systems installed worldwide.

M&D's line of financial information systems represent the largest contribution to revenue.

The company also markets human resource management and manufacturing application software products as well as application development tools.

A list of the software products marketed by M&D is presented in the exhibit.

M&D's Millennium Series of products, introduced in 1983, are designed for IBM 370, 30xx, and 43xx mainframes running under OS and DOS. The products are available for VSAM and IMS environments. The products are also available for Fujitsu and ICL computers in certain international markets (primarily in Japan, Australia, and the U.K.). The company is currently also developing DEC VAX versions of its Millennium products.

M:SDT, M&D's application development tool, works with most major data base management systems, including IMS, VSAM, and DB2. M:SDT is M&D's first product that supports DB2. The company plans to move its full line of applications to DB2.

In August 1987, M&D announced M:ViewPrint, a cross-application detail report writer that allows users to develop and run reports on-line or in batch.

The Satellite Series of products, announced in August 1987, process data on microcomputers for mainframe consolidation.

M&D offers its customers support through its field support offices, a toll-free help line, remote diagnostics, and individual product group support. User group meetings are held during the year to offer users further support and to obtain user input on system enhancements.

Customers receive all system enhancements and full technical support at no charge for a full year after the purchase of an M&D system. Thereafter, M&D provides software maintenance services for its products for an annual fee of approximately 13.5% of the current product purchase price.

M&D's clients are generally large corporations with revenue in excess of $100 million. Over half of the Fortune 500 companies use one or more of the company's products.

The manufacturing industry is the company's largest revenue contributor. The company also has customers in the banking, insurance, utilities, health care, education, retail, oil and gas, and real estate sectors, as well as state and local governments.

M&D has joint marketing agreements with Avatar Technologies, DEC, IBM, GE Information Services, and Aion Corp. In addition, the company has joint initiatives with Arthur Andersen, Arthur Young, Coopers & Lybrand, and Price Waterhouse.

Approximately 70% of M&D's fiscal 1987 revenue was derived form the U.S. and 30% form international sources.

COMPANY PROFILE

MICROSOFT CORPORATION
16011 N.E. 36th, Box 97017
Redmond, Washington 98073

Microsoft designs, manufactures and markets microcomputer systems and applications software and microcomputer peripherals. Approximately 87% of Microsoft's 1987 revenue was derived from software products (49% systems software and 38% application software). The remaining 13% of revenue was derived from hardware and book sales.

The company's largest selling software product to date is MS-DOS®, introduced in 1981. Its business application software products provide: word processing, spreadsheet, file management, graphics, communications and project management capabilities for both the MS-DOS and Macintosh environments. Other applications are provided on CD-ROM disk. It is the leading supplier of Macintosh applications software.

Microsoft markets its software and hardware products through four primary channels of distribution: domestic retail, international OEMs, and international retail.

Major announcements/product introductions made during fiscal 1987 and the first half of fiscal 1988 include the following:

- Microsoft Operating System/2 (Microsoft OS/2)

- Microsoft OS/2 LAN Manager, an advanced local area network operating environment

- XENIX System V/386, an 80386-based version of XENIX (Microsoft's implementation of UNIX System V)

- Microsoft Works, an integrated software product for the Macintosh that contains a spreadsheet, data base program, work processor, and communications tool.

- Microsoft QuickC compiler for IBM and compatible microcomputers

- Microsoft PowerPoint, the desktop presentation program for Macintosh computers

- Microsoft Bookshelf, a library of 10 reference tools on a single CD-ROM disk

- An alliance with Hewlett-Packard and Aldus Corporation to promote the Microsoft-based solution (graphics users interface) for the desktop publishing market for machines running the MS-DOS operating system

- An agreement with American Airlines to provide its integrated office automation software product, Microsoft Works, in the SABRE Travel Information Network

- The SQL Server, a relational data base server software product for local area networks which is being jointly developed by Microsoft, Ashton-Tate, and Sybase, Inc.—SQL Server runs on top of OS/1-based networks, including MS OS/2 LAN Manager and IBM OS/2 LAN Server. The SQL Server is designed to facilitate the development of multiuser applications for workgroup computing problems. SQL Server can run on a network server machine with either the MS OS/2 LAN Manager or the IBM OS/2 LAN Server.

COMPANY PROFILE

MORINO ASSOCIATES, INC.
8615 Westwood Center Drive
Vienna, VA 22180-2215

Morino Associates was founded in 1973 by Mario Morino and William Witzel to design and market systems software for IBM and compatible mainframes. The company's product lines feature monitoring, measurement, and management tools for MVS and MVS/XA installation management, computer systems performance evaluation, and accountability.

In October 1986 the company made an initial public offering of 900,000 shares of common stock. Net proceeds of approximately $8 million will be used for general corporate purposes.

Fiscal 1988 revenue reached $44.7 million, a 35% increase over fiscal 1987 revenue of $33.3 million. Net income was $8.5 million, a 38% increase over net income of $6.2 million for fiscal 1987.

In December 1988 Morino, Inc. and Duquesne Systems, Inc. announced their intention to merge.

In July 1987 Morino Associates announced it had formed a strategic alliance with Business Software Technology (BST) of Westborough (MA).

Under the terms of the agreement, Morino Associates' information product line and BST's ENDEVOR change management product line will be interfaced. The companies will form a technical advisory group to coordinate joint development efforts.

In addition, Morino Associates purchased an equity interest in BST by investing approximately $1.5 million. Mario M. Morino, President and CEO of Morino Associates, will join BST's Board of Directors.

Morino Associates will use BST's ENDEVOR-C1 change management product for the quality assurance and distribution of Morino Associates' MICS products. BST will use the MICS I/S Management Support System for analysis of its product development activity and computer services usage, and for benchmark analysis.

Morino Associates' competitors include IBM, Candle Corporation, and Boole & Babbage.

Ninety-three percent ($30.8 million) of Morino Associates' fiscal 1987 revenue was derived from initial and renewal license fees for the company's system software products. The remaining 7% ($2.4 million) was derived from education services and other sources.

Morino Associates offers the MICS product line, consisting of the MICS base product and 13 optional products; TSO/MON, consisting of the TSO/MON base product and one optional product; and the PAS product. The products are designed for IBM and compatible mainframes running under MVS or MVS/XA.

MICS enables a client to manage, monitor, and analyze more effectively the use, cost, and performance of data processing and computer networks. With MICS a client can build and manage a data base which can store current and historical information on availability, reliability, performance, costs, service, audit trails, and resource usage. Information in the data base is accessible through reports that are used by managers, technicians, and analysts to evaluate and improve the performance of their computer facilities.

MICS Base—The base product provides the architecture of the MICS system, and includes, in addition to three products packaged with the MICS Base product, the MICS Information Center Facility, and a data base applications generator. The former provides access to the data base and enables users to easily generate reports; the latter enables users to incorporate their own data sources into the data base to meet specialized needs.

The three products packaged with the MICS Base product—MICS SMF, MICS RMF, and MICS TSO—process data from each one's respective data source and integrate the data into the data base. The MICS SMF and MICS RMF products provide data for MVS activity analysis, and MICS TSO uses data collected by the company's TSO/MON product for advanced TSO analysis.

MICS option products—A MICS optional product gathers and processes data from sources outside of the data base and/or processes existing data in the MICS data base. The 13 optional products include the following:

- MICS IMS maintains measurement data from two sources that quantify the service, availability, workload, and user activity of IBM's IMS, and reduces the amount of computer time necessary to process and extract IMS log data.

- MICS CICS maintains measurement data that quantifies the service, availability, workload, and user activity of IBM's CICS.

- MICS Installation Accounting collects and maintains data that allows management to account for the use of data processing equipment, computer networks and related facilities, and charges individual users for such services and functions.

- MICS System Reliability maintains software and hardware malfunction data and identifies, tracks, and reports hardware errors by type.

- MICS Capacity Planning includes guides, software, tutorials, and reports that address two major tasks of hardware capacity planning: workload characterization and workload forecasting.

- MICS Performance Management includes a guide, software, tutorials, case studies, and reports that address computer hardware and software performance improvement.

- MICS VM maintains measurement data that quantifies workload, performance, and user activity of VM and CMS.

- MICS DASD Space Management maintains information about DASD storage utilization.

- MICS I/S Management Alert includes a management reporting system that provides a consolidated view of all I/S activities and processes and provides a means for setting goals, monitoring achievements against those goals, analyzing and resolving problems, and planning for implementation changes.

- MICS SNA Network maintains information on SNA performance, activity, and reliability.

- MICS DB2 maintains information on the usage and performance of IBM's DB2.

- MICS MVS Model Generator provides an active interface between the MICS data base and standard analytic modeling products.

- MICS IDMS maintains measurement data that quantifies the service, workload, and activity of Cullinet Software's IDMS and IDMS/R. It runs with the IDMS/R Performance Monitor.

During fiscal 1987, the company introduced MICS/NET, entry-level MICS package designed to control the use, cost, and performance of the SNA network. It is comprised of the MICS system architecture, a data base applications generator, the MICS Information Center Facility, and the MICS SNA Network product. MICS/NET can be upgraded for broader use by the addition of other MICS products. MICS/NET collects, integrates, and organizes data from various IBM network products for users who need to perform extensive SNA network analysis.

TSO/MON monitors IBM's TSO and produces summary and detailed reports for TSO problem analysis and performance evaluation. TSO/MON is used to manage daily TSO problem analysis and to generate management reports on a weekly, monthly, and quarterly basis. It is also used to conduct capacity studies, user audits, and real-time evaluations of TSO performance. TSO/MON includes the base product and one optional product.

The TSO/MON base product allows the client to record TSO and TSO network usage and provides summary and detail usage and audit reports on a daily basis. In addition, it reports a user's activity while operating under ISPF. These reports are based on the data collected by TSO/MON and include information on user identity, hardware resources used, time of use, and the responsiveness of the service.

TSO/MON's optional product, TSO/MON ONLINE, enables a client to track the usage of TSO on a real-time basis.

As of June 30, 1987, the company had installed 871 copies of TSO/MON (744 base products and 127 optional products).

PAS (Problem Alert System) is a systems software management system that addresses problem avoidance, product planning, and diagnostic research. It features a research service that locates and classifies known problems in MVS system software and related IBM program products according to operational area and severity of the problem. PAS includes a data base, a software maintenance analyzer, and a problem reporting subsystem.

Morino Associates licenses its software to its clients on an annual basis. Software support services and maintenance is included in the annual license agreement.

Morino Associates education program includes five MICS courses and one TSO/MON course conducted by trained Morino employees at the company's headquarters in Vienna (VA). Similar classes are conducted in the U.K. and in West Germany.

COMPANY PROFILE

ORACLE SYSTEMS CORPORATION
20 Davis Drive
Belmont, CA 94002

Oracle Systems Corporation was originally founded in June 1977 as Relational Software, Inc. In January 1983 the company name was changed to Oracle Corporation to better identify with its well known ORACLE® relational data base management software product. In June 1985 Oracle Systems Corporation was formed as the parent company of Oracle Corporation. Oracle continues to develop and market data base management, applications development, and decision support software products.

In March 1986 Oracle made an initial public offering of 2.1 million shares of Oracle common stock.

Oracle's fiscal 1988 revenue reached $282 million, a 115% increase over fiscal 1987 revenue of $131.3 million. Net income increased 175% from $15.6 million in fiscal 1987 to $42.3 million in fiscal 1988.

Licenses for use on DEC minicomputers have declined from approximately 60% of new license revenues in fiscal 1986 to 43% of new license revenues in fiscal 1988. Over the same period revenues from new licenses for use on IBM mainframes and microcomputers have increased from a small percentage of revenues for fiscal 1986 to 24% of new license revenues for fiscal 1988. Oracle has been rapidly expanding in the software services markets in the past three years. Maintenance, consulting, and training services represent the fastest growing segment of the company revenues, increasing from 19.4% of revenues in fiscal 1986 to 22.8% in fiscal 1987 and 27.2% in fiscal 1988.

Major competitors of Oracle's data base management software include the following:

* IBM, Cullinet Software, Inc., Cincom, Software AG, and Information Builders, Inc. in the IBM mainframe market

* Relational Technology, Inc., DEC, Data General, Sybase, Computer Associates, and Cognos in the minicomputer market

* Ashton-Tate and Information Builders, Inc. in the microcomputer market

- Unify Corporation, Informix, and Relational Technology in the UNIX-based microcomputer market

Oracle's principal product is the ORACLE relational data base management system. ORACLE allows users to define, retrieve, manipulate, and control data sorted in a computer using the IBM-compatible SQL non-procedural language.

ORACLE was designed and written to make it adaptable or portable to most computer hardware and operating systems. This portability allows customers to use the same data base management software and user interface on all their machines. ORACLE has been ported to a variety of microcomputers, minicomputers, and mainframes, as shown in the exhibit.

The company currently offers five applications development productivity tools as separate products to be used as add-ons to ORACLE Version 5. These tools include the following:

- SQL*Forms™ helps users create applications by means of a question and answer dialogue involving no traditional programming languages.

- SQL*Plus™ makes it possible for users, with just a few commands, to format the results of SQL queries into reports with page and column headings.

- SQL*Report™ makes it possible for users to combine, in a single report or document, both text and the results of SQL queries.

SQL*Menu™ makes it possible for a user or data base administrator to design and maintain menu interfaces to the ORACLE data base for use by novice or infrequent users.

- SQL*Design Dictionary™ is a design, development, and documentation tool that aids in the management and maintenance of applications developed to use ORACLE.

SQL*Forms, SQL*Plus, and SQL*Report are available on all of the computers and operating systems on which ORACLE Version 5 is available. SQL*Menu and SQL* Design Dictionary are available on most of the significant computers and operating systems on which ORACLE Version 5 is available.

Oracle currently offers three decision support products as separately priced products for use with ORACLE.

Products include:

- SQL*Calc® provides a familiar spreadsheet interface to ORACLE and gives users the ability to enter SQL commands into spreadsheet cells to create, retrieve, and modify data base data directly from their spreadsheet.

- SQL*Graph™ gives users the ability to generate pie, bar, and line graphs from the data in their ORACLE data base.

- Easy*SQL™ provides a simple interface to provide casual and novice users the ability to build and use ORACLE data bases without having to learn SQL command syntax.

The decision support products are currently available on DEC VAX minicomputers using the VMS operating system and on the IBM PC/XT, PC/AT, PS/2, and compatible microcomputers. The company intends to port all three products to other computer models and plans to introduce additional decision support products in the future.

Oracle also offers the Pro* series of six tools that allow a programmer to access an ORACLE data base using SQL from programs written in traditional programming languages.

- These tools, called Pro*COBOL™, Pro*CTM, Pro*FORTRAN™, Pro*Ada™, Pro*PL/1®, and Pro*Pascal™, provide programmatic interfaces to the indicated languages.

The Pro* series of tools is available on most of the computers and operating systems on which ORACLE Version 5 is available (to the extent that the appropriate language is supported on that computer and operating system).

In January 1986 Oracle formed its Consulting Services Group in order to emphasize its consulting services offerings. Currently, Oracle provides consulting services on a contract basis primarily to ORACLE customers. Services range from top-down business analysis and enterprise modeling through data base design, application implementation, and tuning.

Oracle education services offer a full curriculum of courses at its 18 training centers around the world.

Courses are structured around functional learning paths, with classes designed for all levels of system user, from non-data processing professionals to application analysts, programmers, and data base administrators.

Courses include in depth case studies and hands-on processing exercises.

Oracle also customizes training courses to meet individual customer needs and performs on-site training using the customer's own data and applications.

Oracle's products are targeted at Fortune 1000 companies and other similarly-sized organizations in the finance, telecommunications, and government sectors.

Oracle markets its products through a direct sales force in the U.S. and through 17 wholly owned subsidiaries and 14 independent distributors in foreign countries.

Oracle also distributes its products through original equipment manufacturers (OEMs) and value-added re-licensors (VARs) that combine ORACLE with their hardware or software products and redistribute them together.

Oracle derived approximately 53% of fiscal 1987 revenue from the U.S., 37% from Europe (36% from Oracle subsidiaries and 1% from distributors), and the remaining 10% from Canada and other foreign countries (8% from Oracle subsidiaries and 2% from distributors).

COMPANY PROFILE

PANSOPHIC SYSTEMS, INCORPORATED
709 Enterprise Drive
Oak Brook, IL 60521

Pansophic Systems, Incorporated, founded in 1969, traditionally has been a provider of systems software products for large IBM and compatible mainframes. Since 1985, through internal development and acquisitions, Pansophic has expanded its products to include application and systems software products for mainframes, minicomputers, and microcomputers.

Systems software products include information retrieval, library control, applications development, and other system productivity tools.

Application software products include graphics, decision support, manufacturing, distribution, and financial packages.

Pansophic's operations are currently organized into four product companies, each with its own marketing, sales, development, and management, as follows:

- System Life Cycle Products Company markets and supports Pansophic's application development and library control systems software products.

- Productivity Products Company markets and supports Pansophic's information retrieval, connectivity, and report writer software products.

- Applications Products Company, formed with the acquisition of Professional Computer Resources, Inc. in 1986, provides application software products for IBM System 38 computers.

- Graphics Products Company provides graphics software and turnkey products for various types of computers.

Fiscal 1987 revenue reached $114.6 million, a 36% increase over fiscal 1986 revenue of $84.2 million. Net income rose 18%, from $14.2 million in fiscal 1986 to $16.8 million in fiscal 1987.

Pansophic management attributes fiscal 1987 revenue increases primarily to substantially greater Telon license and customer support revenue, as well as revenue generated from application software products acquired with Professional Computer Resources, Inc.

Acquisitions made by Pansophic during 1987 include the following:

- In October 1987, Pansophic purchased the XPF family of products from Boole & Babbage for $4.5 million.

The product family includes XPF/COBOL and XPF/COBOL CICS which are interactive test and debug software facilities for IBM mainframes.

The products will be marketed and supported through Pansophic's System Life Cycle Products Company.

- In September 1987, Pansophic acquired the Management of Production Software (MPS) product from Technology Management Group, Inc. of Bellevue (WA). Pansophic markets this product under the name "PANAPT" (Pansophic's Automated Production Turnover).

PANAPT provides for the controlled movement of software from a testing environment into a production environment.

PANAPT is part of Pansophic's Library Management product portfolio which includes Panvalet, Change Management Facility, VMLIB, and XPF/COBOL, all marketed by Pansophic's System Life Cycle Products Company.

- In July 1987, Pansophic acquired West End Film Inc. of Washington, D.C. for $5 million in stock in a polling of interests transaction.

West End Film provides microcomputer-based graphics software.

The products are marketed as part of Pansophic's turnkey Graphics Workstation through its Graphics Products Company.

Major competitors by product area include the following:

- Systems software—Cincom Systems, Cullinet, Computer Associates, and Applied Data Research

- Graphics software—Computer Associates, Precision Visuals, and Genigraphics

Over 98% of Pansophic's fiscal 1987 revenue was derived from software product license fees and associated customer support fees. Less than 2% was derived from finance charges.

Pansophic offers systems and application software products for a range of computer systems.

The company has over 50,000 installations of its products at over 15,000 mainframe, minicomputer, and microcomputer sites worldwide.

Products are grouped by Pansophic into the following functional areas:

- Productivity Products

- System Life Cycle Products

- Applications Products

- Graphics Products

Pansophic's primary products include: Easytrieve^{R}Plus, which facilitates the retrieval of stored data; Panvalet^R, which stores and protects software program libraries, and Telon^R, a computer-aided systems engineering application generator. Recent product introductions made by Pansophic include the following:

- Productivity Products:

The Corporate Tie™, acquired in December 1986, provides facilities to perform high-speed file transfer with both interactive menus and a PC-based command language. It allows PC-based end users to access mainframe data in a controlled environment while fully supporting data center security.

Fusion report writer and query products for IBM System 36 and 38 computers were acquired in September 1986.

- Applications Products

As a result of the acquisition of Professional Computer Resources in December 1986, Pansophic offers manufacturing, distribution, and financial reporting software products for IBM System 38 computers.

Pansophic Manufacturing/38™ (PM/38) is a fully integrated manufacturing, distribution, and financial applications system. PM/38 helps users define needs, analyze resource availabilities and costs, and schedule purchasing and production. This system provides complete business control across all manufacturing environments—discrete, process, and high volume repetitive. Applications include Master Production Scheduling, MRP II, Shop Floor Control, and Capacity Requirements Planning.

Pansophic Distribution/38™ (PD/38) helps users improve customer service levels through better order tracking and backlog management. PD/38 provides the capability to execute, monitor, and control the purchasing aspects of the material plan. The system helps control financial

liabilities through credit checking capabilities. Applications include Order Entry and Billing, Purchasing and Receiving, and Inventory Control.

Pansophic Financial/38™ (PF/38) provides users with the tools necessary to plan, monitor, and report the financial activities of the company. Applications include Accounts Receivable, Accounts Payable, Payroll and Human Resources, and General Ledger, Forecasting, and Budgeting.

• Graphics Products

D-Pict/Intellichart, introduced in January 1986, provides business and technical graphics software for a range of mainframes, minicomputers, and microcomputers.

Pansophic Graphics Workstations, introduced in October 1986, are turnkey products that combines an IBM PC/AT (or compatible) with Starburst and Studio Works software to provide 2-D and 3-D art, charting, text page layout, image capture, paint, and animation.

35mm Express provides simplified graphics capabilities for microcomputer users.

Recent agreements announced by Pansophic include the following:

• In September 1987 Pansophic announced the formation of a Japanese joint venture with K.K. Ashisuto. The newly formed, K.K. Pansophic, will be the exclusive marketer of Pansophic products in Japan.

• In September 1987 Pansophic entered into a joint marketing and development agreement with Cadre Technologies, Inc. for Cadre's Teamwork family of computer-aided software engineering products. Pansophic also acquired 7.8% ownership in Cadre.

• In August 1987 Pansophic signed a marketing agreement with Synon Ltd. and Synon, Inc. to market Synon's application generator products for IBM System 38 computers on a worldwide non-exclusive basis. Pansophic will market the products as TELON 38.

Pansophic's systems software and graphics products are used by clients across industries, including manufacturing, banking, insurance, retail, transportation, utilities, health care, and education, as well as federal, state, and local governments.

Pansophic's application software products are used by clients in the discrete and process manufacturing, distribution, and other industries.

Approximately 67% of Pansophic's fiscal 1987 revenue was derived from the U.S. and 33% was from international operations.

COMPANY PROFILE

SAGE SOFTWARE, INC.
3200 Monroe Street
Rockville, MD 20852
(301) 230-3200

Sage Software, Inc. develops, markets, and supports an integrated family of computer-aided software engineering (CASE) application development tools for IBM and compatible mainframes. The company also derives royalty revenue from the licensing of its products to remote computing services and software vendors.

Sage Software is the successor to the applications development software business begun in 1981 by Sage Systems, Inc.

Sage Systems' original business of providing custom application software professional services to the federal government was formed as a separate company (Sage Federal Systems, Inc.) and sold to certain officers and shareholders in March 1986.

In December 1986, Sage Software made an initial public offering of 1.8 million shares of common stock.

Fiscal 1987 revenues reached $14.5 million, a 39% increase over fiscal 1986 revenues of $10.4 million. Net income grew from $828,000 in fiscal 1986 to $1.8 million in fiscal 1987.

One hundred percent of Sage Software's revenue is derived from its application development systems software product licenses, maintenance fees, and royalties.

Approximately 20% of fiscal 1987 revenue was derived from the federal government and 23% from Results, Inc., the company's licensed remote computing vendor.

Revenues generated through foreign distributors were approximately $1.8 million in fiscal 1987, compared to $190,000 in fiscal 1986.

APS Application Generators consist of mainframe-based products that accept input from the APS/PC Workstation and/or 3270 terminals. These products serve analysts and programmers in the implementation and maintenance phases of the development of applications systems.

APS DB/DC Products consist of mainframe-based products that facilitate the translation of high level commands into source code that is suitable for specific data base management and data communication systems.

APS Maintenance Products copy existing production code from data base and screens and populate the APS Dictionary.

APS Dictionary is the central repository for the other four product groups within the APS family. These products provide support for the management of applications system entities and for job control language and document generation.

Sage Software markets an integrated family of CASE tools, known as the APS Development Center or APS, that are designed to increase the productivity of analysts and programmers involved in the development of applications software systems. APS consists of five product groups comprising a total of 15 integrated products. The company's products run on IBM and compatible mainframe computers, operate with IBM's major operating systems (MVS and VM), and support IBM data base management and data communications systems, including DB2, IMS, VSAM, and CICS.

APS/PC Workstation focuses on the beginning of the development life cycle of an applications software system. Using products in this product group, the analyst can create prototype applications without programming. In addition, by allowing the analyst to simulate the applications software systems in the early stages, misconceptions and errors can be corrected inexpensively before programming begins. There are three products within this product group.

The APS/PC workstation coupled with the Micro Focus COBOL/2™ workbench, based on the MS/2 (386) platform, allows developers to design, generate, and test applications without leaving the PC.

Sage Software's products are licensed to end users pursuant to a perpetual license or a rental license plan.

Sage Software also derives royalty revenues from timesharing and software vendor licensing.

Sage Software has granted an exclusive license to Results, Inc. to provide remote computing services for the company's products in North America. The license entitles the company to receive 35% of all funds received by Results in connection with the use of the company's products. The license also obligates Results to pay Sage Software annual minimum royalties.

APS products are also licensed to third-party software vendors for incorporation into their software products. Sage Software licenses its products to third-party vendors only if they agree to license the software products that contain the company's products on a "right to use", non-exclusive basis.

In fiscal 1988, approximately 70% of total revenues were from the non-federal market segment, up from 57% in fiscal years 1987 and 1986.

The company sells directly through its own salesforce in the domestic U.S. market and through distributors in the international and federal government markets.

COMPANY PROFILE

SAS INSTITUTE, INC.
SAS Circle, Box 8000
Cary, NC 27512-8000

SAS Institute, Inc., incorporated in 1976, develops, supports, and maintains systems software products to address data management, analysis, and presentation functions.

SAS was formed to address the statistical analysis needs of agricultural researchers at the University of North Carolina.

Total fiscal 1987 revenue reached $135.3 million, a 32% increase over fiscal 1986 revenue of $102.4 million. SAS has been profitable since its formation in 1976.

SAS management attributed revenue growth in fiscal 1987 to increased sales internationally as well as strong sales in the minicomputer arena.

Revenue increased 80%, 85%, and 42% in European, Japanese, and Asia/Pacific markets, respectively.

During the year the company achieved a 40% increase in sales of DEC MVS-based minicomputer products.

The company considers itself primarily a research firm and devotes an unprecedented 55% of its revenue and over 30% of its employees to research and development, while only 10% of its revenue is devoted to marketing.

SAS claims to have products installed at over 65% of active IBM mainframe sites.

In January 1987, SAS acquired Lattice, Inc. of Lombard (IL). The acquisition is the culmination of a relationship that began in 1984 when SAS acquired the right to implement a mainframe version of Lattice's microcomputer C compiler. Under terms of the acquisition, Lattice will operate as an independent subsidiary.

SAS Institute's principle competitors, by specific application area, include the following:

* Graphics: Computer Associates' DISSPLA and TELL-A-GRAF (acquired from Integrated Software Systems Corporation)

- Statistical analysis: SPSS

- Data base management systems: Information Builder's FOCUS, On-Line Software International's RAMIS, and Must Software International's NOMAD

- C compiler products: IBM.

SAS derived all of its fiscal 1987 revenue from software products and related services. INPUT estimates that packaged software accounted for 89% and consulting and education services accounted for 11% of revenue.

SAS software products include the following:

- The SAS^R System, an integrated data analysis system and fourth generation language with capabilities for a wide range of applications

- SYSTEM 2000^R Data Management Software, a full-function data manager for IBM, Unisys, and Control Data mainframes—Several procedures provide an interface between SYSTEM 2000 software and the SAS System.

- C compiler products

The SAS System includes more than 125 built-in applications grouped into modular components. These applications provide capabilities for data entry, retrieval, and management; report writing and graphics; statistical and mathematical analysis; business planning, forecasting, and decision support; operations research and project management; and applications development.

The SAS System had over 36,000 product installations as of April 29, 1988, segmented by processor as follows:

- Mainframe: 24,193
- Minicomputer: 6,759
- Microcomputer: 5,890

The entire SAS System is being redesigned and recoded in C. The new design is to be written conforming to "multivendor architecture" (MVA). MVA, first conceived in 1984, is a software architecture that maximizes the system's ease of migration from one operating environment to another. SAS's goal is to have its software run identically across vendor and processor size lines. The SAS System is scheduled to be completely rewritten by sometime in 1989.

SYSTEM 2000 Data Management Software offers integrated tools for enhanced data management. Features include interactive query/update, an integrated data dictionary, indexing capabilities, report writing, relational data base access, high-volume batch and interactive production processing, accounting, data recovery, menu-driven data manipulation, and conversational building of data bases.

The company licenses all software products on an annual basis. License fees for mainframe and minicomputer products are based on machine classification. Fees for the PC products are based on the number of workstations where the product is installed. Renewals are available at lower rates. Discounts are available to degree-granting institutions.

Technical support, enhancements, and one set of documentation are included in the annual license fee. Users also receive a quarterly news magazine free of charge.

SAS offers a range of instructor, video, and computer-based training, as well as trainer's kits. Instructor training is available at the Institute Training Center in Cary (NC) and at satellite training facilities in Austin (TX), Rockville (MD), Lombard (IL), Irvine (CA), and Toronto (Canada). Instruction is also held at customer sites, and hotel and conference centers across the U.S.

SAS Institute's fiscal 1987 revenue was derived from clients in all industries, including many Fortune 1000 companies.

SAS Institute operates subsidiaries in: Heidelberg, West Germany; Marlow, Buckinghamshire (United Kingdom); Paris, France; Copenhagen, Denmark; Sydney, Australia; Wellington, New Zealand; Singapore; Hong Kong; Tokyo, Japan; Kuala Lumpur, Malaysia; Stockholm, Sweden; Oslo, Norway; Milan, Italy.

SAS also has distributors located in the following countries: Saudi Arabia, Israel, Venezuela, Brazil, Spain, Peru, Puerto Rico, Columbia, Uruguay, and Finland.

COMPANY PROFILE

TRANSFORM LOGIC CORPORATION
8502 East Via de Ventura
Scottsdale, AZ 85289

Transform Logic Corporation, formerly Iconics, Inc., was formed in 1980 and provides application development systems software products and related professional services for IBM mainframe computer users.

Transform Logic was founded by Garrett P. Melara. It was operated as a private company until 1983. In 1985 the company changed its name from Iconics, Inc. to Transform Logic Corporation and became a publicly held company.

During fiscal 1987, the company introduced the application professional services business segment.

This segment provides development and implementation services for customized applications to its clients.

The company's management attributes increases in revenue and related reduction in net losses to additional sales activity while expenses increased by only 2.5%.

Major competitors include Pansophic Systems and Sage Software.

Transform Logic derived approximately 73% of its fiscal 1987 revenue from application development systems software products and related services. The remaining 27% was from professional services.

Approximately 95% of the company's software revenue was derived from its Transform/IMS and Transform/CICS products. The remaining 5% was from Transform/Batch.

Transform/IMS is a generator that automates the development and management of applications. The product runs in a DB/DC environment.

Transform/CICS generates and automates CICS command-level COBOL programs. The product runs in a CICS/DL-1 environment.

Transform/Batch supports and automates CICS and IMS programs. The product runs under any MVS environment.

During 1987 the company introduced Transform/DBII, a data base management system.

Transform Logic offers professional services through its application services segment. It develops and implements customized application software to clients.

Transform Logic provides customer training, including personal instruction and hands-on experience for its software products.

Transform Logic derives its revenue from the users of IBM and compatible mainframes. The company's prime targeted market includes Fortune 500 corporations, and the banking and finance and manufacturing industries.

Major clients include Allen Bradley, American Express, Chevron, Computer Task Group, Milliken and Co., University of Texas, and McDonnell Douglas.

Transform Logic derived approximately 93% of its fiscal 1987 revenue form the U.S. and the remaining 7% from Canada, the U.K., Italy, and Australia.

In mid-1988 IBM announced an agreement to license software technology form Transform Logic, to be incorporated into IBM's cross system product development tool product.

VI

Conclusions and Recommendations

VI
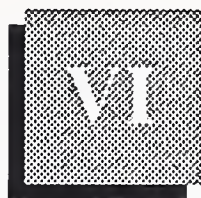
Conclusions and Recommendations

There are several ways that software products vendors can grasp opportunities to increase their market share or increase their revenue. In particular, this involves a thorough evaluation of the structural changes now occurring in the software and software-related industries and adjusting one's strategic and tactical product and marketing strategies to the changing environment. Some suggested types of responses are included in this chapter.

A
Independent Software Developers

1. Products

The following are some strategic recommendations for products:

- Look to the vertical markets for higher growth opportunities, possibly bundling solutions with de facto RDBMS standards

- For startup companies, seek out niche market opportunities where the larger software companies need support products, but which do not represent large enough market potential to attract powerful competitors.

- Utilize technologies from university research environments which the larger companies do not possess—The market potential may exceed original expectations which could attract an attractive buyout offer from larger companies attracted to high growth developing markets.

- Support network and operating systems standards to increase flexibility of product offering—All types of software developers writing software for the de facto operating systems standards should evaluate IBM's System Application Architecture (SAA) as well as other common programming and user interface architectures to improve application development productivity through utilizing cross-platform application development tools. Also, SAA when more complete, will offer the

capability to work within a cooperative processing environment, which will be the preferred distributed processing structure of the future. Even without the full blueprint for SAA, independent software developers should look to adopting current elements of SAA now available, such as OS/Extended Edition incorporating Presentation Manager, the SQL programming interface structure as well as LU6.2, IBM's protocol for peer-to-peer communication.

• Develop commercial applications, in particular, for the leading UNIX standards, which industry studies suggested will be the fastest growing operating system environment over the next five years—Also, with nearly all the major computer systems vendors having recently endorsed some variation of the UNIX de facto standard, such companies will be seeking third-party UNIX applications. The absence of any dominant independent applications software developers in the UNIX applications environment could create a host of activities. In addition, the PICK operating system, particularly for RISC architectures, could provide a major opportunity, in part related to its fully transportable feature.

• Evaluate the various application development tools for building common programming and user interfaces which are becoming available from the leading computer systems vendors as well as from OSF, which recently endorsed a blend of DEC's and Hewlett Packard's/ Microsoft interfaces—Companies should also seek out programming tools that provide cross-system portability.

• Utilize new software technologies to leverage current software investment—In particular, the incorporation of embedded intelligence features even in more traditional software applications could provide a significant proprietary edge.

• Evaluate the various integrated CASE offerings, particularly for such features as reverse engineering capability, incorporation of expert system development tools, and the ability to interface with other leading CASE solutions

• Evaluate object-oriented programming languages which can enhance multimedia applications development, including voice, video, text, data and graphics technologies—This could involve developing applications for the NeXT workstation platform. Another advantage of the object-oriented programming languages for the software developer is the ability to reuse software modules, which can be particularly helpful in creating a common user interface environment.

• For established software companies seeking to maintain a strong growth rate, Oracle Corp. has recently identified a number of new

product and service offerings which represent markets with above average growth potential over the next five years. These include: bundled financial and DBMS applications, professional services, systems integration, office systems products, education and training services, and entry into VAR channel distribution.

- Integrate complementary software product modules and de facto standard interfaces into core software product offerings—One example includes the integration of desktop publishing, text editing, and graphics interface standards as well as integrating graphics editing functionality into a text editing structure through licensing of software component modules.

- Utilize an open systems architecture to create new product opportunities, as other developers look for complementary products which will be integrated into their products—This can lead to third-party or co-marketing relationships.

2. Marketing

The following are some strategic recommendations for marketing:

- Emphasize training and other related support services to achieve value-added pricing and distinguish product identity, particularly in markets characterized by a number of similar software products

- Look to establishing joint development, co-marketing agreements, third-party or value-added reseller alliances with the larger computer systems and/or professional services vendors to increase one's marketing strength and to provide support services—For smaller independent software developers, marketing costs are difficult to recover, and the larger vendors have established considerable presence in nearly all the traditional software distribution channels, with the exception of the regional VAR markets. Consider contacting the IBM Applications Development Division to determine the merits of becoming a third-party vendor, joint-marketing partner, or IBM VAR. The professional services vendors may offer more longer-term opportunities for the smaller independent software developers in that there may not be as much internal software competition as there could be with the major computer systems vendors. Alliances with more than one company representing different operating systems and platform opportunities should also be considered. Additionally, a company may look to working with some of the more nontraditional distributing outlets, such as industry associations and Master VAR/distributors seeking value-added product enhancements.

- Evaluate the significant growth opportunities in the commercial and federal systems integration markets as a subcontractor to the large primary systems integration vendors—The large system vendors will increasingly need to establish ongoing relationships with software vendors that can supply systems and applications solutions for systems integration contracts that today are running into the billions of dollars at the governmental level.

B
Computer Systems Vendors

1. Products

The following are some strategic recommendations for products:

- Examine opportunities for bundling core systems software products offerings with new applications programs into total solutions selling

- Support one of the standard, open operating systems such as UNIX or PICK to increase product flexibility as well as to encourage third-party application develop and response to increasing end user demands for portable software solutions—If developing hardware based on a RISC architecture, the utilization of the PICK operating system, with its transportable characteristics, could provide immediate access to a significant number of PICK application software product applications.

- Look to object-oriented technologies for the next generation of data management systems products, particularly for integrating multimedia information structures, such as voice, data, text, graphics and video— IBM is using an object-oriented architecture in its AS/400 folders feature for creating multiuser file access in workgroup environments. Object-oriented programming languages can be used to create graph-ics-based user interfaces as well as facilitate end user customization of standard packages.

- Support the OSI communications standard as it evolves

- Open up hardware and systems software architectures and provide application development tools to encourage third-party vendor support

- Strengthen applications tools product offerings and integrate with other systems software product offerings—A company should provide integration capability with products from other leading application tools vendors and work to establish standards for the CASE environ-ment.

- Emphasize employee satisfaction and training to reduce turnover—The ability to attract and retain employees with the knowledge of leading-edge technologies will continue to be an increasingly significant issue.

- Produce upgrades compatible with existing programs and maintain as much consistency as possible with previous user interface commands to increase product life cycles

2. Marketing

The following are strategic recommendations for marketing:

- Emphasize support services to provide added value and to maintain account control—This will become increasingly important as many areas of the software products markets evolve into commodity-type products.

- Look for growth opportunities in the systems integration markets, and establish ongoing relationships with software vendors that can enhance a required broad-based product offering

- Implement company plans that emphasize customer satisfaction—A company should evaluate company products from the standpoint of the end user.

- Design products for the end user community which are self-document-ing with extensive built-in online help features, such as is incorporated in the AS/400 product offering

- Develop future product strategies around distributed processing models, such as client/server distributed processing solutions as well as future distributed relational database architectures

A
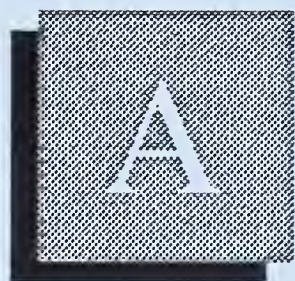
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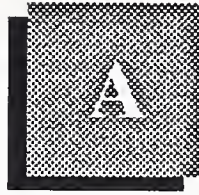
Appendix: Definitions

Appendix A contains the definitions used by INPUT to describe the Information Services Industry.

Appendix B contains the software products user expenditure forecast and data base for 1987-1993.

Information Services - Computer-related services involving one or more of the following:

* Processing of computer-based applications using vendor computers (called "processing services")

* Network-oriented services or functions such as value-added networks, electronic mail, electronic document interchange, on-line data bases, news data bases, videotex

* Products and services that assist users in performing functions on their own computers or vendor computers (called "software products" or "professional services")

* Services that utilize a combination of hardware and software, integrated into a total system (called "turnkey systems" and/or "systems integration")

A

User Expenditures

All user expenditures reported are "available" (i.e., noncaptive, as defined below).

Noncaptive Information Services User Expenditures - Expenditures paid for information services provided by a vendor that is not part of the same parent corporation as the user

Captive Information Services User Expenditures—Expenditures received from users who are part of the same parent corporation as the vendor.

B
Delivery Modes

1. Processing Services

This category includes transaction processing, utility processing, other processing services, and systems operations.

- *Transaction Processing Services* - Updates client-owned data files by entry of specific business activity, such as sales order, inventory receipt, cash disbursement, etc. Transactions may be entered in one of three modes.

  - *Interactive* - Characterized by the interaction of the user with the system, primarily for problem-solving timesharing, but also for data entry and transaction processing; the user is on-line to the program/ files. Computer response is usually measured in seconds or fractions of a second.

  - *Remote Batch* - Where the user hands over control of a job to the vendor's computer, which schedules job execution according to priorities and resource requirements. Computer response is measured in minutes or hours.

  - *User Site Hardware Services (USHS)* - Those offerings provided by processing services vendors that place programmable hardware at the user's site rather than at the vendor's data center. Some vendors in the federal government market provide this service under the label of distributed data services. USHS offers:

    ° Access to a communications network

    ° Access through the network to the RCS vendor's larger computers

    ° Local management and storage of a data base subset that will service local terminal users via the connection of a data base processor to the network.

    ° Significant software as part of the service

  - *Carry-in Batch* - Where users deliver work to a processing services vendor

- *Utility Processing* - Vendor provides access to basic software tools, enabling the users to develop their own problem solutions such as language compilers assemblers, DBMS, sorts scientific library routines, and other systems software.

- *"Other" Processing Services* - Include computer output microfilm, other data output services, data entry services, disaster recovery and backup services.

- *Systems Operations (Processing)* - Also referred to as "resource management," facilities management, or "COCO" (contractor-owned, contractor-operated). Systems control is the management of all or part of a user's data processing functions under a long-term contract of not less than one year. This would include remote computing and batch services. To qualify, the contractor must directly plan, control, operate, and own the facility provided to the user—either onsite, through communications lines, or in a mixed mode.

Processing services are further differentiated as follows:

- *Cross-industry* services involve the processing of applications that are targeted to specific user departments (e.g., finance, personnel, sales) but that cut across industry lines. Most general-ledger, accounts receivable, payroll, and personnel applications fall into this category. General-purpose tools such as financial planning systems, linear regression packages, and other statistical routines are also included. However, when the application, tool, or data base is designed for specific industry use, then the service is industry-specific (see below).

- *Industry-specific* services provide processing for particular functions or problems unique to an industry or industry group. Specialty applications can be either business or scientific in orientation. Examples of industry-specialty applications are seismic data processing, numerically controlled machine tool software development, and demand deposit accounting.

2. Network Services

Network services include a wide variety of network-based functions and operations. Their common thread is that none of these functions could be performed without network involvement. Network services is divided into two major segments: network applications and electronic information systems.

a. Network Applications

The network applications segment is composed of three subsets:

- *Value-Added Networks (VANs)* - VANs typically involve common carrier network transmission facilities that are augmented with computerized switched. These networks have become associated with packet-switching technology because the public VANs that have received the most attention (e.g., Telenet and TYMNET) employ packet-switching

techniques. However, other added data service features, such as store-and-forward message switching, terminal interfacing, error detection and correction, and host computer interfacing, are of equal importance.

- *Electronic Data Interchange (EDI)* - EDI is the application-to-application electronic communications between organizations, based on established business document standards.

- *Electronic Mail (E-Mail)* - Transmission of messages across an electronic mail network managed by a services vendor.

b. Electronic Information Services

Electronic information services are data bases that provide specific terminal-based inquiry such as stock prices, legal precedents, economic indicators, medical diagnosis, airline schedules, current news stories, automobile valuations, etc. Users typically inquire into and extract information from these data bases but do not update them.

3. Software Products

This category includes user purchases of applications and systems software packages for in-house computer systems. Included are lease and purchase expenditures, as well as expenditures for work performed by the vendor to implement or maintain the package at the user's sites.

Expenditures for work performed by organizations other than the package vendor are counted in the category of professional services. Fees for work related to education, consulting, and/or custom modification of software products are counted as professional services, provided such fees are charged separately from the price of the software product itself.

There are several subcategories of software products, as indicated below.

a. Applications Software Products

Applications software products perform functions directly related to solving user's business or organizational need. The products can be:

- *Cross-Industry Products* - Used in multiple-industry applications as well as the federal government sector. Examples are payroll, inventory control, and financial planning.

- *Industry-Specific Products* - Used only in a specific industry sector, such as banking and finance, transportation, or discrete manufacturing. Examples are demand deposit accounting, airline scheduling, material resource planning, and insurance claim management.

b. Systems Software Products

Systems software products enable the computer/communications system to perform basic machine-oriented or user interface functions. These products include:

- *System Control Products* - Function during applications program execution to manage the computer system's resources. Examples include operating systems, communication monitors, emulators, spoolers, network control, library control, windowing, access control.

- *Data Center Management Products* - Used by operations personnel to manage the computer system's resources and personnel more effectively. Examples include performance measurement, job accounting, computer operations scheduling, utilities, capacity management.

- *Applications Development Products* - Used to prepare applications for execution by assisting in designing, programming, testing, and related functions. Examples include traditional programming languages, 4GLs, sorts, productivity aids, assemblers, compilers, data dictionaries, data base management systems, report writers, project control and CASE systems.

4. Turnkey Systems

A turnkey system is an integration of systems and applications software with CPU hardware and peripherals, packaged as a single application (or set of applications) solution. The value added by the vendor is primarily in the software and support. Most CAD/CAM systems and many small-business systems are turnkey systems. This does not include specialized hardware systems such as word processors, cash registers, or process control systems, nor does it include Embedded Computer Resources for military applications. Turnkey systems may be either custom or packaged systems.

- Hardware vendors that combine software with their own general-purpose hardware are not classified by INPUT as turnkey vendors. Their software revenues are included the appropriate software category.

- Turnkey systems revenue is divided into two categories.

  - *Industry-Specific Systems* - Systems that serve a specific function for a given industry sector, such as automobile dealer parts inventory, medical recordkeeping, or discrete manufacturing control systems

  - *Cross-Industry Systems* - Systems that provide a specific function that is applicable to a wide range of industry sectors, such as financial planning systems, payroll systems, or personnel management systems

• Revenue includes hardware, software, and support functions.

5. Systems Integration (SI)

Systems integration (SI) is the delivery of complex, multidisciplinary multivendor systems, incorporating some or all of these products or services: systems design, programming, integration, equipment, communication networks, installation, education and training, SI-related professional services, and system acceptance. Systems integration contracts typically include custom software, take more than a year to complete, and involve a prime contractor assuming full risk and accepting full responsibility.

6. Professional Services

This category includes consulting, education and training, software development, and systems operations as defined below.

• *Software Development* - Development of a software system on a custom basis. It includes one or more of the following: user requirements definition, system design, contract programming, documentation.

• *Education and Training* - Products and/or services related to information systems and services for the user, including computer-aided instruction (CAI), computer-based education (CBE), and vendor instruction of user personnel in operations, programming, and maintenance.

• *Consulting Services* - Information systems and/or services management consulting, project assistance (technical and/or management), feasibility analyses, and cost-effectiveness trade-off studies.

• *Systems Operations (Professional Services)* - This is a counterpart to systems operations (processing services) except the computing equipment is owned or leased by the client, not by the vendor. The vendor provides the staff to operate, maintain, and manage the client's facility.

C
Equipment/Computer Systems

1. Equipment

Equipment includes all computer and telecommunications equipment that can be separately acquired with or without installation by the vendor and not acquired as part of an integrated system.

• *Peripherals* - Includes all input, output, communications, and storage devices (other than main memory) that can be connected locally to the main processor and generally cannot be included in other categories such as terminals

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- *Input Devices* - Includes keyboards, numeric pads, card readers, light pens and track balls, tape readers, position and motion sensors, and analog-to-digital converters

- *Output Devices* - Includes printers, CRTs, projection television screens, micrographics processors, digital graphics, and plotters

- *Communication Devices* - Includes modems, encryption equipment, special interfaces, and error control

- *Storage Devices* - Includes magnetic tape (reel, cartridge, and cassette), floppy and hard disks, solid state (integrated circuits), and bubble and optical memories

- *Terminals* - Three types of terminals are described below:

  - *User-Programmable* - Also called intelligent terminals, including:

    - Single-station or standalone
    - Multistation shared processor
    - Teleprinter
    - Remote batch

  - *User Nonprogrammable*

    - Single-station
    - Multistation shared processor
    - Teleprinter

  - *Limited Function* - Originally developed for specific needs, such as point-of-sale (POS), inventory data collection, controlled access, and other applications.

2. Computer Systems

Computer systems include all processors from microcomputers to super-computers. Computer systems may require type- or model-unique operating software to be functional, but this category excludes applications software and peripheral devices.

- *Microcomputer (Price below $15,000)* - Combines all of the CPU, memory, and peripheral functions of an 8- or 16-bit computer on a chip in the form of:

  - Integrated circuit package
  - Plug-in board with more memory and peripheral circuits
  - Console including keyboard and interfacing connectors
  - Personal computer with at least one external storage device directly addressable by the CPU

- *Workstation (Price between $10,000 and $100,000)* - An integrated multifunctional workstation capable of routine higher-speed communications with mini and mainframe computers and of performing complex local processing. While similar to microcomputers, the workstation typically will have 16- or 32-bit architectures, plus greater graphics and integrated communications capabilities.

- *Minicomputer (Price between $15,000 and $350,000)* - Usually a 16- or 32-bit computer. May represent a portion of a larger system or a complete stand-alone system by itself.

  - Personal business computer
  - Small laboratory computer
  - Nodal computer in a distributed data network, remote data collection network, or connected network, or connected to remote microcomputers

- *Mainframe (Price above $350,000)* - Typically a 32- or 64-bit computer with extensive applications software and a number of peripherals in standalone or multiple-CPU configurations for business (administrative, personnel, and logistics) applications; also called a general-purpose computer.

- *Supercomputer* - High-powered processors with numerical processing throughout that is significantly greater than the fastest general-purpose computers, with capacities in the vicinity of 10-50 million floating point operations per second (MFLOPS). Supercomputers fit in one of two categories:

  - *Real Time* - Generally used for signal processing in military applications.

  - *Non-Real Time* - For scientific use in one of three configurations:

    ° Parallel processors
    ° Pipeline processor
    ° Vector processor

- *Embedded Computer* - Dedicated computer system designed and implemented as an integral part of a weapon, weapon system, or platform; critical to a military or intelligence mission such as command and control, cryptological activities, or intelligence activities. Characterized by military specifications (MIL SPEC) appearance and operation, limited but reprogrammable applications software, and permanent or semipermanent interfaces. May vary in capacity from microcomputers to parallel processor computer systems.

D
Telecommunications

1. Networks

Networks are the electronic interconnections between sites or locations that may incorporate links between central computer sites and remote locations and switching and/or regional data processing nodes. Network services typically are provided on a leased basis by a vendor to move data, voice, video, or textual information between locations. Networks can be categorized in several different ways.

- *Common Carrier Network* - A public access network, such as provided by AT&T, consisting of conventional voice-grade circuits and regular switching facilities accessed through dial-up calling with leased or user-owned modems for transfer rates between 150 and 1200 baud

- *Value-Added Network (VAN)* - (See listing under Section B.2, Delivery Modes.)

- *Local Area Network (LAN)* - Limited-access network between computing resources in a relatively small (but not necessarily contiguous) area, such as a building, complex of buildings, or buildings distributed within a metropolitan area. Uses one of two signaling methods.

  - *Baseband* - Signaling using digital waveforms on a single frequency band, usually at voice frequencies and bandwidth, and limited to a single sender at any given moment. When used for local-area networks, typically implemented with TDM to permit multiple access.

  - *Broadband* - Transmission facilities that use frequencies greater than normal voice-grade, supported in local-area networks with RF modems and AC signaling. Also known as wideband. Employs multiplexing techniques that increase carrier frequency between terminals to provide:

    ° Multiple (simultaneous) channels via FDM (Frequency Division Multiplexing)

    ° Multiple (time-sequenced) channels via TDM (Time Division Multiplexing)

    ° High-speed data transfer rate via parallel mode at rates of up to 96,000 baud (or higher, depending on media)

2. Transmission Facilities

Transmission facilities include wire, carrier, coaxial cable, microwave, optical fiber, satellites, cellular radio, and marine cable operating in one of two modes, depending on the vendor and the distribution of the network.

- *Mode* - may be either:

  - *Analog* - Transmission or signal with continuous-waveform representation, typified by AT&T's predominantly voice-grade DDD network and most telephone operating company distribution systems

  - *Digital* - Transmission or signal using discontinuous, discrete quantities to represent data, which may be voice, data, record, video, or text, in binary form

- *Media* - May be any of the following:

  - *Wire* - Varies from earlier single-line teletype networks, to two-wire standard telephone (twisted pair), to four-wire full- duplex balanced lines

  - *Carrier* - A wave, pulse train, or other signal suitable for modulation by an information-bearing signal to be transmitted over a communications system, used in multiplexing applications to increase network capacity

  - *Coaxial Cable* - A cable used in HF (high-frequency) and VHF (very high frequency), single-frequency, or carrier-based systems; requires frequent reamplification (repeaters) to carry the signal any distance

  - *Microwave* - UHF (ultra-high-frequency) multichannel, point-to-point, repeated radio transmission; also capable of wide frequency channels

  - *Optical Fiber* - Local signal distribution systems employed in limited areas, using light-transmitting glass fibers and TDM for multichannel applications

  - *Communications Satellites* - Synchronous earth-orbiting systems that provide point-to-point, two-way service over significant distances without intermediate amplification (repeaters), but requiring suitable groundstation facilities for up- and down-link operation

  - *Cellular Radio* - Network of fixed, low-powered two-way radios that are linked by a computer system to track mobile phone/data set units. Each radio serves a small area called a cell. The computer switches service connections to the mobile unit from cell to cell.

E
Other Considerations

When questions arise about the proper place to count certain user expenditures, INPUT addresses them from the user's viewpoint. Expenditures are then categorized according to what users perceive they are buying.

The standard industrial classification (SIC) codes are used to define the economic activity contained in generic sectors such as process manufacturing, insurance, or transportation.

The specific industries (and their SIC codes) included under these generic industry sectors are detailed in the exhibit.

EXHIBIT A-1

INDUSTRY SECTOR DEFINITIONS

INDUSTRY SECTOR	INDUSTRY SIC	INDUSTRY NAME
Discrete Manufacturing	23	Apparel
	25	Furniture
	27	Printing
	31	Leather
	34	Metal
	35	Machinery
	36	Electronics
	37	Transportation
	38	Scientific and Control Instruments
	39	Miscellaneous
Process Manufacturing	10	Metal Mining
	11	Anthracite Mining
	12	Coal Mining
	13	Oil and Gas Extraction
	14	Mining/Quarrying of Non-Metallic Minerals, except Fuels
	20	Food Products
	21	Tobacco
	22	Textile Products
	24	Lumber and Wood Products
	26	Paper Products
	28	Chemicals
	29	Petroleum
	30	Rubber and Plastics
	32	Stone, Glass, Clay
	33	Primary Metals
Transportation	40	Railroads
	41	Local Transit
	42	Motor Freight
	43	U.S. Postal Service
	44	Water Transportation
	45	Air
	46	Pipelines
	47	Transportation Services

EXHIBIT A-1 (Cont.)

INDUSTRY SECTOR DEFINITIONS

INDUSTRY SECTOR	INDUSTRY SIC	INDUSTRY NAME
Utilities	49	Electric, Gas, and Sanitary
Telecommunications	48	Communications
Wholesale Distribution	50	Durable Goods
	51	Nondurable Goods
Retail Distribution	52	Building Materials, Hardware
	53	General Merchandise
	54	Food
	55	Automotive and Gas Stations
	56	Apparel
	57	Furniture
	58	Eating and Drinking
	59	Miscellaneous Retail
Banking and Finance	60	Banks
	61	Credit Agencies
	62	Security and Commodity Brokers
	67	Holding and Investment Offices
Insurance	63	Insurance (Life, Health, Etc.)
	64	Insurance Agents
Medical	80	Health Services
Education	82	Educational Services

EXHIBIT A-1 (Cont.)

INDUSTRY SECTOR DEFINITIONS

INDUSTRY SECTOR	INDUSTRY SIC	INDUSTRY NAME
Services	72	Personal Services
	73	Business Services (Excluding Information Services Companies Themselves)
	89	Miscellaneous Services
	66	Combinations of Real Estate, Insurance, Loans, Law Offices
	81	Legal Services
	76	Miscellaneous Repair
Federal Government	N/A	As Appropriate
State and Local Government	N/A	As Appropriate
Other Industries	01-09	Agriculture, Forestry, and Fishing
	15-17	Construction
	70	Hotels, Rooming Houses, Camps, and Other Lodging Places
	75	Automotive Repair, Services, and Garages
	78	Motion Pictures
	79	Amusement and Recreation Services, except Motion Pictures
	83	Social Services
	84	Museums, Art Galleries, Botanical and Zoological Gardens
	86	Membership Organizations
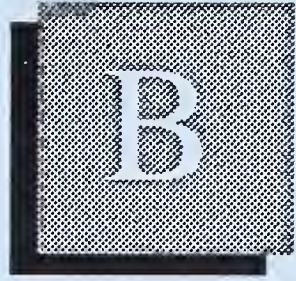
Appendix: Market Forecast Data Base, 1988-1993

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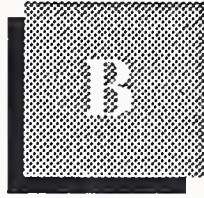
Appendix: Market Forecast Data Base, 1988-1993

This appendix contains the following information:

- Exhibit B-1—Market size and forecasts by platform size

- Exhibit B-2—Application software market size and forecasts by industry-specific and cross-industry definitions

EXHIBIT B-1

USER EXPENDITURE FORECAST
BY DELIVERY MODE, 1988-1993
(Millions of Dollars)

Delivery Submode	1987	(%) 87-88 Growth	1988	1989	1990	1991	1992	1993	(%) CAGR 88-93
Applications Software	10,670	21	12,970	15,238	17,950	21,300	25,415	30,310	19
Mainframe	3,820	12	4,285	4,695	5,180	5,680	6,235	6,845	10
Minicomputer	3,565	16	4,125	4,730	5,380	6,150	6,995	7,980	14
Workstation/PC	3,285	28	4,560	5,810	7,390	9,470	12,185	15,485	(28)
System Software	9,880	22	12,095	14,730	17,865	21,630	25,880	30,835	21
Mainframe	5,110	17	5,965	6,940	8,035	9,290	10,600	12,055	15
Minicomputer	3,400	19	4,050	4,810	5,680	6,710	7,880	9,220	18
Workstation/PC	1,370	52	2,080	2,980	4,150	5,630	7,400	9,560	35

EXHIBIT B-2

SOFTWARE USER EXPENDITURE FORECAST BY INDUSTRY SECTOR, 1988 - 1993
(In Millions of Dollars)

Industry Sector	1987	87-88 Growth (%)	1988	1989	1990	1991	1992	1993	CAGR 88-93 (%)
Total Software Products Industry	20,550	22	25,065	29,965	35,815	42,930	51,295	61,145	20
Application Software									
Discrete Manufacturing	1,130	21	1,380	1,620	1,915	2,270	2,710	3,235	19
Process Manufacturing	145	18	180	215	255	300	360	435	19
Transportation	215	25	260	330	400	490	590	715	22
Utilities	145	20	180	220	240	290	340	410	18
Telecommunications	110	49	155	195	255	340	455	605	32
Wholesale Distribution	290	32	390	465	580	705	875	1,090	23
Retail Distribution	180	32	235	320	410	540	715	925	31
Banking & Finance	1,490	17	1,750	2,030	2,370	2,795	3,300	3,930	18
Insurance	455	25	570	700	850	1,070	1,330	1,680	24
Medical	570	18	670	780	920	1,080	1,280	1,520	18
Education	450	13	505	560	630	700	830	855	11
Services	270	22	340	405	490	580	710	860	20
Federal Government	180	25	230	265	300	340	390	440	14
State & Local Govt	65	29	90	100	130	160	210	250	24
Other Industry Sector	130	19	160	190	220	260	310	360	18
Total Industry Sectors	5,825	21	7,095	8,395	9,965	11,920	14,405	17,310	20
Cross-Industry Sector									
Accounting	1,270	20	1,515	1,730	1,990	2,320	2,690	3,165	16
Education & Training	110	34	140	180	220	280	350	445	25
Engineering & Scientific	310	28	400	500	615	770	970	1,230	25
Human Resources	690	10	760	820	885	940	1,000	1,050	7
Office Systems	970	28	1,240	1,500	1,820	2,220	2,700	3,295	22
Planning & Analysis	1,210	23	1,490	1,725	2,005	2,310	2,670	3,080	16
Other Cross-Industry Sector	285	18	330	385	450	540	630	735	17
Total Cross-Industry Sectors	4,845	21	5,875	6,840	7,985	9,380	11,010	13,000	17
Total Application Software	10,670	21	12,970	15,235	17,950	21,300	25,415	30,310	19
Total System Software	9,880	22	12,090	14,720	17,870	21,615	25,885	30,730	21

C
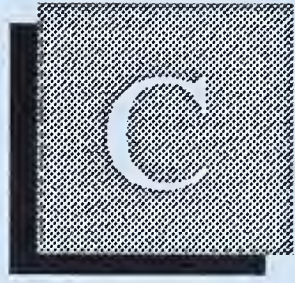
Appendix: Data Base Reconciliation, 1987-1988
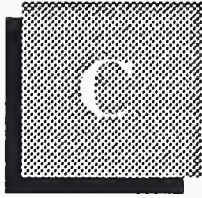
Appendix: Forecast Reconciliation, 1987-1988

This appendix contains the following information:

- Exhibit C-1, which includes the changes made in this year's forecast as compared to last year's.

- An explanation of any significant changes that were made to the forecasts.

Explanation:

The change in the forecasted growth rate for mini/mainframe systems control reflects a substantial downward revision in the growth rate projections for mainframe and minicomputer platform shipments.

The variances in the growth rate projection for the 1987 micro-based data center management tools reflects primarily an over-estimate in 1986 of the size of the developing market.

The increase in the forecasted growth rate for the micro-based application development tool market reflects a upward revision in the forecasted growth rate for the total application development tools market and the rapid migration to the workstation/PC platform base for many front-end development programs.

EXHIBIT C-1

SOFTWARE PRODUCTS— DATABASE RECONCILIATION OF MARKET FORECAST BY DELIVERY MODE

Delivery Mode	1987 Market			1992 Market			1987-1992 CAGR Fcst. in 1987 Rpt. (%)	1988-1993 CAGR Fcst. in 1988 Rpt. (%)
	1987 Fcst. ($ M)	1988 Rpt. ($ M)	Variance as Percent of 1988 Rpt.	1987 Fcst. ($ M)	1988 Rpt. ($ M)	Variance as Percent of 1988 Fcst.		
Systems Software	9,600	9,880	+2	29,600	25,880	(15)	25	21
Mini/Mainframe								
Systems Control	3,300	3,560	+7	11,700	7,140	(64)	28	15
Data Center Management	2,100	1,905	(10)	5,800	4,525	(28)	22	18
Application Development	2,600	3,045	+15	6,500	6,810	+5	20	17
Micro								
System Control	600	590	(2)	2,500	3,110	+20	34	35
Data Center Management	100	70	(43)	300	615	+51	43	43
Application Development	800	710	(13)	2,800	3,670	+24	29	35
Applications Software	10,300	10,590	+3	22,600	25,770	+12	17	19

D

Appendix: Vendor Questionnaire
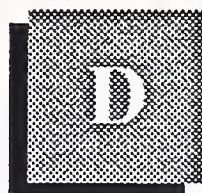
Appendix: Vendor Questionnaire

I.   Company Background Data

Company name: _____

Headquarters address: _____

_____

Respondent Name and Title: _____

CEO Name _____ Headquarters telephone: (   )_____

Number of employees associated with information services activities:

Marketing/Sales   _____
Computer Operations   _____
Research & Development   _____
Customer Support   _____
Finance/Admin.   _____
IS Total   _____
Company Total   _____

Please provide a brief statement of the principal business of your firm.

_____

_____

II.   Revenues

1.   Please indicate annual revenues for United States, noncaptive information services (revenues from sources outside your own corporate structure).

	Fiscal Year Ending___/86 Mo	Fiscal Year Ending___/87 Mo	Fiscal Year Projection Ending___/88 Mo
Revenues - ($ Millions)	$M	$M	$M
Revenue Growth % From Previous Year: Total	%	%	%
• From price increases	%	%	%
• From acquisition	%	%	%
• From new products	%	%	%
• From sales volume	%	%	%

2.   Percent of Noncaptive Prior Year U.S. Revenues from Following Delivery Modes (See Definitions Attached):

Application Software Products _____%   Turnkey Systems _____%
Systems Software Products _____%   Professional Services _____%
Processing Services _____%   Systems Integration _____%
Network and Electronic Information Services _____%

3.   Percent of Prior Year's Revenues From:

United States _____%   Canada _____%   Europe _____%   Asia Pacific (Total) _____%
Japan (only) _____%   Latin America _____%   Other _____%

III.   Additional Corporate Information

Year company was incorporated or founded: _____
Ownership: ❑ Public   ❑ Private   ❑ Owned by another company
    If owned by another organization, please indicate legal relationship with parent:
        ❑ Subsidiary   ❑ Division   Other: _____

    Parent company's name:_____

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Subsidiary Operations:

Please provide the following information for all active subsidiaries or divisions
owned by your company that are engaged in information services activities.

Name of Company: _____

Headquarters Address: _____

City, State, Zip: _____

President's Name: _____

Telephone Number: (　　)_____

**On the following pages, please provide additional information for those service
delivery modes applicable to your business.**

Please send us your product literature for our files and reference use, and add INPUT to
your mailing list for press releases and financial reports. Thanks very much for your
assistance.

A

Application Software

Please indicate the percentage of your U.S. last year's revenue from application software products. (Total for Section1 should equal 100% of those revenues. Total for Section 2A **plus** 2B should also be 100%.)

Revenue Growth Last Year: _____%

1. **Applications Software Products** ...._____%   -
   Mainframe ...._____%
     - Minicomputer.._____%
     - Workstation/PC..._____%
                                                                                   100%

2A. Revenues from Vertical Markets
(Based on U.S. Dept. of Commerce SIC Codes)

Discrete Manufacturing	_____%
Process Manufacturing	_____%
Transportation	_____%
Utilities	_____%
Telecommunications	_____%
Retail Distribution	_____%
Wholesale Distribution	_____%
Banking and Finance	
- Commercial Banks	_____%
- Savings/Thrifts	_____%
- Brokerage	_____%
- Other	_____%
Insurance	
- Life/Health	_____%
- Property/Casualty	_____%
- Agency	_____%
Medical	
- Hospitals	_____%
- Physicians/Clinics	_____%
- Other	_____%
Education	_____%
Services (lawyers, accountants, etc.)	_____%
Federal Government	
- DoD	_____%
- Civil	_____%
State/Local Government	
- State	_____%
- Local	_____%
Other (construction, non-profit)	_____%
Consumer, Home Usage	_____%

2B. Revenues from Cross-Industry Markets

Planning/Analysis/ Spreadsheets	_____%
Accounting	_____%
Education/Training	_____%
Human Resources	_____%
Engineering/Scientific	_____%
Office Systems (Word Processing, E-Mail, Calendar, etc.)	_____%
Sales/Marketing	_____%
Publishing Systems	_____%
Graphics	_____%
Other	_____%

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B
Systems Software Products

Please indicate the percentage of your U.S. last year's revenue from systems software products. (Total for Section 1 should equal 100% of those revenues. Total for Section 2 should also be 100%.)

Revenue Growth Last Year: _____%

1. Systems Software ...._____%
    a. Systems Control.._____%
        - Mainframe ...._____%
        - Minicomputer ...._____%
        - Workstation/PC ...._____%
                             100%

    b. Data Center Management
    Tools ...._____%
        - Mainframe ...._____%
        - Minicomputer ...._____%
        - Workstation/PC ...._____%
                          ·100%

    c. Application Development
    Tools ...._____%
                    100%
        - Mainframe ...._____%
        - Minicomputer ...._____%
        - Workstation/PC ...._____%
                          100%

C
Processing Services

Please indicate the percentage of your U.S. last year's revenue from processing services. (Total for Section 1 should equal 100% of those revenues. Total for Section 2A **plus** 2B should also be 100%.)

Revenue Growth Last Year: _____%

1. Processing Services _____%
    a. Remote/interactive.........................._____%
        - Transaction Services ...._____%
        - Utility Services ...._____%
        - Other Services ...._____%
        ....100%

b. Systems Operations (facilities
    management of vendor-
    owned systems) ...._____%
                                                    100%

2A. Revenues from Vertical Markets
(Based on U.S. Dept. of Commerce SIC Codes)

Discrete Manufacturing	_____%
Process Manufacturing	_____%
Transportation	_____%
Utilities	_____%
Telecommunications	_____%
Retail Distribution	_____%
Wholesale Distribution	_____%
Banking and Finance	
- Commercial Banks	_____%
- Savings/Thrifts	_____%
- Brokerage	_____%
- Other	_____%
Insurance	
- Life/Health	_____%
- Property/Casualty	_____%
- Agency	_____%
Medical	
- Hospitals	_____%
- Physicians/Clinics	_____%
- Other	_____%
Education	_____%
Services (lawyers, accountants, etc.)	_____%
Federal Government	
- DoD	_____%
- Civil	_____%
State/Local Government	
- State	_____%
- Local	_____%
Other (construction, non-profit)	_____%
Consumer, Home Usage	_____%

2B. Revenues from Cross-Industry Markets

- Utility Services	_____%
- Other Services	_____%
Computer Output Microfilm	_____%
Data Entry	_____%
Disaster Recovery	_____%
Carry-In Batch	_____%
All Other	_____%
Planning/Analysis/ Spreadsheets	_____%
Accounting	_____%
Education/Training	_____%
Human Resources	_____%
Engineering/Scientific	_____%
Office Systems (Word Processing, E-Mail, Calendar, etc.)	_____%
Sales/Marketing	_____%
Publishing Systems	_____%
Graphics	_____%
Other	_____%

D

Network Services

Please indicate the percentage of your U.S. last year's revenue from network services. (Total for Section 1 should equal 100% of those revenues. Totals for Section 2A **plus** 2B should also be 100%.)

Revenue Growth Last Year: _____%

1. Network Applications ...._____%
    -Value-Added Network Services (VANS) ...._____%
    - Electronic Mail ...._____%
    -Electronic Data Interchange (EDI)...................................._____%
                                                  100%

2. Electronic Information Services (EIS) ...._____%
                            100%

    - Databases..._____%
    - News.._____%
    - Videotex ...._____%
                             100%

2A. Revenues from Vertical Markets
(Based on U.S. Dept. of Commerce SIC Codes)

Discrete Manufacturing	_____%
Process Manufacturing	_____%
Transportation	_____%
Utilities	_____%
Telecommunications	_____%
Retail Distribution	_____%
Wholesale Distribution	_____%
Banking and Finance	
- Commercial Banks	_____%
- Savings/Thrifts	_____%
- Brokerage	_____%
- Other	_____%
Insurance	
- Life/Health	_____%
- Property/Casualty	_____%
- Agency	_____%
Medical	
- Hospitals	_____%
- Physicians/Clinics	_____%
- Other	_____%

2B. Revenues from Cross-Industry Markets

VANs	_____%
Electronic Mail	_____%
EIS Data Bases	
- Credit	_____%
- Securities	_____%
- Others	_____%

2A. Revenues from Vertical Markets (con't)
(Based on U.S. Dept. of Commerce SIC Codes)

Education   _____%

Services (lawyers,
accountants, etc.)   _____%

Federal Government

- DoD   _____%

- Civil   _____%

State/Local Government

- State   _____%

- Local   _____%

Other (construction, non-
profit)   _____%

Consumer, Home Usage   _____%

E

Turnkey Systems

Please indicate the percentage of your U.S. last year's revenue from turnkey systems.
(Total for Section 1 should equal 100% of those revenues. Totals for Section 2A **plus** 2B
should also be 100%.)

Revenue Growth Last Year _____%

1. Turnkey Systems ...._____%

     a. Equipment..._____%

        - Mainframe ...._____%

        - Minicomputer.._____%

        - Workstation/PC ...._____%

                                               100%

     b. Packaged Software ...._____%

     c. Customized Software..................................._____%

     d. Other (Education, Training,......................._____%
        Professional Services)   100%

2A. Revenues from Vertical Markets
(Based on U.S. Dept. of Commerce SIC Codes)

2B. Revenues from Cross-Industry Markets

Discrete Manufacturing	_____%	
Process Manufacturing	_____%	
Transportation	_____%	
Utilities	_____%	
Telecommunications	_____%	

Planning/Analysis/	
Spreadsheets	_____%
Accounting	_____%
Education/Training	_____%
Human Resources	_____%

2A. Revenues from Vertical Markets
(Based on U.S. Dept. of Commerce SIC Codes)

Retail Distribution	_____%
Wholesale Distribution	_____%
Banking and Finance	
- Commercial Banks	_____%
- Savings/Thrifts	_____%
- Brokerage	_____%
- Other	_____%
Insurance	
- Life/Health	_____%
- Property/Casualty	_____%
- Agency	_____%
Medical	
- Hospitals	_____%
- Physicians/Clinics	_____%
- Other	_____%
Education	_____%
Services (lawyers, accountants, etc.)	_____%
Federal Government	
- DoD	_____%
- Civil	_____%
State/Local Government	
- State	_____%
- Local	_____%
Other (construction, non-profit)	_____%
Consumer, Home Usage	_____%

2B. Revenues from Cross-Industry Markets

Engineering/Scientific/ CAD-CAM	_____%
Office Systems (Word Processing, E-Mail, Calendar, etc.)	_____%
Sales/Marketing	_____%
Publishing Systems	_____%
Graphics	_____%
Other	_____%

F

Professional Services

Please indicate the percentage of your U.S. last year's revenue from professional services. (Total for Section 1 should equal 100% of those revenues. Total for Section 2 should also be 100%.)

Revenue Growth Last Year _____%

1. Professional Services .... _____%
- Consulting ...._____%
- Education & Training..............................._____%
- Software Development..............................._____%
- Systems Operations (facilities management of client-owned systems) ...._____%

100%

2. Revenues from Vertical Markets
(Based on U.S. Dept. of Commerce SIC Codes)

Discrete Manufacturing	_____%
Process Manufacturing	_____%
Transportation	_____%
Utilities	_____%
Telecommunications	_____%
Retail Distribution	_____%
Wholesale Distribution	_____%
Banking and Finance	
- Commercial Banks	_____%
- Savings/Thrifts	_____%
- Brokerage	_____%
- Other	_____%
Insurance	
- Life/Health	_____%
- Property/Casualty	_____%
- Agency	_____%
Medical	
- Hospitals	_____%
- Physicians/Clinics	_____%
- Other	_____%
Education	_____%
Services (lawyers, accountants, etc.)	_____%
Federal Government	
- DoD	_____%
- Civil	_____%
State/Local Government	
- State	_____%
- Local	_____%
Other (construction, non-profit)	_____%
Consumer, Home Usage	_____%
	100%

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G
Systems Integration

Please indicate the percentage of your U.S. last year's revenue from systems integration. (Total for Section 1 should equal 100% of those revenues. Total for Section 2 should also be 100%.)

Revenue Growth Last Year _____%

1. Systems Integration ...._____%
- Equipment ...._____%
- Packaged Software ...._____%
- Customized Software ...._____%
- Professional Services
  (For Systems Integration Only) ...._____%

100%

2. Revenues from Vertical Markets
(Based on U.S. Dept. of Commerce SIC Codes)

Discrete Manufacturing	_____%
Process Manufacturing	_____%
Transportation	_____%
Utilities	_____%
Telecommunications	_____%
Retail Distribution	_____%
Wholesale Distribution	_____%
Banking and Finance	
- Commercial Banks	_____%
- Savings/Thrifts	_____%
- Brokerage	_____%
- Other	_____%
Insurance	
- Life/Health	_____%
- Property/Casualty	_____%
- Agency	_____%
Medical	
- Hospitals	_____%
- Physicians/Clinics	_____%
- Other	_____%
Education	_____%
Services (lawyers, accountants, etc.)	_____%

2. Revenues from Vertical Markets (con't)
(Based on U.S. Dept. of Commerce SIC Codes)

Federal Government
- DoD   _____%
- Civil   _____%

State/Local Government
- State   _____%
- Local   _____%

Other (construction, non-
profit)   _____%

Consumer, Home Usage   _____%

                       100%